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February 22, 2011

68259

The Afghanistan Mining Sector as a Driver of Sustainable Growth: Benefits and Opportunities for Large-Scale Mining

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Abbreviations

CDA	Community Development Agreement
CSR	Corporate Social Responsibility
ERP	Economic Recovery Programme (Ghana)
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GIM	Gemological Institute of Madagascar
GNI	Gross National Income
GoA	Government of Afghanistan
GoM	Government of Madagascar
HDSA	Historically Disadvantaged South African
LME	London Metal Exchange
MCC	Metallurgical Corporation of China
MPC	Marginal Propensity to Consume
MW	Megawatt
PPP	Private Public Partnership
SME	Small and Medium Sized Enterprises
SVPF	Steelpoort Valley Producers Forum

Executive Summary

This study attempts to quantify the benefits that could be obtained for the country of Afghanistan from the developments of the Aynak copper and Hajigak iron ore deposits and to discuss policies and programs—based on the experience of other countries—that would tend to maximize the benefits from these and other mines. The intent of the quantitative analysis is to provide orders of magnitude, including an analysis of the relative importance of key parameters. It is intended to lend itself to further analysis that will be able to probe more deeply into the various linkage effects as well as the values of the parameters. The ability to achieve the impacts described in this document will be heavily dependent on reaching a level of security to allow for mining the deposits, discovering new deposits, and creating infrastructure for functional linkage industries. Strong sector and macroeconomic governance is also a requisite if the impacts are going to significantly increase beyond the mine site; such governance will also help to minimize cultural, social, and environmental costs. Addressing such concerns from the beginning of the mine developments will help to ensure the resource curse is avoided in Afghanistan.

The results of the analysis suggests that, subject to the restrictions noted above, the economic benefits to Afghanistan of these two (and other) mines) could be very significant. The richness of the deposits and the current high metal prices combined with the relatively high sector taxes and large infrastructure needs of the mining operations means that the country could benefit from a large increase in fiscal revenues, substantial new power and rail investments, and, if the necessary policies and programs are implemented, a sector large enough to be a driver of growth of the industrialization process in the country. The central quantitative result is that the 2011-40 average annual direct impact on national income would be about US$745 million (or 8.1 percent of 2008 GNI), not including linkage or multiplier effects.[1] When procurement to local suppliers is included, this figure rises to US$ 1.04 billion or 11.3 percent of 2008 GNI.

The average annual direct impact on fiscal revenues is calculated at US$511 million—54 percent of 2008-09 revenues—,an impact that easily could be twice as high if the sector and its revenues are able to generate significant other economic activities. While annual direct employment in the mines is calculated to only increase by 6,400, if the fiscal revenues are used judiciously to develop infrastructure and linkage industries, this number could be several times higher due to indirect and induced employment. Of course, the more successful is the management of government expenditures, the higher will be the final impact on income and employment. The average annual exports of the two mines from 2016-40 is calculated to be US$2.3 billion—almost 4 times total official exports of goods and services in 2009 and still 10 percent higher than official exports, smuggling, & transit trade—although the impact on the balance of payments is much smaller at US$630 million when repatriated profits, imported inputs, and imports of consumer goods are deducted.[2]

[1] All the results reported in the Executive Summary are from the base (medium impact) case. See text for results of the low and high impact cases.

[2] In most of the simulations, copper was set at $3/lb and iron ore at $125/tonne. As demonstrated in the text, if January 2011 prices are used, $160/tonne for iron ore and $4/lb for 27 month forward copper, the impacts would be much larger. In this scenario, total mining exports average US$3.0 billion per year.

However, the quantitative analysis can only go so far. The development of several large mining operations would increase the relative level of prosperity in Afghanistan for a number of years or even decades as has often happened in resource rich countries, particularly in Africa and South America. Whether this would result in a standard of living like in the Democratic Republic of Congo, Botswana, or South Africa depends on the successful implementation of policies and programs that would increase the amount of domestic sourcing and, more ambitiously, use the infrastructure and other types of capital (including human and social capital) generated by the mining sector as a driver of sustainable growth in the country, through the creation of industrial clusters, growth poles, or resource corridors. In the Afghanistan context, the mining sector is poised to be an important source of fiscal revenues, but it is likely just as important as an industry that can kickstart the industrialization process of the country and lead to broadly based inclusive growth. However, if the social and environmental costs of the mining operations are not managed properly, these benefits will not be sustainable in the long-term.

While detailed recommendations are available in the paper, the main messages coming out of this study are the following.

1. As the deposits were both rich and known and are being developed in an era of high mineral prices, the economic benefits from these two mines to Afghanistan are expected to be considerably higher than the international norm. Unlike most countries, Afghanistan has not had to make a trade-off between high fiscal revenues, infrastructure development, and domestic employment in the mines and linkage industries. Consequently, the ultimate success of the mining sector depends on factors outside of the sector itself more than is usually the case. High quality public expenditure management, for example, may well be the most important factor in determining the overall contribution of the mining sector to sustainable development in Afghanistan.
2. The development of linkage industries, particularly in mining supply firms, is very important for increasing employment and income in the mining sector but can also have very strong impacts on fiscal revenues, which, once again, underlines the role of public expenditure management. International experience is quite clear on the matter that these industries will for the most part not develop by themselves, as mining firms are quite willing to outsource to trusted international partners. Consequently, the Government of Afghanistan with the assistance of donors and other stakeholders will need to undertake active policies to increase the capacity for firms and individuals to work in the identified linkage industries.
3. Major infrastructure investments will need to be undertaken to support the mining industry, particularly in rail and power. It is essential that such infrastructure is integrated to the largest extent possible with the infrastructure needs of other sectors of the economy, which could include the development of resource corridors anchored by the mining sector. It is likely that public-private partnerships will be required to take full advantage of this unique historical opportunity.
4. If security issues are overcome and these two mines are developed (and likely many others if exploration can take off), they will generate a very large amount of revenue—income, fiscal, and foreign exchange. Even in the pessimistic, low-impact scenario, the amounts are very large in relation to current macroeconomic variables in Afghanistan. On the one hand, this means that there will be a strong need for

transparency on the benefits and costs of the sector in order to maintain support for the sector from the affected regions and general population. On the other hand, it also means that the Government of Afghanistan must be prepared to confront new macroeconomic challenges, particularly with regards to the management of higher but highly variable fiscal revenues and a potentially much stronger foreign exchange rate. Programs like EITI could help meet the transparency challenge, while a stabilization fund could help meet the macro challenges.

5. Finally, there will be large impacts on communities in the mining regions. International experience shows us that there can be enormous stress on communities, particularly if they do not see themselves as receiving significant social and economic benefits from the mining operations while having to deal with problems associated with very large in-migrations or environmental damage. These impacts often lead to conflict and even armed rebellion. Consequently, it is essential that programs are put into place that will both provide the impacted communities with a fair share of the benefits—which can be defined in trilateral agreements—, manage the influx of migrants, and control environmental contamination.

1. Introduction

Historically, the mining sector has been one of the main drivers for economic growth for many countries or sub-regions of countries through one or more of the following three channels. In some cases this has been due to its leading role in industrialization, including the generation of important foreign exchange (e.g. Chile, South Africa); in other cases it has played a large role in the development of infrastructure (e.g. northeastern Brazil, western Australia); and in other cases it has been the leading source of fiscal revenues (e.g. Botswana, Peru), which in turn can be used to promote growth through the creation of human, physical and social capital. In the context of a long period of high mineral prices with no significant (sustained) plunge in sight, coupled with the discovery of important deposits in a number of low income countries, the pressure for the sector to be the driver of sustainable growth has likely never been higher than today as can be witnessed around the globe from Peru to Mali to Zambia to Papua New Guinea to Mongolia to the Kyrgyz Republic. With its two large known world class deposits (copper and iron ore) and a largely unexplored terrain, Afghanistan is another country which is turning towards the mining sector to drive its growth process.

Moreover, while it could be argued that the three channels above are not all 'necessary' for sustained growth, it seems likely that for the majority of low income countries, it is the ability to harness all three of these forces that can result in mining becoming an engine of sustainable development. Given the general lack of industrialization in many mineral rich countries, it will rarely be enough to use the fiscal revenues generated by the mining sector to create the conditions for new industries. It is the mining sector itself, where a comparative advantage would already exist, that can be used to ignite the industrialization process. At the same time, without major investments in infrastructure—particularly power and transport—it is not likely that there will be much diffusion from mining related industries to other sectors.

In this study, the potential economic benefits to Afghanistan of its mining sector will be analyzed, focusing on the Aynak copper and Hajigak iron ore deposits. After an overview of the Afghan mineral industry and global trends in mining, a quantitative analysis will be made of the economic contribution of the development of these deposits and related infrastructure for income and employment in Afghanistan. Various scenarios will be presented as well as sensitivity analysis of key parameters. The analysis will focus on income, fiscal revenues, employment, sidestream linkages (sourcing), and the multiplier effects of expenditure by both the government and consumers. In Section 4, based on international experience in extending the benefits of large mining operations, a qualitative analysis is undertaken of the scenario in which Afghanistan is likely to find itself in the near future and as the sector develops over time. The emphasis here is on the development of linkages and industries that increase the portion of expenditure of the mining sector, government, and consumers that remains in the country. The section ends with a brief discussion of industrial clusters and resource corridors. The final section contains conclusions and policy recommendations.

Of course, even with the best policies, programs, and intentions, the mining sector in Afghanistan will face other obstacles in its development, probably to an even greater extent than other economic sectors in the country, given the remoteness of many deposits, the infrastructure demands, the need to transport inputs and outputs over long distances, and the large amounts of

revenues involved. It is not the intent of this paper to resolve the security and governance issues associated with any development in Afghanistan, but it is important to keep in mind that benefit streams identified in this paper will to some extent depend on the resolution of the wider security and governance issues in the country. This is particularly true for the creation of successful linkages and use of fiscal revenues, both of which can turn the sector from an exhaustible source of fiscal revenues into a source of broadly based sustainable development. Similarly, macroeconomic issues such as the resource course or the possibility of Dutch Disease will not be addressed in this paper, although if the mining sector does develop as envisaged in this study, these issues will also need to be resolved properly.

In addition, the paper does not discuss environmental or social issues related to mining operations, other than to stress the importance of increasing local benefits to build support for the sector. Due to its limited scale, the mining sector has not been a significant source of environmental contamination or damage in Afghanistan. The environmental implications of the expansion of the mining industry will be investigated in detail in a strategic environmental assessment, which will be undertaken in parallel with this study, as well as work being led by the South Asia Sustainable Development Division on 'Afghanistan Mining Environmental and Social Sustainability'. The focus of that work will be to strengthen technical capacities for environmental and socially sustainable management of the mining sector and will include an institutional assessment of the National Environmental Protection Agency. A complete analysis of the sector would have to offset the benefits reported in this study by environmental and social costs.[3]

2. Background

2.1 The Afghanistan Mining Sector

The Afghanistan mineral sector consists of copper, gold, and iron ore, among other metals, as well as construction materials, dimensional stone and gemstones, coal, and hydrocarbons (mostly natural gas). Some of these mineral resources were produced during the 1970s and 1980s. Damage from war, chronic neglect, and severe under-funding in the last two decades led to plummeting production which fell far short of Afghanistan's potential. Existing mineral production is currently limited to small coal operations, limestone, construction materials, and gemstones and dimensional stone from artisanal and small-scale operations. Nevertheless, the situation is about to change dramatically as the ground is prepared for the development and exploitation of a previously identified world class copper deposit at Aynak, just 35 kilometers south of Kabul. Moreover, a previously identified world class iron ore deposit at Hajigak, 130 kilometers west of Kabul, has recently been put out for tender.

[3] During preparation of this study, important cultural artifacts were discovered at the Aynak site, leading to a significant amount of resources being pledged to preserve the artifacts, which in turn will likely lead to a significant delay in the opening of the mine.

These two possible developments are unlikely to be the end of the story. There has only been limited basic geological work done in Afghanistan in the last 20 years and very little intensive exploration. There is a great likelihood that there are a number of attractive medium- and large-scale deposits waiting to be discovered (see Box 1). In this regard, the Government of Afghanistan has undertaken steps to improve its capacity to effectively regulate Afghanistan's minerals and hydrocarbon resources sectors in a transparent manner and to foster private investment in these sectors. The results of its efforts include a modern mining law and regulations, a mining and hydrocarbons title registry and cadastre, a functioning mining and hydrocarbons inspectorate (in progress), and a modern Afghanistan Geological Survey (in progress). Map 1 shows the most important areas of known and potential mineral deposits in Afghanistan.

Box 1: Mineral Deposits and Occurrences in Afghanistan[4]

Despite the fact that no systematic and detailed geological studies have been carried out in Afghanistan for at least 25 years, it is known to contain world class deposits of copper and iron, important occurrences of nickel, coal and gold, and the potential for a large number of other minerals. In addition, there are two known important hydrocarbon basins (Afghan-Tajik and Amu Darya) and three potential ones (Katawaz, Helmand, Herat).

Most mineral occurrences and potential (given the underlying geology) occur along two belts. The first belt stretches in a crescent from Herat in the far central-northwest of the country to Badakhshan in the northeast corner. It contains occurrences of iron, gold (mainly in NE), copper, tin, tungsten, and gemstones (mainly NE). The second belt, an extension of the Tethyan mineral belt, goes roughly from Kabul to Kandahar. It contains occurrences of copper, gold, chromite, gemstones, and molybdenum (Sediqi, 2010).

Without further geological work, it is difficult to even give a rough value of the potential economic value. Of course, major infrastructure built primarily for one project will often make another project viable. It does seem likely that a peaceful Afghanistan contains at least several hundred billion dollars of minerals that could become economically viable in this century.

[4] Mineral occurrences are deposits of geological interest whose economic potential can only be determined with further geological study.

Map 1: Prospective Mineral Belts in Afghanistan

Source: Afghanistan Geological Survey, 2010.

Aynak and Hajigak would be by a wide margin the two largest investments in the history of Afghanistan. In addition to the US$1-2.5 billion for each mine development, each mine would require investment in infrastructure and power sources in the order of US$2-5 billion. Moreover, an integrated steel plant could be built in conjunction with Hajigak. While calculating the amount of income, jobs, fiscal revenues and foreign exchange that would be generated by the mines and related developments is one objective of this study, the amounts would clearly be at levels high enough to have country-wide socio-economic and macroeconomic implications. If managed well, the medium- and large-scale mining sector[5] has the potential to be the main driver of growth in Afghanistan in the medium-term through its own direct contribution as well as the incentives it creates for the development of upstream, sidestream and downstream industries as well as various types of infrastructure, which other industries can use to their advantage. Whether this potential is met will depend upon the ability of the Afghan population to take advantage of the opportunities afforded by these developments. In turn this will depend on the success of GoA programs and policies in preparing its citizens with the requisite information, skill formation, access to business opportunities, and complementary infrastructure.

2.2 From Mining as an Enclave Industry to a Driver of Sustainable Growth

Given its status as a new mining country, Afghanistan has a rich history to borrow on. Moreover, there have been a number of very significant developments in the industry and how it relates to host governments and communities that can help shape policy and programs in Afghanistan and avoid many of the mistakes or stumbles undertaken in other mining countries.

A large mining operation used to generate thousands and often tens of thousands of jobs, which made local communities very receptive to their development. However, in the 1970s technological change, driven by the need to reduce costs and be able to exploit increasingly marginal deposits, resulted in strong improvements in technology in mining and the movement to more and more open pit operations. At the same time there was a trend to outsourcing non-essential services, most often to companies based in other countries or, at best, in large, distant national cities. In sum, the number of jobs in a typical mine decreased, often to several hundred and rarely to more than 2000. Given the social and environmental challenges often associated with large mining developments, many communities perceived the negative externalities to be greater than the benefits of the mining operation. Similarly, given the long-term trend of low mineral prices, the fiscal benefits, which mostly (if not all) accrued to the central government, stagnated over time. From the early 1970s to late 1990s the most important benefit of many new mining projects was often the associated infrastructure, particularly for base metals like iron ore, copper and nickel.

[5] By global standards a medium-scale mine usually requires a total investment of at least US$ 25 million, although normally substantially more. A large-scale mine would require an investment of at least US$ 500 million, although often well over US$ 1 billion. This study will not cover the artisanal and small-scale mining sectors, currently important sources of employment in Afghanistan**.** See Swire (2010) for a recent study on the gemstone sector, the main source of artisanal mining in Afghanistan.

Given their often isolated and usually poor status, the misgivings of communities only came to the fore when new information and communication technologies allowed them—usually through non-governmental organizations (NGOs)—to air their complaints to the world and have pressure put on the industry and their governments. In addition to better environmental performance, communities wanted a bigger share of the benefits, which in some cases led to local or regional governments receiving a bigger share of the fiscal revenues paid by the mining companies but more often resulted in much larger corporate social responsibility (CSR) expenditures by the firms, often through foundations or trusts. Since the 1990s there has been a great deal of emphasis placed on new arrangements of benefit sharing between mining operations, national governments, regions, and local communities and the ways in which mining operations can contribute to the long-term sustainable development of a community, a region, or even a country. At first, many of the benefits provided had the nature of public services, such as health facilities, schools, and basic infrastructure. However, over the last ten years, the move has been towards training programs to enhance the capacity of national citizens to work in the mines and domestic firms to sell goods and services to the mines or to develop alternative livelihoods for when the mining operation closes. In a number of cases mining firms have worked directly with firms to enhance their ability to provide high quality, competitively priced goods and services. It is becoming common in mining policies that contracts with large-scale mines include a schedule of graduated benefits to the local community; that is, a certain percentage of employment in the mine, which grows over time and includes related training, must go to local community members. Just as or more important, the mining company may be obliged to procure an increasing percentage of its outsourcing from local providers, with a similar training obligation. The skills learned in supplying the mine can often be more important than those obtained working in the mine as they may be more transferable over time.

While mining companies were playing a much more active role in the communities and regions in which they were based, two other important developments at the national level occurred. First, in the 1980s and 1990s, as part of major reform programs, many countries reformed their mining laws and regulations, reversed the prior nationalization of the industry, and made their economies more attractive to investment in general, resulting in a large increase in foreign direct investment (FDI) in the sector. Second, the contracts for much of this FDI were negotiated prior to the 'secular' rise in mining prices that began in 2003 and hit full swing in 2006. For many countries this meant that the fiscal take of their booming mining industries was judged to be rather unfair, leading to many calls for contract renegotiations or further changes in mining fiscal regimes.[6] There is a movement towards more progressive corporate income taxes and sliding scale taxes or royalties, where the percentage of revenues that goes to the country's treasury moves up and down with mineral prices. These extra revenues could be used to support broad and sustainable development by investing in training, education, infrastructure, and other activities that are complementary to private investment.

This combination of developments at the local/regional and central levels has led to good to rapid economic growth in many mineral rich countries (nouveaux or otherwise, see Table 1). However, many of these countries do not want their mining sectors to simply kick-start growth,

[6] In the last 18 months, the terms of mining contracts have been renegotiated or are under threat to be renegotiated in the Democratic Republic of Congo, Ghana, Niger, Guinea, Zimbabwe, Zambia, Mongolia, Peru, Chile, Madagascar, Tanzania, and Australia.

they see it as the engine of sustainable development. This means no more mining enclaves, but a sector that stimulates linkages to other activities and has strong multiplier effects on the economy, as a large percentage of the income generated in the sector is spent domestically. A mining sector that is the engine of sustainable development maximizes the employment of nationals, maximizes local and domestic procurement, and stimulates forward linkages. Each of these outcomes will depend heavily on training in technical skills, the ability to provide quality inputs on-time, and small business management, as well as the ability to find and exploit new markets.

Table 1: Mineral Dependent Countries: Growth rates in 1990s vs. 2000s

Country (*-New mineral dependent country in 2000s)	Mineral export revenues (% of total exports of goods, 2000-07)	GDP Annual Growth Rate, 1989-1998	GDP Annual Growth Rate, 1999-2008
Botswana	77.5	5.5	5.0
Burkina Faso*	NA	4.4	5.4
Chile	41.8	7.8	4.1
DRC	54.0	-5.9	3.2
Ghana	34.5	4.3	5.2
Guinea	85.6	4.2	3.2
Kyrgyz Republic	31.8	-6.4	4.4
Liberia	51.9	-14.3	7.0 (2005-8)
Mali*	NA	3.3	5.5
Mauritania	51.6	2.5	4.6
Mongolia*	53.3	-0.9	6.6
Mozambique*	NA	4.7	7.7
Namibia	60.3	4.1	5.1
Niger*	NA	1.5	3.7
Peru	52.4	3.4	5.0
Sierra Leone	64.1	-4.2	9.9
South Africa	21.2	1.4	4.1
Tanzania*	NA	2.8	6.5
Zambia	66.2	-0.1	4.9
Average (Unweighted)		0.95	5.32

Source: International Monetary Fund (column 2), World Development Indicators (columns 3 & 4).

Infrastructure development will be crucial. It is essential to mobilize additional capital—potentially from the increased level of fiscal revenues paid by the sector—to 'piggyback' on the infrastructure being developed for the mining operations. This infrastructure will not only help the country take advantage of linkages to and from the mining sector but will open up

opportunities in other industries, including agricultural exports and tourism. The development of a strong infrastructural backbone will be the key to the development of industrial clusters, often beginning with mining related activities, as has occurred, for example, in Chile (Antofogasta), Canada (Sudbury), and South Africa (Johannesburg). The ultimate goal is for mining clusters to attract or spin-off into other industrial clusters, using the technological, innovative, and management capacities that were first developed in the mining sector.

Afghanistan has no history of large-scale extractive industry projects, so in many aspects it will be starting with a clean slate. It has no local history to fall back upon and has no institutions with any operational experience of monitoring and enforcement of a large mining operation. Moreover, at least with respect to Aynak, the investor is a Chinese company, which in turn does not have much experience in operating a large mine in a low income country. In general, given their relatively recent entry into the global mining industry, Chinese companies have less best-practice experience in managing environmental and, particularly, socio-economic challenges surrounding large mining operations. Huntzinger (2008: 58) reports that the company awarded the deposit, China Metallurgical Construction Corporation, has been operating a copper mine in Pakistan since 2003, which had not realized any significant lateral linkages or spillovers on the local economy by 2008.[7]

If Afghanistan is to have more than a series of mining enclaves, albeit ones generating large amounts of fiscal revenue, it will be necessary to make a very concerted effort to maximize the local or national jobs generated by the industry, particularly with respect to sidestream linkages and infrastructure 'externalities'. It may not be able to count on its investors to manage the process, and it currently lacks the information and the capacity to implement the necessary types of policies and programs itself. The main objective of this study is to fill some of this information gap, partially through analysis of the current possibilities in Afghanistan and partly through a careful application of successful socio-economic development in other countries to the situation in Afghanistan.

3. Economic Benefits of Aynak and Hajigak Mining Operations: A Quantitative Analysis

In this section an analysis is undertaken of the potential benefits to Afghanistan of the exploitation of the Aynak and Hajigak mineral deposits, starting from the construction phase and extended until the year 2040. The analysis is mostly quantitative although at times, given the data paucity and the difficulties of disentangling some important impacts, it will be necessary to qualitatively describe the various potential impacts. The word 'potential' is emphasized as the impacts will depend very much on a number of parameters, some of which are endogenous to the mining operations and all of which are endogenous to economic and social policy of the country

[7] Huntzinger, Emmanuel (2008), "Aynak Copper Mine: Opportunities and Threats for Development from a Sustainable Business Perspective", Integrity Watch Afghanistan, Kabul, Afghanistan.

as a whole. The values of these parameters, if unknown, will be varied in the scenario and sensitivity analysis described below.

The economic benefits of a mining project can cover a wide range, from a railway joining two formerly disconnected regions of a country to a sidewalk vendor selling fruits and vegetables to the families of mine workers. The analysis will attempt to include all of these options even if some are difficult to quantify. Note that the analysis will focus on the income that goes to nationals of Afghanistan (contributes to gross national income) and not on 'repatriated' value added (such as profits of foreign companies and income of foreign workers).

The main quantifiable benefits to a country of a large mining operation are the following:

(i) Employment and income of nationals:
   a. Working for the mining company during construction and operation of the mine.
   b. Working for the mining company during construction and operation of ancillary infrastructure.
   c. Working in upstream, sidestream, and downstream industries of the mining operations, including income earned by owners of domestic companies. In the analysis the focus here will be on the sidestream industries. Hired by the GoA in the public service or as contractors with fiscal revenues generated by the mining operations—directly, indirectly or through multiplier impacts.

(ii) Multiplier impacts caused by:
   a. Consumption of domestically produced goods and services by individuals who have received income from the mine directly or in domestic linkage industries, including foreign workers.
   b. Consumption of domestically produced goods and services by the GoA or by individuals who have received employment and income through government expenditure of the fiscal revenues generated by mining operations.

(iii) Fiscal revenues generated directly by the mine—the analysis focuses on the signing bonus, royalties, and income tax on profits and mine workers.

(iv) Amount of investment in the mine and ancillary operations.

(v) Net impact on the balance of payments of the mining operation—i.e. the increase in foreign exchange available to the country.

(vi) Savings generated by access to more efficient large-scale infrastructure (e.g. less expensive power).

(vii) Amount spent on local community projects, including small infrastructure projects. (As the value of this item is likely to be very small compared to many of those above, this will not be included in the analysis.)

The main other, difficult to quantify benefits of a large mining operation are:

(i) Employment and income generated by companies that are created outside of the mining industry to take advantage of improved infrastructure (including more reliable power in Kabul).

(ii) Benefits to local/regional community members of better infrastructure.

(iii) Welfare benefits of local/regional community members of better public services, including reduced morbidity and mortality.

(iv) Benefits to society as a whole of better infrastructure (e.g. railway, power).

(v) Enterprises created as a result of investment of a part of the mining sector generated fiscal revenues in infrastructure or other public goods.
(vi) Social capital created (particularly in local/regional communities) through process of consultation and participation in the development of the mine, including the building up of local governance capacity and the learning of new skills.
(vii) Other extractive industry projects that become viable because of the existence of infrastructure built for the operation, including related spin-offs and externalities as in all of the above.

In the analysis that follows the first set of benefits will be quantified and the second set will be discussed in a qualitative manner, albeit trying to relate to the Afghanistan reality as much as possible.

3.1 The Model and Data

In the analysis below we begin with Aynak and then move on to Hajigak. As there are more data (and fewer complications) with Aynak, the results for Hajigak are more speculative, but at a minimum they give orders of magnitude for the operation as a whole as well as the differences in the benefits under the various scenarios. Where available, actual data provided on the mining operations or Afghanistan was used. In other cases data for similar operations or parameters in other countries were used or it was deduced from other sources of data. For example, in the base case the percentage of GoA fiscal revenue spent on domestic goods and services (including public service employment) was set at 66% based on a breakdown of expenditure patterns of the GoA in the last fiscal years. In a small number of cases there is very little information on which to make an estimate, so the results rely on sensitivity analysis over a range of likely values (e.g. marginal propensity to consume of Afghans on local versus imported goods).

For each mining operation the model is divided into a number of sub-models, representing the construction and operating phases of the mine and the largest ancillary developments—rail, power, and the coal mine. However, the profits and taxes are only calculated for the mine itself as the ancillary infrastructure is treated as an input. The only exception is the imputed benefit of the power that the Aynak operators (200MW) and the projected Hajigak operators (100MW) must provide at cost to their regions. For the mines, the operating period is further broken down into 2 periods, one in which the capital cost of the initial investment is being amortized (reducing profits and taxes) and the other when it has all been amortized.[8]

In the construction period, it is assumed that no significant taxes are paid by the mining companies except the bonus payments. The local and foreign workers receive their wages, part of which they spend on domestic goods—a lower portion for foreign workers—, part of which is taxed (a total of 10%, either income tax or sales tax) and the rest they either save or buy imports with. When calculating the benefits to Afghanistan, the wages of foreign workers are not included but the amount they spend on domestic goods and their income tax payments are included in the multiplier effects. The amount spent on labor is deducted from the total

[8] There is an added complication here for Aynak as the investment for the later underground mine is being amortized when the original investment for the open pit mine and ancillary infrastructure has already been completely amortized.

investment. Part of this investment is spent on domestic goods and services (firms are taxed 20%), although most is assumed to be imported. Sensitivity analysis is undertaken later on the propensities to consume domestic goods and the amount of investment that is domestically sourced. The GoA spends the revenues it receives from the bonus payments and incomes and sales taxes, partly on domestic goods and services (estimated at 66% in the base case) and partly on imports.

The various expenditures on domestic goods and services—by workers, firms supplying goods and services to the mine owners, and the GoA—are then subject to multiplier effects, the magnitude of which again depend heavily on the marginal propensity to consume of Afghanis on domestic goods and services.

The model for the operating (or exploitation) phase is very similar except that it is necessary to determine profits and profit based income taxes paid by the mine. The output of the mine is multiplied by the price to get gross revenues. For copper, the current London Metal Exchange (LME) price is used as this is generally the best estimator of future prices but for iron ore the base price is set at $125/t, less than the current price ($150/t in June 2010). Given the number of large iron ore developments underway globally, it is our estimation that long-run prices may fall from the current historically high levels. Nevertheless, in the sensitivity analysis, the model is run with prices of $100/t and $150/t. For Aynak, costs are based partially on information provided by the company[9] and mid-range operating costs globally. The estimated cost of pellet production at Hajigak is $75 per ton, which is based on mid-range, global production costs. Profits and profit taxes are then calculated allowing for amortization, which feeds into GoA revenues and expenditures, as well as corresponding multiplier impacts.

In addition, the net impact on the balance of payments is calculated for the two mines during the construction and exploitation stages. During construction the main net inflows would be the signing bonuses, local wages, and any domestically produced inputs, from which is subtracted imported consumption goods of the workers. (It is assumed that the imported capital goods and materials are paid for with FDI.) In the exploitation stage, to obtain the net impact, a number of items must be subtracted from export revenues: repatriated profits and expat wages, imported goods and services used in operations, expenditures by the GoA on imports with the fiscal revenues it receives, expenditures by workers on imported goods, and expenditures on imported goods derived from the multiplier impacts.[10]

In all three phases, the results are again broken down into direct, indirect, and imputed benefits. The direct benefits are those associated with the operation of the mine and the ancillary infrastructure and are composed of employment and wages, taxes paid by the mining company, and the imputed power savings. The indirect benefits include domestic sourcing, the multiplier

[9] In MCC's bid for Aynak, production costs are set at $.50/lb but this doesn't appear to include power costs, which should be about $.35/lb. In the end $.80/lb was used in first stage of exploitation and $1.00/lb was used in the more costly underground phase. These numbers seemed more consistent with the costs of other new copper mines around the world. For example, the expected costs for Freeport-McMoran in 2010 are 86 cents/lb (Bloomsberg, 2010). Bloomsbury Mineral Economics (2010) uses $1/lb in its sophisticated analysis of copper markets.

[10] Individuals or companies benefiting from the multiplier impacts will also spend part of their incomes on imports, reducing the net impact on the balance of payments. We are not able to calculate any new exports that arise as an externality of the mine and related infrastructure.

impacts of expenditure by mine employees and mine supply companies, and taxes related to domestic sourcing and the multiplier impacts. The induced impacts are the benefits to the economy of the expenditure of the increased fiscal revenues of the government.

3.2 Quantifiable Benefits of Aynak and Hajigak (No railway)

The Aynak copper mine development, as specified by MCC in its financial bid for the project, plans to produce annually approximately 200,000 tons of copper cathode, or an equivalent amount of copper concentrate. MCC is to build a 400 MW power plant, fueled by coal from a mine operated by MCC through a concession from the GoA; 50% of the power is to be provided to the community at cost. MCC is also to build a railroad that has yet to be specified in value and route, and is to contribute to a number of social projects in the mining community.

The GoA only recently announced a request for bids for the Hajigak development. Given the size of deposits at Hajigak and the remote location from suitable markets for iron ore, this analysis assumes the inclusion of a concentrator and pelletizer with the Hajigak development. Without this level of beneficiation, serious doubts arise regarding the feasibility of exporting large quantities of a low value product, such as iron ore, over such long distances. Other higher-value configurations exist and range from the production of low-grade iron to highly-refined steel products. The quantitative analyses below do not attempt to include these higher value-added products, given the great number of factors affecting the estimates needed for their analysis.

The development included in this study for Hajigak follows the general design of the Aynak development, and is assumed to produce 7.5 million tons of iron ore pellets.[11] The development includes a 300 MW coal power plant, fueled by coal from a mine operated by the mine owner through a concession from the GoA; 50% of the power is to be provided to the community at cost. The developer would also be required to build a railroad that is not specified but is assumed to be equal in value to the assumed railroad for Aynak; social contributions to the local community are assumed equal to those required for Aynak. Given the uncertainty regarding the railroads for each project, one analysis considers the mine developments and auxiliary projects, but without the railroads. A second analysis assumes that each of the two mine developments share the costs of a $3.2 billion railroad, which is the estimated amount required to export the final products of both developments.

In Tables 2a and 2b estimates of the annual (quantifiable) benefits to the Afghan people from Aynak and Hajigak are given, excluding railway development, in the low impact, moderate impact and high impact cases. These benefits, which represent the contribution to Gross National Income (GNI), are shown for the direct, indirect and induced impacts as described above. Note that in the medium impact case, the total average annual increase in GNI of $1.7 billion is equal to about 18 percent of total 2008 GNI of Afghanistan, while the direct impacts alone are 8.1 percent of 2008 GNI. The different scenarios vary according to the parameters used for domestic spending and outsourcing as described below the table. For each scenario, the

[11] This is a modest assumption considering the size of the deposits identified at Hajigak. The results from the analyses below can be scaled, within reason, to accommodate a larger development.

benefits are divided into the construction phase, the exploitation during amortization of investment phase, and the exploitation with no amortization phase. The various prices and costs do not vary, although in the sensitivity analysis it will be shown how they can affect the level of benefits.

Clearly, the benefits vary greatly depending on how integrated the mines are into the domestic economy and the size of the market of domestically produced goods. It seems likely that currently these parameters fall roughly into the low impact scenario, although that does not preclude them increasing over time as the linkages and economy develops. In the last row of each table, it is assumed that the low impact parameters hold for the construction phase, the medium impact parameters hold for the amortization-exploitation phase and the high impact parameters hold for the no amortization-exploitation phase. For the medium impact case, the income benefits to the economy are illustrated over time in Graph 1.

Table 2a: Annual Economic Benefits (GNI) to Afghanistan from Aynak Copper Mine ($USm)

	2011-15	2016-22	2023-40	Weighted Annual Average (Undiscounted)
Low Impact – Direct	175	568	598	520
Low Impact – Indirect	70	89	74	77
Low Impact - Induced	141	310	318	286
Low Impact - Total	386	966	990	884
Medium Impact - Direct	175	568	598	520
Medium Impact – Indirect	137	145	123	130
Medium Impact – Induced	215	472	484	436
Medium Impact - Total	527	1185	1204	1087
High Impact - Direct	175	568	598	520
High Impact - Indirect	295	281	239	258
High Impact - Induced	392	850	865	783
High Impact - Total	862	1699	1702	1561
Mixed impacts –Total (see text above)	386	1185	1702	1362

Includes coal mine, power plant; excludes railway.

Table 2b: Annual Economic Benefits (GNI) to Afghanistan from Hajigak Iron Ore Mine (US$m)

	2011-15	2016-22	2023-40	Weighted Annual Average (Undiscounted)
Low Impact – Direct	93	230	259	225
Low Impact – Indirect	60	102	104	96
Low Impact - Induced	80	145	165	146
Low Impact - Total	233	477	529	467
Medium Impact - Direct	93	230	259	225
Medium Impact – Indirect	117	167	171	161
Medium Impact – Induced	124	225	255	226
Medium Impact - Total	334	622	685	612

High Impact - Direct	93	230	259	225
High Impact - Indirect	251	322	331	316
High Impact - Induced	231	425	479	425
High Impact - Total	575	977	1069	965
Mixed impacts –Total (see text above)	233	622	1069	825

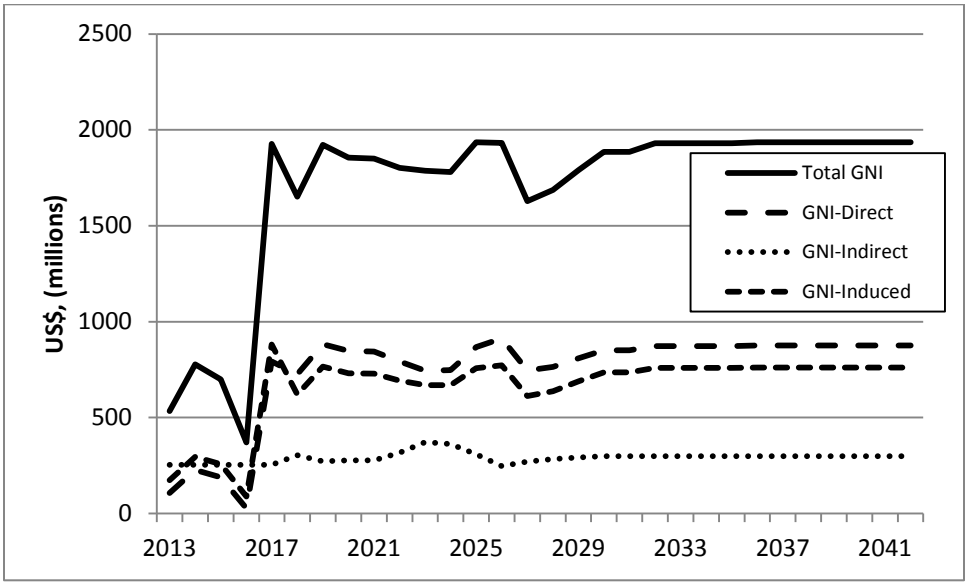
Includes coal mine, power plant; excludes railway.

Key Assumptions

1. Price of copper is $6800/tonne ($3.1/lb); Price of iron ore is $125/tonne.
2. Investment is depreciated over 7 years.
3. Ancillary includes coal mine and power plant; it does not include railway.
4. The imputed shadow benefit of power is 10 cents/kWh for 200 MW of power capacity for Aynak and 100 MW for Hajigak.
5. Expenditure of GoA on domestic goods and services varies from 60% to 66% to 72%.
6. Marginal Propensity to Consume (MPC) of domestic goods of Afghans varies from 0.2 to 0.4 to 0.6; MPC of domestic goods for foreign workers varies from 0.1 to 0.2 to 0.3.
7. Outsourcing to domestic companies (adjusting for their own imports) ranges from 6% to 14% to 24%.

It should be stressed that the parameter values in assumptions #6 and #7 are quite modest. In the base (medium impact) case, for example, it is assumed that the Afghani workers only spend 40 percent of their income on domestically made goods. A recent survey undertaken on a new large Zambian copper mine (Kansanshi in Solwezi) found that the domestic mine and mine supplier employees spent about 70 percent of their disposable income on domestic goods (McMahon and Tracy, forthcoming). Similarly, the base case assumption for sourcing from domestic sources is only 14 percent, compared to approximately 60 percent in the Kansanshi case in a country with a long established mining industry. In Ghana, another low income mining country, the Ghana Chamber of Mines (2009) reports that 47 percent of inputs are procured domestically.

Graph 1: Contribution of Aynak and Hajigak to GNI from 2011-2042: Direct, Indirect, and Induced Benefits in the Medium Impact Case



Source: Authors' compilation from simulations.

The numbers of jobs generated directly and indirectly by these mining operations are as important as the income generated. In tables 3a and 3b below, estimates are given under the three scenarios. In addition to the jobs in the construction and operation of the mine and ancillary infrastructure are the jobs in public service, sourcing and through the multiplier effects. For the public service, it is assumed fiscal revenues that are not used to buy imports are used for job creation, either in the civil service or through contracting. To derive the number of jobs, this figure is divided by the average wage. Note that given the high royalties and tax revenues being paid by the mines, the employment figures through this channel dominate the other sources.[12] For domestic sourcing and multiplier effects, it is assumed that 50% of the income created goes to labor. This figure is then divided by the average wage to obtain the number of jobs. Total average annual job creation associated with both mining operations in the medium impact case is 245,000. Approximately 80 percent of employment is generated by the multiplier impacts plus the effects of the large increase in fiscal expenditures. Graph 2 shows the evolution of employment over time by each component.

[12] Approximately 80% of employment is generated by the direct and subsequent multiplier impacts of the expenditure of the fiscal revenues generated by the sector.

Table 3a: Annual Employment Impact of Aynak Copper Mine[13]

	2011-15	2016-22	2023-40
Low Impact – Direct	4500	2140	4149
Low Impact – Indirect	7640	6152	5368
Low Impact - Induced	62450	137565	141362
Low Impact - Total	74591	145857	150879
Medium Impact - Direct	4500	2140	4149
Medium Impact – Indirect	23542	19015	16438
Medium Impact – Induced	71736	157361	161347
Medium Impact - Total	99778	178516	181934
High Impact - Direct	4500	2140	4149
High Impact - Indirect	60094	48657	41766
High Impact - Induced	87198	188902	192299
High Impact - Total	151792	239700	238214
Mixed impacts –Total (see text above)	74591	178516	238214

Includes coal mine, power plant; excludes railway.

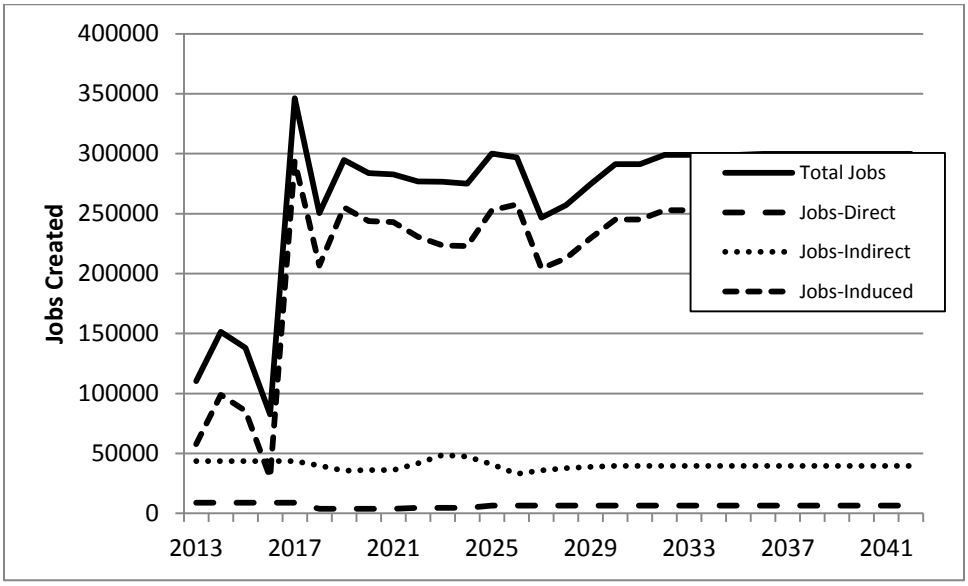
Table 3b: Annual Employment Impact of Hajigak Iron Ore Mine

	2011-15	2016-22	2023-40
Low Impact – Direct	4500	2008	2426
Low Impact – Indirect	6519	7028	7257
Low Impact - Induced	35755	64438	73369
Low Impact - Total	46775	73475	83052
Medium Impact - Direct	4500	2008	2426
Medium Impact – Indirect	20054	21750	22434
Medium Impact – Induced	41371	74878	85025
Medium Impact - Total	65925	98636	109885
High Impact - Direct	4500	2008	2426
High Impact - Indirect	51125	55706	57412
High Impact - Induced	51406	94416	106348
High Impact - Total	107031	152130	166185
Mixed impacts –Total (see text above)	46775	98636	166185

Includes coal mine, power plant; excludes railway.

[13] The direct benefits are those associated with the operation of the mine and the ancillary infrastructure and are composed of employment and wages, taxes paid by the mining company, and the imputed power savings. The indirect benefits include domestic sourcing, the multiplier impacts of expenditure by mine employees and mine supply companies, and taxes related to domestic sourcing and the multiplier impacts. The induced impacts are the benefits to the economy of the expenditure of the increased fiscal revenues of the government.

Graph 2: Contribution of Aynak and Hajigak to Employment from 2011-2042: Direct, Indirect, and Induced Benefits in the Medium Impact Case



Source: Authors' compilation from simulations.

For the same simulations, Tables 4a to 4c give the effects on fiscal revenues. In both Aynak and Hajigak, royalties dominate the fiscal contribution, followed by corporate income taxes and personal income taxes. The average annual direct and total fiscal revenues generated by the mining sector in the medium impact case are US$511 million and US$670 million, about 54 percent and 76 percent of fiscal revenues of $910 million (excluding foreign aid) in 2008-09. In the case of fiscal revenues, it is the direct impact that dominates due to the combination of high mineral prices and high tax rates negotiated by the GoA (actual for Aynak, assumed for Hajigak).[14] Graph 3 illustrates the medium impact case for fiscal revenues over time.

Table 4a: Annual Fiscal Revenues Generated Directly and Indirectly by Aynak Copper Mine (US$m)

	2011-15	2016-22	2023-40
Low Impact – Direct	166	388	412
Low Impact – Indirect	39	64	52
Low Impact - Induced	3	7	7
Low Impact - Total	208	459	471
Medium Impact - Direct	166	388	412
Medium Impact – Indirect	43	69	56
Medium Impact – Induced	9	20	21
Medium Impact - Total	217	477	489
High Impact - Direct	166	388	412
High Impact - Indirect	53	86	70

[14] It could be argued that the imputed power savings should be included in the fiscal revenues as it is a form of payment from the mining companies. If included, fiscal revenues from the sector would increase by US$263 million.

High Impact - Induced	24	51	52
High Impact - Total	242	525	534
Mixed impacts –Total (see text above)	208	477	534

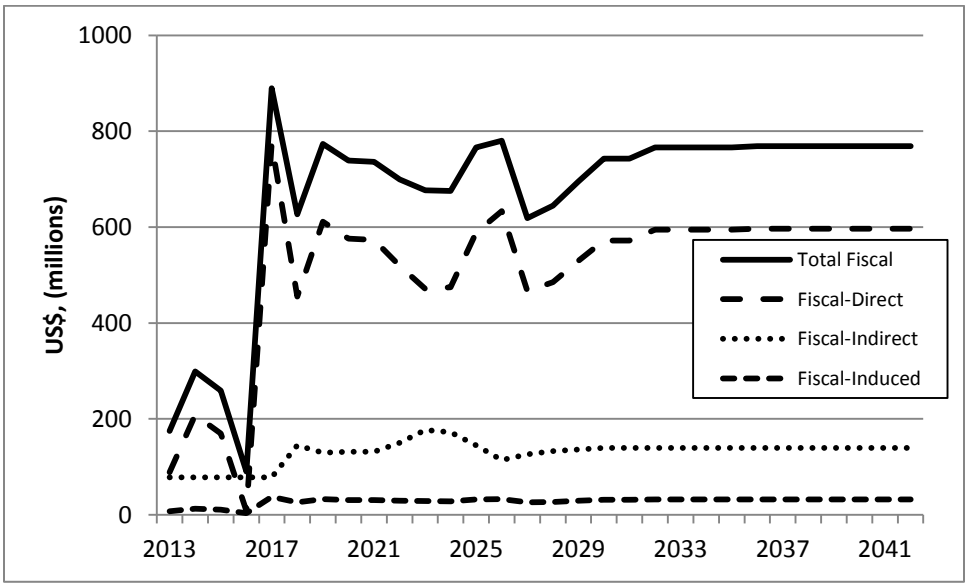
Includes coal mine, power plant; excludes railway.

Table 4b: Annual Fiscal Revenues Generated Directly and Indirectly by Hajigak Iron Ore Mine (US$m)

	2011-15	2016-22	2023-40
Low Impact – Direct	84	138	166
Low Impact – Indirect	33	74	75
Low Impact - Induced	2	3	4
Low Impact - Total	119	215	245
Medium Impact - Direct	84	138	166
Medium Impact – Indirect	36	79	81
Medium Impact – Induced	5	10	11
Medium Impact - Total	125	227	258
High Impact - Direct	84	138	166
High Impact - Indirect	45	99	101
High Impact - Induced	14	26	29
High Impact - Total	143	262	295
Mixed impacts –Total (see text above)	119	227	295

Includes coal mine, power plant; excludes railway.

Graph 3: Contribution of Aynak and Hajigak to Fiscal Revenues from 2011-2042: Direct, Indirect, and Induced Benefits in the Medium Impact Case



Source: Authors' compilation from simulations.

Another benefit of a large mining operation is the foreign exchange it can bring into a country. Nevertheless, the size of this impact is often exaggerated, particularly in a country with a weak industrial base. A large amount of the foreign exchange will go towards importing capital equipment and raw materials; another large amount will be repatriated profits. Moreover, if domestic goods and services are limited in quantity and scope, there will be a large impact on imports by domestic consumers. Some preliminary estimates are made below on the net balance of payments impacts of the two mines.

Tables 5a and 5b give the effects on the net balance of payments. It is assumed that all the mining output is exported and all net profits are expatriated, as well as savings of foreign workers. From this figure, the imports of inputs by the mining operation and its domestic suppliers, consumption imports by all workers and beneficiaries of the multiplier impacts, and the imports of the GoA are subtracted. During the construction phase, it is assumed that the only significant inflows are the bonus payments and FDI covers the cost of all capital goods and raw material imports. The other assumptions are the same.[15]

The direct impact on the balance of payments is calculated to be very large, an average annual surplus of US$ 1.34 billion in the medium impact case, compared to the balance of trade deficit of US$6.7 billion in 2008-09. A large part of this surplus is 'used up' through imports by supply firms, the government, and consumers. Nevertheless, the increased foreign exchange availability plays an important role in increasing economic welfare by making these imports accessible. Note that in the high impact case, the total effect on the balance of payments is actually negative. This result occurs as there is a large increase in imports due to the 'booming' economy but the largely sectoral model does not allow for any increase in exports outside of the mining sector. See Graph 4 for the impact on the balance of payments over time of each component.

Table 5a: Annual Impact on Net Annual Balance of Payments of Aynak Copper Mine (US$m)

	2011-15	2016-22	2023-40
Low Impact – Direct	201	880	808
Low Impact – Indirect	-42	-167	-133
Low Impact - Induced	-83	-226	-232
Low Impact - Total	77	487	443
Medium Impact - Direct	201	880	808[16]
Medium Impact – Indirect	-51	-208	-166
Medium Impact – Induced	-72	-259	-265
Medium Impact - Total	78	413	377
High Impact - Direct	201	880	808
High Impact - Indirect	-64	-277	-222
High Impact - Induced	-64	-332	-337
High Impact - Total	73	271	248

[15] The model is not 'closed' in that there are no exchange rate or relative price adjustments and it does not capture the balance of payment impact of new industries started in reaction to the growing economy. Consequently, it is possible to have a negative balance of payments effect as the increase in imports for consumption and as inputs is higher than the inflows from the bonus payments or exports.

[16] The direct effect on the balance of payments is less in the third than second period as there is additional investment in that period (underground mine) that results in lower taxes and more repatriated profits.

Mixed impacts –Total (see text above)	77	413	248

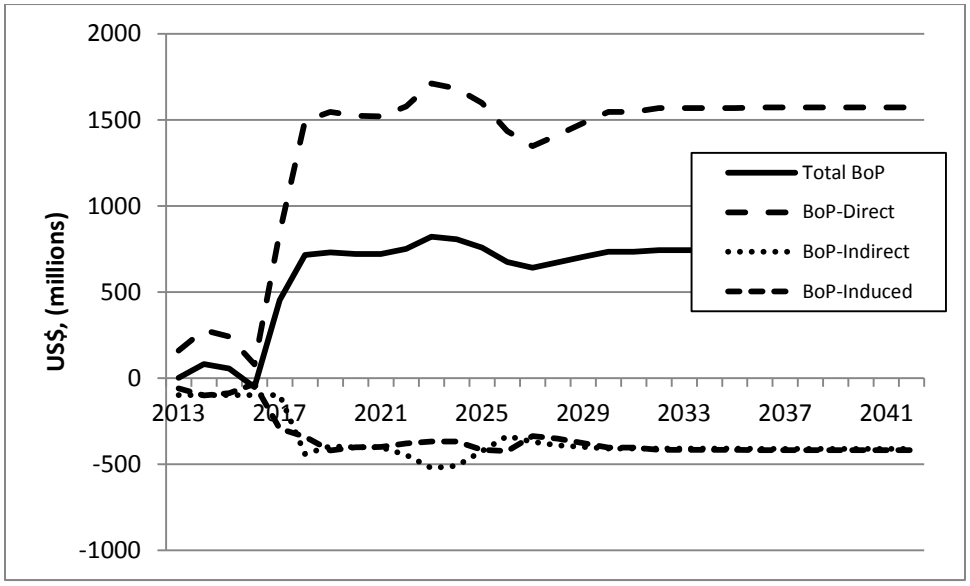
Includes coal mine, power plant; excludes railway.

Table 5b: Impact on Net Annual Balance of Payments of Hajigak Iron Ore Mine (US$m)

	2011-15	2016-22	2023-40
Low Impact – Direct	120	699	728
Low Impact – Indirect	-40	-189	-187
Low Impact - Induced	-47	-106	-120
Low Impact - Total	32	404	420
Medium Impact - Direct	120	699	728
Medium Impact – Indirect	-47	-237	-236
Medium Impact – Induced	-42	-123	-140
Medium Impact - Total	31	339	351
High Impact - Direct	120	699	728
High Impact - Indirect	-57	-317	-319
High Impact - Induced	-39	-166	-187
High Impact - Total	24	216	222
Mixed impacts –Total (see text above)	32	339	222

Includes coal mine, power plant; excludes railway

Graph 4: Contribution of Aynak and Hajigak to the Balance of Payments from 2011-2042: Direct, Indirect, and Induced Benefits in the Medium Impact Case



Source: Authors' compilation from simulations.

The last set of tables of this sub-section sums up the impacts on the variables for both Aynak and Hajigak and simulates the prices at which the mines would be near the 'break even' level. This was defined as the prices at which the net present value became positive with discount rates of either 5 percent or 10 percent. For both operations, and for both discount rates, the break-even prices are well below actual prices in late 2010.

Table 6a: Average Annual Impacts of Aynak and Hajigak on Selected Variables (2013-2040) (US$m)

	GNI	Employment	Fiscal Revenues	Net Balance of Payments
Low Impact – Direct	745	6413	511	1343
Low Impact – Indirect	173	13010	121	-289
Low Impact - Induced	433	192340	9	-311
Low Impact – Total	1351	211763	641	744
Medium Impact - Direct	745	6413	511	1343
Medium Impact – Indirect	291	40101	130	-361
Medium Impact – Induced	663	220864	28	-351
Medium Impact (base case) – Total	1699	267378	669	630
High Impact - Direct	745	6413	511	1343
High Impact - Indirect	574	102395	162	-484
High Impact - Induced	1208	268396	73	-448
High Impact – total	2526	377204	746	412
Mixed impacts –Total[17]	2187	327536	717	476

Includes coal mine, power plant; excludes railway.

Table 6b: 'Break-Even' Prices for Aynak and Hajigak

Mining Operation	Discount Rate	Break-Even Price
Aynak	5%	$1.49/lb
Aynak	10%	$1.85/lb
Hajigak[18]	5%	$97.9/tonne
Hajigak	10%	$114/tonne

Includes power plant, coal mine, no railway

3.3 Sensitivity Analysis

[17] In the mixed impacts, it is assumed that the economy develops over time so that in the first period the results aer the low impact case, the second period, the medium impact case, and the third period the high impact case.

[18] Given the tender process for Hajigak is just underway and the difficulty in finding operating costs for comparable mines, it was assumed that the operating cost/tonne for Hajigak would be $75/tonne. If the operating cost/tonne for Hajigak was $50, for example, the break-even prices would be $73 and $91 for a 5% and 10% discount rate, respectively.

In this section the results obtained in the two previous sub-sections will be subjected to a further sensitivity analysis of some of the most important parameters (e.g. prices of copper and iron ore, government spending). In addition, the relative impact of the parameters that were varied in the analysis above will be examined.

In the first simulations, the base case parameters are used except one of the a priori most important parameters fluctuates: (i) the GoA expenditure on domestic goods moves from 0.60 to 0.66 (base) to 0.72; (ii) the MPC of domestic goods moves from 0.2 to 0.4 (base) to 0.6; and (iii) the domestic sourcing parameter moves from .06 to .14 (base) to .24. The intent here is to see if changes in one of the parameters dominate the other two.

Table 7a: Total Annual Economic Benefits (GNI) to Afghanistan from Aynak Copper Mine ($USm): Sensitivity Analysis

	2011-15	2016-22	2023-40	Weighted Annual Average (Undiscounted)
Base Case	527	1185	1204	1087
GoA MPC domestic goods is 0.60	507	1141	1159	1046
GoA MPC domestic goods is 0.72	548	1230	1250	1129
MPC domestic goods of workers is .2	523	1183	1200	1083
MPC domestic goods of workers is .6	535	1190	1214	1095
Domestic sourcing is 0.06	473	1137	1165	1043
Domestic sourcing is 0.24	596	1246	1254	1142

Includes coal mine, power plant; excludes railway.

Table 7b: Annual Economic Benefits (GNI) to Afghanistan from Hajigak Iron Ore Mine ($USm): Sensitivity Analysis

	2013-17	2018-24	2025-42	Weighted Annual Average (Undiscounted)
Base Case	334	622	685	612
GoA MPC domestic goods is 0.60	322	600	661	591
GoA MPC domestic goods is 0.72	346	643	710	633
MPC domestic goods of workers is .2	330	620	683	609
MPC domestic goods of workers is .6	342	626	690	617
Domestic sourcing is 0.06	288	566	628	557
Domestic sourcing is 0.24	392	691	757	681

Includes coal mine, power plant; excludes railway.

The variation in the value assigned to domestic sourcing has the greatest effect and appears to be a more important parameter than the amount of extra income spent on domestic goods or how the government spends its money. However, the variation in the government expenditure variable is over a much narrower range, largely because the base case is based on 'harder' data.

The next set of simulations estimates the sensitivity of the results to copper and iron ore prices in the base case scenario. The price of copper was varied from $2 to $4 per pound and the price of

iron ore from $100 to $150 per tonne. It is assumed that they both go up or down together. Tables 8a to 8d show the direct, indirect, induced and total impacts on selected variables of these price changes in the medium impact case. Graph 5 shows the impact on GNI over time when metal prices are high.

Table 8a: Combined Annual Direct Impacts of Aynak and Hajigak on Selected Variables (2013-2040): Sensitivity Analysis of Copper and Iron Ore Prices (Medium Impact Case)[19]

	GNI	Employment	Fiscal Revenues	Net Balance of Payments
Base Case (Pc=3.1 & Pio=125)	745	6413	511	1343
Pc=2 & Pio=100	527	6413	293	1125
Pc=4 & Pio=150	914	6413	680	1512

Table 8b: Combined Annual Indirect Impacts of Aynak and Hajigak on Selected Variables (2013-2040): Sensitivity Analysis of Copper and Iron Ore Prices (Medium Impact Case)[20]

	GNI	Employment	Fiscal Revenues	Net Balance of Payments
Base Case (Pc=3.1 & Pio=125)	291	40101	130	-361
Pc=2 & Pio=100	291	40101	130	-361
Pc=4 & Pio=150	291	40101	130	-361

Table 8c: Combined Annual Imputed Impacts of Aynak and Hajigak on Selected Variables (2013-2040): Sensitivity Analysis of Copper and Iron Ore Prices (Medium Impact Case)

	GNI	Employment	Fiscal Revenues	Net Balance of Payments
Base Case (Pc=3.1 & Pio=125)	663	220864	28	-351
Pc=2 & Pio=100	437	145764	19	-228
Pc=4 & Pio=150	837	279022	36	-447

Table 8d: Combined Annual Total Impacts of Aynak and Hajigak on Selected Variables (2013-2040): Sensitivity Analysis of Copper and Iron Ore Prices (Medium Impact Case)

	GNI	Employment	Fiscal Revenues	Net Balance of Payments
Base Case (Pc=3.1 &	1699	267378	669	630

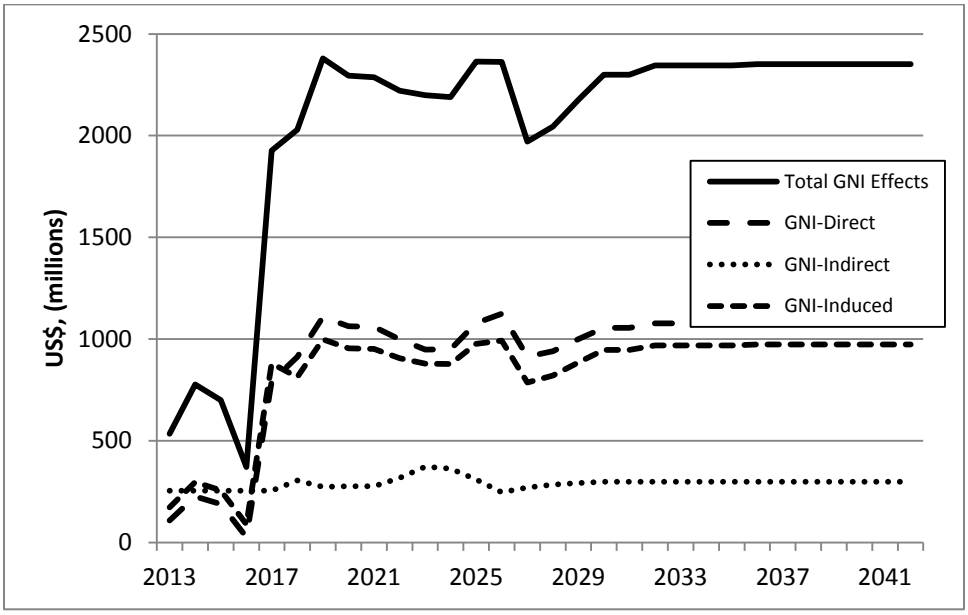
[19] The direct benefits are those associated with the operation of the mine and the ancillary infrastructure and are composed of employment and wages, taxes paid by the mining company, and the imputed power savings. The indirect benefits include domestic sourcing, the multiplier impacts of expenditure by mine employees and mine supply companies, and taxes related to domestic sourcing and the multiplier impacts. The induced impacts are the benefits to the economy of the expenditure of the increased fiscal revenues of the government.

[20] None of the indirect impacts depend on mineral prices as the amount of domestic sourcing, employment and related taxes and multiplier impacts only depend on the amount of production, which does not vary.

Pio=125)				
Pc=2 & Pio=100	1256	192278	442	536
Pc=4 & Pio=150	2042	325536	846	704

All include coal mine and power plant, exclude railway

Graph 5: Contribution of Aynak and Hajigak to GNI from 2011-2042: Direct, Indirect, and Induced Benefits in the Medium Impact Case with High Metal Prices



Source: Authors' compilation from simulations.

Clearly large changes in the prices of copper and iron ore would have very significant effects on various measures of economic activity in Afghanistan. This is partly due to the very high royalty amounts, which in turn would be buttressed by the corporate income taxes that would begin earlier (as depreciation would be quicker) and be higher. While it must be stressed that it is impossible to predict prices of metals even five years in the future, the prices near the end of January 2011, when this study was being wrapped up, were in fact closer to those of the sensitivity analysis with copper (LME 27 month future) going for about $4.00/lb and iron ore going for between $160 and $170/tonne, including shipping.

3.4 Quantifiable Benefits of Aynak and Hajigak with Railway

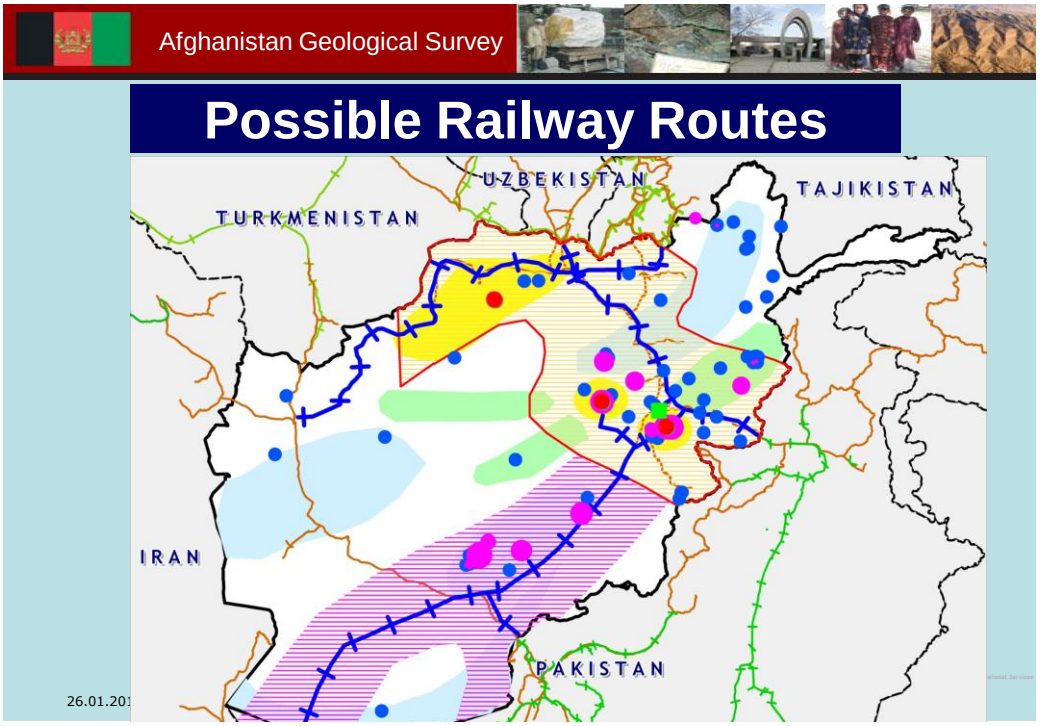
Both mines would result in large amounts of materials to be transported out of the country. While it could be feasible to truck the output of Aynak, the developer, MCC, is contractually obliged to provide a railroad. The development of Hajigak would be impossible without a rail link. In the estimates in the tables that follow, it is first assumed that MCC builds and pays for a railway for its own needs up to Kabul and then on to Jalalabad and Peshwar. In the second case,

the two mine operators join forces to build a railway from Aynak to Kabul to Hajigak and up to Mazaar-e-Sharif. A link from Mazaar-e-Sharif to Hairatan and on to Tajikistan is currently under construction. It is assumed that the two companies share the costs equally of building the railway from Aynak to Mazaar-e-Sharif.[21] Map 2, building on the mineral belts illustrated in Map 1, shows the potential railway routings in Afghanistan.

The main purpose of this section is to show what happens to the viability of the mines when the costs of building the railways are included. If, for example, the profits of a mine fall below a minimum acceptable level, it would not be viable. Then it could be necessary to forge a private-public partnership (PPP) to develop the railway. Part of the fiscal revenues collected from the mines would need to be invested in the railway (and/or donor funding). Of course, profits will depend on the prices of the commodities. In the simulations we varied the prices of copper and iron ore until average profits over the exploitation period fell to 10% of total investment after royalties were paid. This gives some indication of the room to maneuver that exists for each mine. The construction costs of the railway are based on Asian Development Bank and World Bank estimates for Afghanistan, taking into account the terrain that will need to be traversed (HB Consultants, 2010; World Bank, 2008). Freight costs were assumed to be 2 cents per tonne-kilometer over 1000 kilometers on average. Graph 6 shows the impact over time on GNI when a railway is included to Mazaar-e-Sharif.

[21] If security was not taken into consideration, it is possible that the most effective route would be through Kandahar, across southwestern Afghanistan and south to the Pakistan port of Gwadar (passing by 2 existing copper mines on this last stretch). However, we do not believe that the construction and operation of such a route is feasible by the time it would be needed by the mines.

Map 2: Railway Routes along Mineral Belts in Afghanistan



Source: Afghanistan Geological Survey (2010).

Table 9a: Annual Impacts on GNI of Aynak with Railway to Peshawar (assumed cost US$1.6 B): Base Case (Medium Impact)[22]

	2011-15	2016-22	2023-40	Weighted Annual Average (undiscounted)
GNI – Direct	178	568	598	521
GNI – Indirect	246	147	124	150
GNI - Induced	252	472	484	442
GNI—Total with RR	675	1187	1206	1113
GNI—Total without RR	527	1185	1204	1087
"Break-even" price, 5% discount rate	$1.79/lb $2.35/lb			

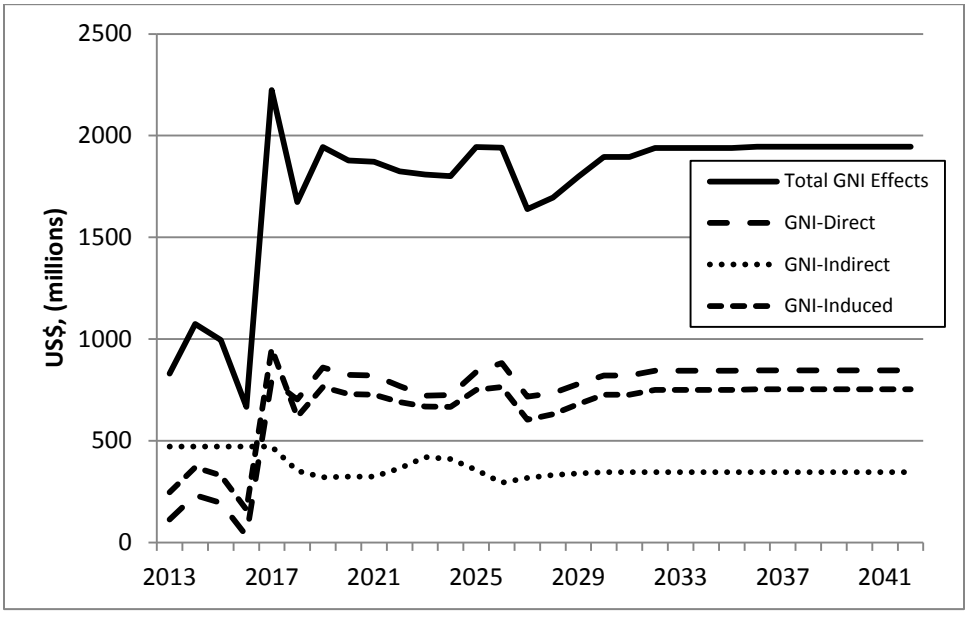
[22] The direct benefits are those associated with the operation of the mine and the ancillary infrastructure and are composed of employment and wages, taxes paid by the mining company, and the imputed power savings. The indirect benefits include domestic sourcing, the multiplier impacts of expenditure by mine employees and mine supply companies, and taxes related to domestic sourcing and the multiplier impacts. The induced impacts are the benefits to the economy of the expenditure of the increased fiscal revenues of the government.

10% discount rate		

Table 9b: Annual Combined Impacts on GNI of Aynak and Hajigak with Railway to Mazaar-e-Sharif (assumed cost US$3.2 B): Base Case

	2011-17	2018-24	2025-42	Weighted Annual Average (Undiscounted)
GNI – Direct	274	775	827	723
GNI – Indirect	472	359	341	367
GNI - Induced	412	695	731	669
GNI—Total with RR	1158	1829	1899	1759
GNI—Total without RR	862	1807	1890	1699
Aynak: Average profits (% of I); current price	14			
"Break-even" price for Aynak, 5% discount rate 10% discount rate	$1.79/lb $2.35/lb			
"Break-even" price for Hajigak, 5% discount rate 10% discount rate	$135/tonne $163/tonne			

Graph 6: Contribution of Aynak and Hajigak with Railway to GNI from 2011-2042: Direct, Indirect, and Induced Benefits in the Base Case



Source: Authors' compilation from simulations.

Even if the developer of Aynak had to pay the full cost of the railway, it still appears to be a highly profitable investment unless copper prices fall significantly from their current (LME 27 month futures in late 2010) price level of nearly $3.60 per pound. However, at the assumed $75/tonne operating cost, the iron ore mine would be closer to break-even levels if it had to pay half of the costs of the extended railway. As noted in FN 15, it will be very difficult to know the likely operating costs of Hajigak until tenders come in. If they are closer to $50/tonne, the break-even price of iron ore falls to $90 and $119 at 5% and 10% discount rates, respectively, when the mining company has to bear the full cost burden of the railway.

Of course, either railway option will likely have very strong externalities for the rest of the economy, including increasing the abilities to develop more domestic suppliers of goods and services to the mining industry and the impact on the likely discovery of additional important deposits. These opportunities are discussed in more detail in the next section.

4. International Experience on Increasing Socio-Economic Benefits from Large Mining Operations: Lessons for Afghanistan

As discussed at the beginning of section 3, a large number of impacts of potential mining operations are difficult to quantify, a challenge that is magnified by the general lack of data in Afghanistan. The focus of this section will be on procurement possibilities in the mining industry in the short-, medium-, and long-term; the implications of infrastructure developments to serve Aynak and Hajigak on other economic sectors in Afghanistan, including an analysis of harmonization of these developments with other planned or potential infrastructure projects in Afghanistan and the implications for growth poles, resource corridors, and public-private partnerships (PPP).

4.1 Domestic Sourcing by the Mining Industry

The biggest issue facing mining countries and the firms that operate in them in recent years likely is how to increase the value added generated by or associated with the mining operations. While the impetus was first mostly at the local level—how can host communities get more jobs and other benefits from the mining industry—it soon became a national issue, particularly in countries with a small industrial base. That is, how can the mining industry be used to kick start the industrialization process beyond the jobs in the mines—which have fallen enormously over time—and the fiscal revenues it provides.

Historically, the emphasis has been on upstream and downstream linkages associated with mining operations or on the externalities of associated, non-dedicated infrastructure. However, the upstream possibilities are quite limited and mostly require a high level of sophistication—e.g. mining machinery and design. The downstream linkages, particularly for consumer products, usually require geographic proximity to large markets and strong marketing skills, and are subject to very strong competition. Even for industries like steel, the global experience has been quite poor if there are no large internal or nearby markets for the products. While the associated infrastructure often can have a strong role, in some types of mining—gold and precious stones in particular—this is not at a scale to have regional or national repercussions. Moreover, in a country with a very small industrial base and associated skills and entrepreneurship, the impacts of new roads and rail will likely be limited.

Consequently the emphasis has turned towards obtaining a larger portion of the generally sizable outsourcing or sidestream possibilities. As noted earlier there are generally many more jobs in firms selling goods and services to mines than in the mines themselves, particularly if the operation is a highly capital intensive open pit mine. Various estimates range from 2 to 8 times as many.[23] For example, the Argentinean mining industry, which only reached a significant size

[23] One of the earliest studies on the issue, albeit undertaken with limited data, found between 1.8 and 4.5 outsourcing jobs per mine job in six Latin America mines (McMahon, Gary and Felix Remy, 2001).

in the last 5 or 6 years, estimates that for each job in a mine (87,000), nearly 4 jobs are created in affiliated industries in Argentina (316,000) (Secretaría de Minería, 2009). As the sector is dominated by gold mines, with relatively small infrastructure demands, these figures are all the more impressive.

The first step in increasing domestic sourcing is to make existing companies aware of the possibilities. This means that the government or business groups (e.g. chamber of commerce) need to create information banks that include all the contracts up for bid. In relatively new mining countries, these data banks need to go further and carefully outline the types of skills and other inputs necessary to fulfill these contracts. Further, they can list training opportunities to develop the required capabilities as well as how to make professional bids. As discussed further below (see Box 3), the Mozal aluminum smelter in Mozambique set up a program called Mozlink that identifies contracts that could be sourced locally and trains local entrepreneurs on tendering. In Ghana potential suppliers receive information on contracts up for bid from a number of sources—the Ghana Chamber of Mines, the Association of Ghana Industries and the Suame Magazine Industrial Development Organization.

In Table 10 below the general patterns with respect to mineral industry procurement are listed for Burkina Faso, Ghana and Mali (Diawara et al (2010). In reality other than some food services, few things in the second column are sourced domestically except for Ghana. This result is not surprising given its mining industry is larger and has a much longer history. Nevertheless, even in Ghana there have been widespread complaints about the lack of spinoff industries, which in recent years have led to a number of innovative programs (see Box 2). In short, if no proactive measures are taken, there will likely not be much of a natural progression from column one to column three. It is also important to stress that mining is a high technology industry that demands high quality inputs.

Table 10: Current Patterns of Imports versus Domestic Procurement in Mai, Ghana and Burkina Faso

Often procured locally	Some local procurement	Usually imported
On-site mining services, e.g. • Grassroots geochemistry /sampling/ Exploration drillings • earthworks • Lab analysis • Explosives **Non-core onsite services, e.g.** • Camp construction	• Maintenance and repairs • Logistics/ transport/ warehousing Supply chain services • Civil works, construction, basic fabrication • PPE 1 (overall, uniforms) • Steel goods • Plastic goods • Foods supplied • Mining contracting • Primary crushing	• Reagents • Fuel • PPE 1 (glasses, gloves and helmets, cyanide and dust masks) • Machinery and Spare parts of mining capital equipments • Original Equipment Manufacturers supplied (sometimes through local partners of international

• Catering • Security Transport of staff	• Primary haulage	dealers)

If we examine Table 10 more closely, it is difficult to envisage a large amount of domestic sourcing in Afghanistan outside of the group labeled 'non-core onsite services' without a large amount of technical assistance to identify and develop suppliers. In fact, an examination of the proposed expenditures during construction by MCC in its bid document does not reveal much opportunity for Afghans or Afghan companies other than unskilled labor on the mine site. This is not a surprising result given that Aynak would be the first large-scale mine in the country's history. Nevertheless, a more detailed breakdown of the demands of the company would likely reveal several niche opportunities that Afghan companies could fill in a relatively short period of time.

Box 2: Mining Sector Linkages in Ghana

Ghana is the second largest gold producer in Africa behind South Africa. The Economic Recovery Program (ERP), which included an important mining sector reform, was launched in 1983 to stop the steady decline of Ghana's per capita GDP since independence in 1957. ERP helped to reverse the decline in Ghanaian mineral production, leading to a significant increase in investment in exploration and equipment (>US$ 8 billion invested from 1994 to 2010) with FDI representing 95%. Mining accounted in 2008 for 45% of exports and 6% of GDP compared to 20% of exports and 1% of GDP in the 1980s. It also contributed an average of over 12% of fiscal revenues between 1990 and 2008. The industrial mining sector generates 24,000 direct employees. Many other indirect jobs are created through downstream and side-stream activities, such as: lime and cement production; local confection and supply of basic safety and protective equipment; basic steel products; basic metal spare parts manufacturing; cupels and crucibles for laboratories produced from local kaolin; plastic products such as pipes, sheets and bags; explosives manufacturing; geological, geochemical, laboratory and drilling works and services; training courses in mining and related manufacturing and services; food production and catering; security services; and housing and accommodation for miners. In 2008, the mining industry deployed 43% of all its revenues to procure inputs locally, including 21% for power. Ghana also has a quite good training system and a proactive policy to limit and progressively diminish the use of expatriate labor in mining.

Each holder of a mining lease has to submit to the Minerals Commission a detailed program for the recruitment and training of Ghanaian personnel. Holders of mineral rights must give preference to: materials and products made in Ghana; service agencies located in the country and owned by citizens; companies or partnership registered in Ghana. There has been much more emphasis placed in Ghana on domestic outsourcing in the last decade and a number of policies and programs were either defined or intensified to contribute towards greater domestic supply. These programs include:

- A localization policy and training program aimed at progressive replacement of expatriate personnel by well trained Ghanaian personnel under the supervision of the Minerals Commission's Inspectorate Division with appropriate staffing and financing mechanisms. Under the proposed change to the Minerals and Mining Act, companies will have to procure 60% of their purchases domestically from the 4th year of operation.
- Support from professional organizations/institutions (like the Ghana Chamber of Mines) for entrepreneurs networking, policy dialog, sustainable financing through trust funds and more coordinated public-private interventions, infrastructure development, and targeted support to specific products' domestic manufacturing and supply.
- Supply chain linkages programs that support SMEs by providing finance, technical assistance, business planning services, transfer of skills, and access to raw material and technology.
- Establishing training institutions (particularly the University of Mines and Technology) and ensuring their appropriateness with the needs of the modern industry.

The Inspectorate Division is in charge of enforcing the observance of standards and codes by mining operators and making sure they meet all their commitments. In order to cover all its charges, including reasonable wages and equipment, the Division has established official tariffs and fees to be charged against the certificates and services it provides to the clients.

Source: Diawara, Adoo, and Ouedraogo (2010).

The experience of the Mozal aluminum smelting complex in Mozambique is quite revealing in this context. There was a large increase (300%) in domestic sourcing in the construction of Mozal 2 versus Mozal 1, partly due to more time to gain experience but also due to a number of other factors. For example, contracts were unbundled into 'chunks' that were manageable for local firms (see Box 3).

Box 3: Development of SMEs at Mozal, Mozambique

The Mozal smelter in Mozambique, near Maputo, was built by BHP Billiton in 2000 with a large expansion in 2003, Mozal II. It is a large smelter with a capacity of 550,000 tonnes per year. Mozal has brought substantial socioeconomic benefits to its local area and Mozambique in general. These include:

- At peak employment, 9,000 construction jobs at Mozal I and 6,000 at Mozal II;
- Mozal has 1,150 permanent jobs; indirect job creation is approximately 10,000;
- BHP-Billiton spends US$35-40m per year on purchases from Mozambican companies; from 2002-07, the number of local suppliers increased from 40 to 250, by 2008 over 1600 contractors in total have benefited;
- Through the Mozal Community Development Trust, BHP-Billiton spends 1 percent of pre-tax profits on community initiatives, US$ 2.5 million per annum and has had over 200 projects;
- Over 8,000 students have benefited from educational upgrades, including 40 new classrooms and a new secondary school;
- Through the Small and Medium Enterprise and Empowerment Program (SMEELP), 28 companies benefited from US$5m in contracts from 2001-03;
- Through Mozlink service, by 2005 local SMEs won US$11m in contracts (Thomas, 2005); and
- Big increase in quality and quantity of local infrastructure ($31 million by 2008).

Success with SMEs increased significantly with Mozal II, as Mozal I had failed to develop effective linkages to the local economy. The main reasons were: (i) contracts were 'bundled', including components that local SMEs could not fulfill; and (ii) contracts were in English. With SMEELP (and later Mozlink), Mozal II developed a specialized program that identified contracts that could be sourced locally, trained local entrepreneurs on tendering, and provided training and mentoring to SMEs (Thomas, 2005). By 2007, SME performance in the areas of quality, management, maintenance and safety improved by 20% on average (Jaspers and Mehta, 2007).

The case of Mozal shows that there can be substantial indirect benefits generated by a highly capital intensive industry such as an aluminum smelter. It is important for national and local governments to work closely with the owner of the smelter to identify possibilities, including human capital shortages and related training needs. It is particularly important for the company to have an active involvement with SMEs in order that they deliver the high quality inputs required by the smelter's operations. In addition, if local infrastructure is only dedicated to the smelter, it will be difficult for SMEs to have the required efficiency.

Source: Compiled by authors from noted sources.

While mining companies may have the lead role to play in increasing the potential for domestic sourcing, there are many other stakeholders, including national and local governments, NGOs and aid agencies, business groups, and development institutions such as the World Bank and International Financial Corporation. Although many of the more well-known companies may not need any compulsion, there is a growing tendency for governments to include clauses in mining contracts requiring companies to buy national goods and services when their prices and quality are competitive. More radically, some contracts require companies to assist in the development of SMEs to enable them to become their suppliers. Community Development Agreements (CDAs) are another tool that is being more frequently used. Under a CDA, the company must sign a separate agreement with each local community or region outlining the socio-economic benefits that it will be providing. The emphasis of such agreements is often on the sustainable development of the community past mine closure. Such CDAs entail programs that will increase the human and social capacity in the area and generally put a large emphasis on increasing local procurement.

The Republic of South Africa may be the country that has gone the furthest in being proactive towards increasing the amount of domestic value added, in part due to its unique historic situation; i.e. many countries would not trade with it during the apartheid era, and after that time it was necessary to introduce policies to increase benefits to historically disadvantaged groups. Until near the turn of the century, domestic value added was increased primarily through the needs or good will (CSR) of the mining companies. However, since that time the emphasis has moved from voluntary behavior to legislated actions. The requirements of mining companies in South Africa include the following:

- Fifteen percent of the ownership or equity of the companies must be held by historically disadvantaged South Africans (HDSAs) within five years and 26 percent within ten years.
- Forty percent of management must come from HDSAs within five years.
- Ten percent of the employees of a mining company must be women within five years of start-up.
- The company's social spending (whether through traditional CSR or a foundation) must be aligned with local and regional development plans (see Box 4 for an exceptional example of meeting this target in the Steelpoort Valley).
- Stakeholders undertake to give HDSAs a preferred supplier status.

For the purpose of this study, the last bullet is of particular importance. It makes it mandatory for mining companies to (i) Identify current levels of procurement from HDSA companies; (ii) Commit to a progression of procurement from HDSA companies over a 3 to 5-year period, reflecting the genuine value added by the HDSA provider; (iii) Encourage existing suppliers to form partnerships with HDSA companies, where no HDSA company tenders to supply goods or services; and (iv) Stakeholders commit to help develop HDSA procurement capacity and access Department of Trade and Industry assistance programs in order to achieve this. Note that the mining company is not legally required to buy from HDSA companies if they are not competitive both in price and quality. However, it is important that companies demonstrate good

will by increasing HDSA procurement over time or enabling HDSA companies to meet their standards.

Box 4: Steelpoort Valley Producers Forum, South Africa

The Steelpoort Valley Producers Forum (SVPF) is a group of 12 platinum and chrome mining operations operating in the Greater Tubatse Municipality in South Africa. SVPF was formed in 2002 due to a number of common challenges for the member companies and for their host communities, including:
- Shortage of water in the area that was going to present a major challenge for the companies' operations as well as for the development of local communities.
- Lack of local governance capacity and spatial planning created difficulties with respect to managing individual and collective infrastructure requirements and providing meaningful support to local development.
- Uncoordinated efforts by individual mines with respect to their social responsibility programs were limiting potential development impact of the mining operations in the area.

In this context, the need for the industry to solve common challenges and to maintain "social license to operate" led to the establishment of SVPF and also motivated various stakeholders to go well beyond the question of water and for the SVPF to become a major development player in the region. The main objectives of the forum were to co-ordinate and develop joint strategies between government and mining industry to ensure sustainable local economic development. The SVPF manages the whole process, which is formalized in terms of the forum's governance structure and implementation of projects.

A project management unit has been set up to manage the existing agreements between local government and participating mines until the government capacity is sufficient to carry out these functions. All work takes into account the overall developmental needs and supports local development plans. The projects and programs in which the SVPF is involved are all contractually based and rigorously managed and monitored. Examples of areas that SVPF has supported include:
- Spatial development and geological information systems
- Water management
- Transport infrastructure
- Capacity building and training of the Greater Tubatse Municipality Technical Department

As the result of the successes from this and other similar initiatives, the concept of producer's forum is now moving beyond the mining industry in South Africa to other industry groups as well as in multi-industry groups (such as, for example, producer's forum between mining and agricultural companies.

Source: Lourens (2009), Venter (2007)

4.1.1 Local Community/Regional Development in Madagascar

While the relevance of South Africa for Afghanistan could be debated, it is clear that countries can leapfrog different steps in the development of their mining industries. Madagascar is a country that is comparable to Afghanistan in many aspects: mountainous, poor, similar sized population, a thriving artisanal gemstone mining community, two known large mineral deposits, and the prospect of many others. While it is not landlocked, with the exception of South Africa, it is far from markets.

In 1998, with World Bank support, the Government of Madagascar (GoM) began mining sector reforms that eventually led to a large increase in activity, including the development of large mining operations in ilmenite and nickel/cobalt as well as several other strong possibilities. Given the wide spread poverty in the country, the GoM realized that sustainable development of mining could not be undertaken without a decentralized administration and a deep involvement of affected communities. Its strategy calls for: (i) capacity building of the provincial mining administration; (ii) increase of fiscal revenues to the communes, including the decentralization of tax collection; and (iii) definition of effective ways and means for community empowerment and participation, including the establishment of public/private partnerships with responsible mining companies willing to invest part of their profits in human resources capacity building, social, and physical infrastructure. A key element of this strategy is the provision of technical assistance to community associations and municipal governments for the integration of mineral resources management in their participatory development plans.

In short, mining companies and communities and regions must work together to integrate their respective development plans. In order to move responsibility to lower levels of government and increase the capacity of local populations to benefit from the opportunities afforded by the mining developments, a number of initiatives were undertaken, including: (i) training of nationals to work (as employees or suppliers) in the mining industry in both the short-term and long-term; (ii) programs to increase the capacity of local governments to manage fiscal resources; (iii) community participation in decision making for regional and local development—including land use planning and biodiversity—and budgeting; and (iv) infrastructure built to support the mining operations were integrated as much as possible with regional development plans, using public-private partnerships if necessary.

While there is still much to be done, particularly with respect to capacity building of local governments, important progress has been made. 12,000 domestic jobs were created during construction of the two mines and there are expected to be 5000 full time jobs at the two operations during exploitation—the ilmenite mine opened in 2009 and the nickel/cobalt mine is expected to open in early 2011. Mine forestry committees have been established to assist with biodiversity and land use planning. Both mining companies have provided extensive short-term training and some long-term training for workers in the mine. Both have taken very proactive stances in enabling local SMEs to take advantage of business opportunities arising from the requirements of the mining operations during construction and exploitation. A new multi-use port (with Bank guaranteed finance) has been built near the ilmenite operation, while the nickel/cobalt operation has done a major port upgrade. Both operations are providing power to

their local areas. A foundation is being established in connection with the ilmenite mine that will provide local communities with a source of income beyond mine closure.

Finally, given the importance of gemstones in Afghanistan, it is worth highlighting the success of the Gemological Institute of Madagascar (GIM: www.igm.mg) in increasing the employment, value added, and contribution to fiscal revenues in Madagascar of its large gemstone sector. Over 50,000 individuals and rising are involved in the gemstone industry in Madagascar. Students at GIM, which opened in 2004, are trained in different aspects of gemology—including training of trainers—both to increase the value received for its gems and reduce the 97% of stones that left the country in a rough state as recently as 2001. GIM provides all the skills that are needed to increase domestic value added, including cutting, valuation and marketing. Training is offered at all levels, even one day courses on gemology in remote villages. In 2005, the first regional cutting school was opened in Antsirabe. In 2007 a jewelry making school was opened, further enhancing the development of forward linkages. Many graduates of GIM now run their own businesses or work for one of the foreign-owned gem-cutting factories that have opened in Madagascar. It is estimated that 95% of the gems produced by weight now leave the country legally (DeLeon, 2008).

4.1.2 Lessons for Afghanistan

Despite the nascent state of its large-scale mining industry, there is clearly much to be learned from the experience of other countries. In Burkina Faso, for example, a country at a very low level of industrialization that had no modern mining sector to speak of just four years ago, over 80 percent of employees in all of its seven new mines are Burkinabe nationals. Although local procurement has been limited, the Government of Burkina Faso will soon begin a project with the objective of increasing the contribution of the mining sector to general economic development through better integration of ancillary infrastructure development around mines with the general needs of the country; regional spatial analysis of integrated geological and mining information, infrastructure data, environmental priorities, and other economic opportunities around clusters of mines in Burkina Faso; and knowledge platforms as forums of exchange on in/out of country best practice in (i) approaches to community development including engagement process, participation, funding, inclusion, gender, transparency mechanisms and alignment with local economic development plans; and (ii) measures to improve the quantity and quality of goods and services procured locally including procurement forums and training programs.

Similarly, it took less than ten years for Madagascar, another low-income country, to develop its gemstone industry in a situation that at least with respect to access to markets is much less favorable than in Afghanistan. While Ghana has a much longer mining history, the sector had become marginalized before major policy reforms in the late 1980s. Despite some dissatisfaction with progress to date, over 40 percent of inputs are now procured domestically.

The success of the Argentinean mining industry in creating jobs was noted above. That country may well be the best example of just how quickly things can take off if the appropriate infrastructure and skill base are developed or available. It had a very small mining industry until

reforms were undertaken in the second half of the 1990s. Mining investment was only $56 million in 1995, but by 2008 investment was $2.4 billion. From 2003-2008, the cumulative increases of the following key variables were: investment, 1014 percent; exports, 275 percent—$4.1 billion in 2008; production, 292 percent; employment, 259 percent—256,000 jobs in 2008 not including multiplier impacts; and exploration, 907 percent. Based on ongoing developments, it is projected that investment, exports, and production will at least double by 2015 and employment will increase by another 50 percent (Secretaría de Minería, 2009).

It is likely that, as is the case with Aynak, the Hajigak iron ore deposit will not be developed by one of the 'major' more established mining companies, which have a longer experience of working with local communities and national governments on issues of employment and increasing value added. Accordingly, it will not be possible to place the 'burden of expectations' on the mining companies alone. There will need to be a great deal of cooperation among all the stakeholders to ensure that programs are being delivered and that they are the right programs. The immediate concern is to develop the skill base to ensure that Afghans fill the large majority of the jobs in the mine and in firms providing the goods and services in the first column of Table 10 on procurement. Given the large amount of construction that has taken place in the country in the last decade, there is room to be optimistic that there already exists a good supply of the basic skills needed by the mining industry.

Nevertheless, SMES face many challenges in Afghanistan. Despite attempts to simplify business development, the country was still ranked 167th in the 2011 ease of doing business rankings (World Bank, 2011). In addition to the problems associated with security and corruption issues, the obstacles confronting SMES in Afghanistan include expensive and unreliable power, the absence of a proper land registration system, weak legal structures, a lack of a pool of skilled labor, and inappropriate business development services (most of which are funded by donors) (USAID Afghanistan, 2009).

It will be important for Afghanistan to take stock of the projected demand and supply of the various skills and types of goods and services that will be required by the mining industry in the short-, medium-, and long-term. The appropriate training and other required services can then be delivered through existing training and SME programs or through new ones adapted more specifically the needs of the mining sector. Of course, much of the benefits of a more well-trained workforce and business community will be lost if the accompanying infrastructure is inadequate or very costly, as discussed in the next sub-section.

4.2 Mining Supported Infrastructure, Growth Poles and Resource Corridors

All modern mines need supportive infrastructure but the amount and type varies greatly depending on the mineral, the size and location of the mine, and the degree of processing that takes place on site. In the case of large mines that are not near a seaport, the type of mineral is the driving factor with respect to transport infrastructure. For example, in a typical gold mine, there will be only one to eight grams of product (gold) for every tonne of ore that is processed. At the other extreme, a rich iron ore deposit can contain over sixty percent iron. Accordingly, while the gold can be flown out, the iron will likely need to be shipped by train. Base metal

operations usually require port facilities unless there are relatively nearby overland markets. The amount of power required by a mining operation tends to rise exponentially with the amount of processing that takes place, with aluminum smelting being the electricity 'guzzler' without comparison.

Paradoxically, the more infrastructure required by mining operations, the better it can be for the country's economic development due to the externalities generated and economies of scale in infrastructure provision, the latter allowing for opportunities to form PPPs. In the Afghan context, the known copper and iron deposits by themselves provide an opportunity to provide transport and power infrastructure to regions of the country desperately in need of such.

Non-dedicated infrastructure developed to service mining operations combined with programs to develop the skill base and SMEs can lead to growth poles around the mining operations, as has happened in such diverse places as Sudbury (Canada), Antofogasta (Chile, see Box 5), Johannesburg (South Africa) and the Copper Belt (Zambia). Growth poles usually begin as industrial clusters focused on supplying the mining industry but over time with the development of skills and entrepreneurship they can evolve into a mix of industries. Given that in the next few years, only two large mines may be developed in Afghanistan, it is premature to speak of mining centered growth poles in Afghanistan, but if significant discoveries are made along a resource corridor, they could play an important part in the country's future.

Box 5: Industrial Cluster and Beyond in Chile

Region II in Chile is one of the world's best examples of an industrial cluster built around a mining industry, in this case primarily copper. In the development of this cluster, centered on Antofogasta, mining companies have played a prominent role in infrastructure development and direct and indirect skill training for mining, including training in the work habits and management skills necessary in an advanced industrial economy. Mining companies work with new suppliers on quality enhancement and currently 50% of mining industry's procurement comes from Region II. Fiscal revenues generated by the mining sector have been targeted for education, including tertiary, for mine employment and related industries and the provision of finance for suppliers, primarily for companies trying to upgrade performance to obtain ISO 9000 and 14000 certification.

Chile is not content, however, with the vast progress made so far. The ultimate goal is to expand or spinoff the mining industrial cluster into other activities that will become increasingly independent of mining. The objective of the Innovation Fund created in 2009, funded by mining taxes, is to identify and accelerate the development of dynamic comparative advantage in strategic clusters in Chile. Sixty percent of the funds are to be spent in mining regions.

There have been a number of contributing factors to the success of Chile's mining cluster. The country has had fiscal and macroeconomic stability for many years, including the use of a copper stabilization fund to smooth out revenues coming from the copper industry. There has been social stability for nearly 20 years, partly due to large increases in funding of social programs. The programs of the Government of Chile have placed a strong focus on literacy, education, and poverty reduction. Region II has the lowest poverty rate and highest literacy and education rates in the country. It is important to emphasize that the success of the mining cluster is not due to

regionally targeted redistributive policies but on a strategy based on generating broad-based employment opportunities.

4.2.1 Resource Corridors in Afghanistan

Resource corridors are infrastructure developments that allow for development of otherwise economically unviable resources, both renewable and non-renewable. There is a great interest in Afghanistan for using the known large mineral deposits as the anchors for building resource corridors. In particular, rail, road, and power infrastructure built to service Aynak and Hajigak and export their production could be integrated with other infrastructure plans and routed through areas of high geological and agricultural potential. Putting security concerns aside for the moment, a rail line from Hajigak to Aynak and then south through Kandahar and eventually to the Pakistani port being developed at Gwadar would open up several important geological areas for exploration (see the extensive discussion in Brett and Jourdan, 2010). It is highly possible that there would eventually be three or four areas with a high enough concentration of mining activity to justify the creation of mining-led growth poles. In turn, these would provide much bigger markets for agriculture, quarrying, tourism and other economic opportunities in these regions, in addition to the service industries that would develop to meet other consumption demands of the employees of mining and other industries.

There are three overriding questions with respect to the provision of infrastructure for a growth corridor. First, what is the expected rate of return? Second, who pays for it? Third, what needs to be done so that entrepreneurs will take advantage of the corridor? In general, even in a situation without the security problems of Afghanistan, determining the rate of return is a difficult task. While probabilities can be assigned to finding deposits of various types, it is very difficult to determine how all the externalities would work out, never mind how to value some very important benefits such as social cohesion. Nevertheless, as discussed further below, there is some evidence that a resource corridor based on the Aynak and Hajigak operations would be financially justified.

On the second question, if the infrastructure is intended to go significantly beyond the mining company's needs, in general it should not be expected to pay for everything. If there is more than one mining company that would benefit, how much should each contribute? It is possible, of course, that the deposit is projected to be so profitable that the company can pay for the extended infrastructure in lieu of some future tax payments, although this solution means that the company will need access to a very large amount of financing before there is any output from the mine.

In the concrete context of Aynak (and something similar is likely to be true for Hajigak), the company is committed to building a railway line to export its production and to provide 200 MW of power for Kabul and surrounding areas at cost. This suggests that the cost of building train stations and depots and distribution lines for the power would become the responsibility of the Government of Afghanistan with support from donors and international financial institutions.

If current copper prices persist, the revenues generated by the mines would likely be sufficiently high to fund Aynak's infrastructure needs (through profits) and the GoA's infrastructure burden (through fiscal revenues). In the admittedly rough calculations in section 3 above (tables 9a and

9b), the price of copper is more than one and one-half times above the break-even price for Aynak at a 10 percent rate of return when it assumes all the railway infrastructure costs. In the case of Hajigak, there may be a better argument for a PPP, depending on the operating cost of the mine. With an operating cost of $50/tonne, the current iron ore price is about one and one-half the break-even price including a railway, but at operating cost of $75/tonne, the current (quite high) price is roughly the same as the break-even price.

Still, even with the infrastructure development, that does not mean that other activities will necessarily spring up out of the air. There have been many large infrastructure projects around the world that were intended to open up regions of a country for higher economic growth but only turned out to be white elephants, which quickly became potholed and weed covered as there was no incentive for upkeep. For entrepreneurs to take advantage of the infrastructure, the third question above, they need to have recognizable opportunities, access to finance, the proper management skills, and access to a trained labor force.

Building the corridor along a route with important natural resources almost by definition opens up new opportunities. However, most of these can easily end up being sourced to foreign companies if proactive policies are not taken. As discussed in section 4.1, all major stakeholders have important roles to play. The main strategy decision is often to decide whether stakeholders' actions (particularly the resource companies) should be compulsory or should the emphasis be on capacity building and then allowing market forces to take over.

5. Conclusions and Recommendations

5.1 Conclusions

This study attempts to quantify the benefits that could be obtained for the country of Afghanistan from the developments of the Aynak copper and Hajigak iron ore deposits and to discuss policies and programs—based on the experience of other countries—that would tend to maximize these benefits. The intent of the quantitative analysis is to provide orders of magnitude, including an analysis of the relative importance of key parameters. It is intended to lend itself to further analysis that will be able to probe more deeply into the various linkage effects as well as the values of the key parameters. Clearly, the ability to achieve the impacts described below will be heavily dependent on reaching a level of security to allow for mining the deposits, discovering new deposits, and creating infrastructure for functional linkage industries. Strong sector governance is also a requisite if the impacts are going to significantly increase beyond the mine site and cultural, social and environmental costs are to be minimized.

The central result is that the total impact on annual national income could vary by 87 percent per year on average (US$1.35 billion versus $US 2.53 billion or 14.7 percent to 27.5 percent of Afghan GNI in 2008), depending on what portion of the mining revenues are spent domestically and what portion of mine procurement goes to domestically based companies. Note that the majority of this variation is not due to the direct benefits of the mining sector—which do not

depend on linkages so constant at US$728 million across the case—but the indirect impacts, which vary from US$ 173 million to US$574 million, and the induced impacts, which vary from US$433 million to US$1.2 billion. The direct impacts are the most predictable at all, to a large extent dependent on the price of copper and iron, while the indirect and induced impacts depend on the ability of domestic firms to supply goods and services to the mining operations and on the preferences of income earners to buy domestically made goods and services—which of course will depend on the ability of domestic firms to supply them at competitive prices. Note that in reality the induced impacts will depend not only on the values of the parameters in the model but on how effectively the GoA is able to spend the large increase in fiscal revenues—or public expenditure management.

The annual impact on domestic employment varies from 212,000 to 377,000 jobs while annual fiscal revenues vary from US$641 million to US$746 million. In the case of fiscal revenues, the direct impacts are again invariant to the scenario ($US511 million) but taxes generated through sourcing and multiplier effects (the indirect and induced impacts) vary from US$130 million to US$235 million. The situation in employment is much more extreme as most jobs are created through the multiplier impacts, particularly via the large government expenditures. If the linkage and spending parameters are modest, the annual indirect and induced impacts are 205,000 jobs, but if they are very responsive, the indirect and induced impacts are 370,000 jobs, an additional 165,000 places.

Due to the high propensity to import goods in Afghanistan, the net balance of payments impacts are not that large. That is, when the indirect and induced impacts are higher, there is more substitution of domestic for imported goods, but at higher income and employment levels, there is an increase in imports. However, the model does not capture any increase in the production of domestic consumption goods or exports that would occur if the country is able to use the mining industry to leverage other industries or develop industrial clusters and resource corridors. The annual direct impact of the mining sector on the balance of payments, which helps to pay for imported inputs and consumer goods, however, is very large at US$1.43 billion in the base case.

Even in the pessimistic scenario, the impact on the Afghanistan economy will be very large. Moreover, while it is nearly impossible to accurately forecast mineral prices very far into the future, if copper and iron ore prices were to remain at their current levels, the impacts would be substantially larger than calculated in this paper. In the medium impact case, the annual direct GNI benefits to Afghanistan of the two mines are US$914 at near current (January 2011) prices—copper at $4 per pound and iron ore at $150 per tonne—while the total GNI benefits are calculated at US$2.0 billion (versus US$745 million and US$1.7 billion with copper at $3/lb and iron ore at $125/tonne). Other large mines are likely to be discovered in Afghanistan during the lifetime of these two mines, adding to the overall impact of the sector.

However, the quantitative analysis can only go so far. The development of several large mining operations would increase the relative level of prosperity in Afghanistan for a number of years or even decades as has often happened in resource rich countries, particularly in Africa and South America. Whether this would ultimately result in a level of prosperity like in the Democratic Republic of Congo, Botswana, South Africa, or Chile depends on the successful implementation of policies and programs that would increase the amount of domestic sourcing and, more ambitiously, use the infrastructure and other types of capital (including human and social capital) generated by the mining sector as a driver of sustainable growth in the country, through the

creation of industrial clusters, growth poles, or resource corridors. In the Afghanistan context, the mining sector is an important source of fiscal revenues but it is likely just as important as an industry that can kickstart the industrialization process of the country and lead to broadly based inclusive growth. However, if the social and environmental costs of the mining operations are not managed properly, the benefits will not be sustainable in the long-term.

Finally, successful sector management does not guarantee that the overall impact of the mining sector will be maximized. The increase in foreign exchange revenues could have a large effect on foreign exchange rates, while the rise in fiscal revenues, which could more than double current revenues in several years, will certainly put increased pressure on public expenditure management. If these revenues are not used judiciously, much of the benefits from the sector could be dissipated.

5.2 Recommendations

Five general recommendations, followed by more specific possible interventions, come out of this study.

1. As the deposits were both rich and known and are being developed in an era of high mineral prices, the economic benefits from these two mines to Afghanistan are considerably higher than the international norm. Unlike most countries, Afghanistan has not had to make a trade-off between high fiscal revenues, infrastructure development, and domestic employment in the mines and linkage industries. Consequently, the ultimate success of the mining sector depends on factors outside of the sector itself more than is usually the case. High quality public expenditure management, for example, may well be the most important factor in determining the overall contribution of the mining sector to sustainable development in Afghanistan.
2. The development of linkage industries, particularly in mining supply firms, is very important for increasing employment and income in the mining sector but can also have very strong impacts on fiscal revenues, which, once again, underlines the role of public expenditure management. International experience is quite clear on the matter that these industries will for the most part not develop by themselves, as mining firms are quite willing to outsource to trusted international partners. Consequently, the Government of Afghanistan with the assistance of donors and other stakeholders will need to undertake active policies to increase the capacity for firms and individuals to work in the identified linkage industries.
3. Major infrastructure investments will need to be undertaken to support the mining industry, particularly in rail and power. It is essential that such infrastructure is integrated to the largest extent possible with the infrastructure needs of other sectors of the economy, which could include the development of resource corridors anchored by the mining sector. It is likely that public-private partnerships will be required to take full advantage of this unique historical opportunity.
4. If security issues are overcome and these two mines are developed (and likely many others if exploration can take off), they will generate a very large amount of revenue—income, fiscal, and foreign exchange. Even in the pessimistic, low-impact scenario, the

amounts are very large in relation to current macroeconomic variables in Afghanistan. On the one hand, this means that there will be a strong need for transparency on the benefits and costs of the sector in order to maintain support for the sector from the affected regions and general population. On the other hand, it also means that the Government of Afghanistan must be prepared to confront new macroeconomic challenges, particularly with regards to the management of higher but highly variable fiscal revenues and a potentially much stronger foreign exchange rate. Programs like EITI could help meet the transparency challenge, while a stabilization fund could help meet the macro challenges.

5. Finally, there will be large impacts on communities in the mining regions. International experience shows us that there can be enormous stress on communities, particularly if they do not see themselves as receiving significant social and economic benefits from the mining operations while having to deal with problems associated with very large in-migrations or environmental damage. These impacts often lead to conflict and even armed rebellion. Consequently, it is essential that programs are put into place that will both provide the impacted communities with a fair share of the benefits—which can be defined in trilateral agreements—, manage the influx of migrants, and control environmental contamination.

The specific recommendations coming out of this study are grouped into three categories—increasing the benefits (or value added) generated by the sector, governance issues at the national and local level, and macroeconomic consequences. In each category the analysis of international experience should play an important part in the solution.

5.2.1 Increasing Mining Sector Benefits

The GoA, private sector and donor agencies all have a role to play in the following areas:

- Estimate the supply and demand of the various skills that will be required by the mining and related industries.
- Determine the policies and training programs that are necessary to fill the skill void and the responsibilities and sources of funding for delivering such programs.
- Determine the types and quantities of goods and services that the mining sector in Afghanistan is likely to source and the ability of Afghan companies to meet this demand.
- Develop and deliver programs that will increase the ability of Afghan companies to meet the procurement needs of the mining sector.
- Integrate infrastructure required by the mining sector with regional and national infrastructure plans, employing public-private partnerships where possible.
- Undertake a more in-depth analysis, including a cost-benefit analysis, of the feasibility of developing a resource corridor anchored by the mining sector based on existing knowledge of deposits and geology.
- Analyze the mineral policy and regulations and other relevant legislation to: (i) determine if they contain any impediments to increasing domestic sourcing and the development of resource corridors, including incentives to explore for and develop new deposits; and (ii) they reflect best international practice in supporting the development of domestic skills and firms to service the mining industry.

5.2.2 Governance Issues

The GoA would play the lead role in the following recommendations, although with input from donors and the private sector.

- With respect to the transparency of mining sector fiscal revenues, become certified as compliant by the Extractive Industries Transparency Initiative. Consider the inclusion of other important documents in the public domain (e.g. mining contracts).
- Develop the institutional and personal capacities to monitor and enforce laws and regulations in the mining sector, including those related to cultural, social and environmental impacts. Set up procedures to enable civil society to actively participate in the monitoring of the performance of mining operations.
- Develop a mechanism by which communities impacted by mining operations participate in the establishment of the agreement between the mining company and government. Establish an inexpensive grievance procedure for citizens impacted by mining operations.
- Develop the legal basis and institutional capacity of local and regional governments in mining areas in order that they can adequately respond to the increased demands that will accompany the mining operations.

5.2.3 Managing Macroeconomic Impacts

While donor agencies can play a role in the early stages of these recommended interventions, the bulk of the responsibility will be on the GoA.

- Consider the establishment of a mining sector revenue stabilization fund similar to those used in other successful mining countries, such as Chile and Botswana. Such a fund would need to manage investment allocation decisions over time balancing the immense need for investment now versus more efficient investments in the future as the investment climate improves, as well as prepare the country for a time when foreign aid diminishes.
- Analyze the distribution of mining sector revenues to lower level governments, taking into account the importance of local community cooperation, the demand pressures for services caused by rapidly rising populations in the areas of mining operations, the infrastructure needs of linkage industries, and equity considerations regards non-mining provinces.
- There will be need for rigorous public expenditure management, particularly with respect to consumption versus income redistribution versus public investment allocations.

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