Effects of oil, gas and mining investments on jobs

Literature review &

estimation tool for Ghana and Peru

Policy Research Paper prepared by Steward Redqueen and IFC (the Infrastructure and Natural Resources Department and the Results Measurement Unit)

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Contents

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EXECUTIVE SUMMARY

The extractive industry, that consists of any operations that remove metals, mineral and aggregates from the earth, is capital-intensive and presents opportunities for transformational impacts by creating employment and boosting shared prosperity. Worldwide, about 3.5 billion people live in oil, gas and mineral rich countries.

This study has three objectives: (i) to summarize the current state of economic research regarding employment creation by the extractive sector; (ii) to provide an overview of methodologies currently used to estimate indirect and induced employment in the economy; and (iii) to design a tool useful to estimate ex-ante job effects of extractive sector investments in two pilot countries. The findings are organized around a framework that aggregates industry linkages into three domains: private sector, public sector, and those that relate to the macro-level impact of the extractive sector on economic complexity and diversity.

Private sector linkages focus on the dynamics of foreign direct investment, environmental and social effects, and several links between the private sector and employment. Public sector linkages focus on topics such as revenue management, local content requirement, and effects of public investment on employment. Lastly, linkages related to economic complexity and diversity focus on the potential for the extractive sector to lever structural economic development.

The study identified three main barriers that prevent the development of stronger linkages between the extractive sector and job creation. The first one relates to the extractive sector and country economic complexity / diversification. In developing countries, the research points to the negative effects of extractive sector investments in the development of other sectors of the economy. The second addresses the influence of the extractive sector in the countries' institutional framework. The extractive sector, in some cases, allows for the proliferation of corruptive practices and unfair income distributions. We found that 80% of countries are associated with bad (or low scores of) governance. The third barrier relates to the spending of government revenues (originated from the extractive sector) in public investment such as infrastructure and education. The study found that the effectiveness of these linkages has significant implications on long-term employment creation. However, the study also found that even when they are ineffective, the private sector could still contribute to job creation.

Finally, the study also designed a tool that estimates ex-ante direct, indirect and induced employment generated by extractive sector investments (i.e. Oil and Gas; Mining) in two pilot countries: Ghana and Peru. It distinguishes employment at the various stages of extractive sector investments, and includes add-ons such as gender and skill specific data. The tool was developed based on Input-Output (IO) modeling. The study assessed this modeling technique as appropriate for the types of ex-ante estimates required, given the tradeoff that it implies between accuracy, and data collection, reproducibility, and cost. Moreover, it has proven to be sufficiently reliable when the size of the investment is relatively small compared to the country's economy.

The tool could potentially consider the employment effects of public investment if detailed information were available on government spending from revenues generated by the extractive sector. The employment effects derived from economic diversification, economic complexity, and institutional capacity were beyond the scope of this study.

1 INTRODUCTION

1.1 Background

It is widely recognized that jobs are both the result and the engine for economic growth, and that they help lift people out of poverty. Since 2006, the International Finance Corporation (IFC) uses the Development Tracking Outcome System (DOTS) to measure and monitor the development results of its investment and advisory services. However, DOTS does not capture the number of indirect and induced jobs created along supply chains in the oil, gas and mining sectors and in the wider economy. Therefore, IFC is seeking to better understand what the magnitude is of direct, indirect and induced employment associated with its investments in the oil, gas, and mining sectors.

The objectives of this study are to: (i) review and summarize the current state of economic research and literature on the potential and actual employment creation by the extractive sector; (ii) provide a concise overview of methodologies used to estimate indirect and induced employment (including gap analysis); and (iii) introduce a pragmatic and easy-to-use tool that provides ex-antes estimations of the employment effects of extractive investments using input-output analysis. The tool has been applied in two pilot countries: Ghana and Peru.

1.2 Methodology of literature review

This review summarizes the literature that assesses the linkages between the extractive sector and employment creation. A quick scan of the literature focused on the linkages between the extractive sector and employment led to the framework presented in Section 2.1. Google and Google Scholar provided good insight in the papers written on the topic, as did the references used in often-cited studies. The World Bank platform Collaboration for Development offered additional literature references. Abstracts from qualitative and quantitative research papers were screened for relevance using keywords such as ‘extractives and job creation’, ‘job multipliers in the oil industry’ and ‘development impact of the extractive sector’. The developed framework and collected literature were discussed by the core team in order to identify gaps and to strengthen the framework.

A more in-depth study of the various linkages set out in the framework led to more specific insights on individual pathways. For each of the 116 papers from 89 sources which were considered relevant, useful and of good quality, the strengths of the linkages were assessed and scored very positive (++), positive (+), neutral (+/-) or negative (-). Reflecting the balance of evidence of the sources we indicated the strengths of the linkages in the framework in Section **Error! Reference source not found.**.

Sources used in this review range from journals, institutions and research groups, to notes from conferences and organizations. Although the researchers attempted to capture a wide range of related topics, aspects that are less related to employment creation were left out for reasons of brevity. Given the size of the body of literature, this overview does not claim to be exhaustive.

1.3 Overview

Section 2 introduces a framework that shows the pathways from extractive sector investments to employment. It also serves to summarize the current state of economic research and literature on the economic effects of extractive companies and projects. Section 3 presents a concise overview of methodologies used in the industry to estimate job effects and addresses their respective strengths and weaknesses. In Section 4 presents the tool developed to estimate indirect and induced employment effects of investments in the extractive sector, as well as its application to Ghana and Peru.

2 EMPLOYMENT CREATION PATHWAYS OF THE EXTRACTIVE SECTOR

2.1 Theoretical Framework

The extractive sector, consisting of oil & gas (O&G) and mining subsectors, is connected to an economy in many different ways. The direction and strength of these connections determine the extent to which the sector contributes to employment. Exhibit 1 aggregates the many linkages into distinct groups: financial flows and enabling factors, belonging to either the public or the private domains.

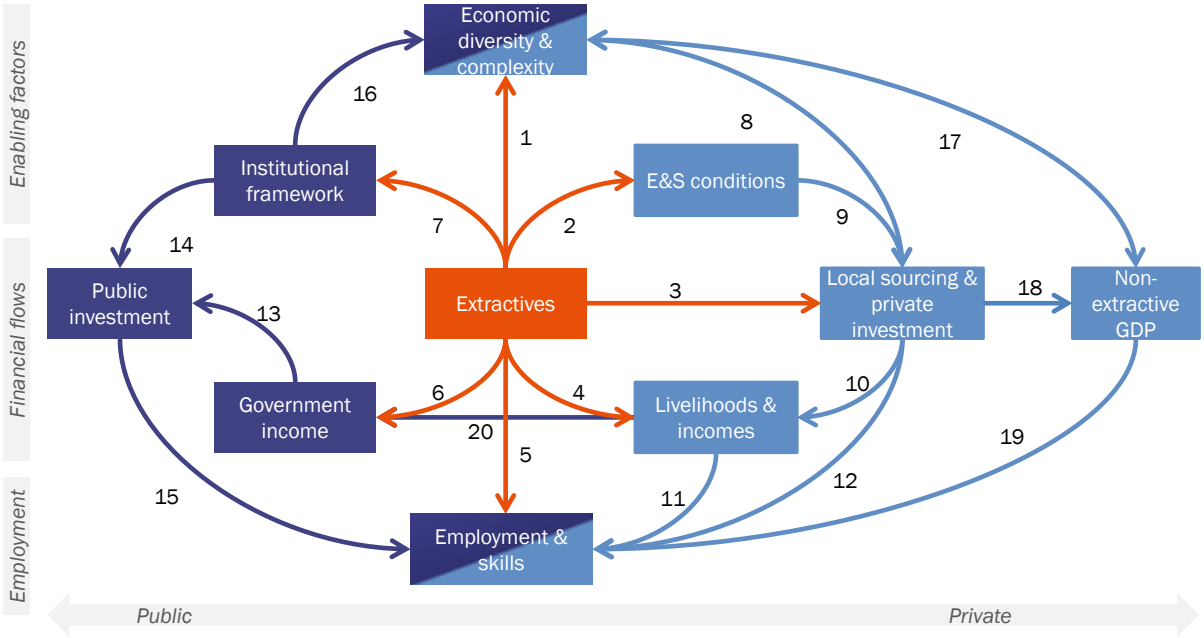

Exhibit 1: Framework for linkages in extractives (orange arrows indicate direct linkages, light blue arrow indicate indirect, private sector linkages and dark blue arrows indicate public sector linkages)

The direct (1-7) and indirect (8-19) connections are the following[1]:

1. *From extractives to economic diversity and complexity*

Extractives industries can generate opportunities for economic diversification but they can also contribute to or exacerbate Dutch disease and increase dependency on commodities.

2. *From extractives to environmental and social conditions*

Extractives industries leave a negative environmental footprint, which can be partially mitigated, and impact communities both positively (creation of opportunities for skill enhancement/knowledge transfer) and negatively (resettlement).

3. *From extractives to local sourcing and private investment*

Extractives procure goods and services from local suppliers and invest in the infrastructure of the local economy.

4. *From extractives to livelihoods and incomes*

Extractives provide incomes and offer social security, health and education to their employees.

[1] For more information on definitions, see Appendix 1

5. *From extractives to employment and skills*

People are directly employed by oil, gas and mining companies and the knowledge and technology transfers that occur within these companies positively affect skill development.

6. *From extractives to government income*

Oil, gas and mining companies pay taxes, royalties and carried interests.

7. *From extractives to the institutional framework*

Extractives can influence institutional frameworks through standards and practices incorporated in their operations.

8. *From economic diversity and complexity to local sourcing and private investment*

A more diverse and complex economy allows for better opportunities to source locally.

9. *From environmental and social conditions to local sourcing and private investment*

Environmental and social programs initiated by the extractives influence the ability to source locally and mitigate harmful effects of extractives activities. Investments in environmental and social programs are dependent on the level of development of the region in which extractive companies operate.

10. *From local sourcing and private investment to livelihoods and incomes*

Increase in private investment and local sourcing will benefit livelihoods and incomes.

11. *From livelihoods and incomes to employment and skills*

The re-spending of salaries by people directly and indirectly employed supports induced jobs.

12. *From local sourcing and private investment to employment and skills*

By procuring local goods and services, the extractive sector creates indirect employment (jobs along the supply chain). By investing in infrastructure, it creates downstream jobs (related to the use of products and services, e.g. electricity, roads and telecom).

13. *From government income to public investment*

Government income can be used for recurring public spending (e.g. wages of civil servants) and/or public investment (e.g. infrastructure and education).

14. *From institutional framework to public investment*

The quality of the institutional framework influences the ability to effectively and efficiently make public investments.

15. *From public investment to employment and skills*

Public investments affect indirect (operational expenditures), induced (civil servant salaries), and forward (infrastructure-related) jobs.

16. *From institutional framework to economic diversity and complexity*

The policies set by the institutional framework influence economic development.

17. *From economic diversity and complexity to non-extractive GDP*

More diversified and complex economies are better positioned for long-term growth and exhibit less volatility.

18. *From local sourcing and private investment to non-extractive GDP*

Investment in non-extractive goods and services contribute to an increase in non-extractive GDP.

19. *From non-extractive GDP to employment and skills*

An increase in non-extractive GDP relates positively to employment.

20. From livelihoods and incomes to government income

Households pay taxes to the government over salaries and incomes received (although oftentimes the taxes and social security payments are paid on their behalf by the companies that employ them).

2.2 Results from the Review

The results from the review are summarized in Exhibit 2 and the research papers reviewed are listed in Appendix 3. The thickness of the arrow depicts the number of sources that have researched or discussed the linkage; the thicker the arrow, the more sources. The color of the arrow indicates whether the evidence points to a positive (green), negative (red), or debatable (orange) relation between the groups. Although the results are generalized in this review, it should be noted that they are context specific. This means that project and country specific factors should be taken into account as they may significantly influence the strength of the relationship. For example, offshore oil and gas projects typically generate less employment than on-shore projects.

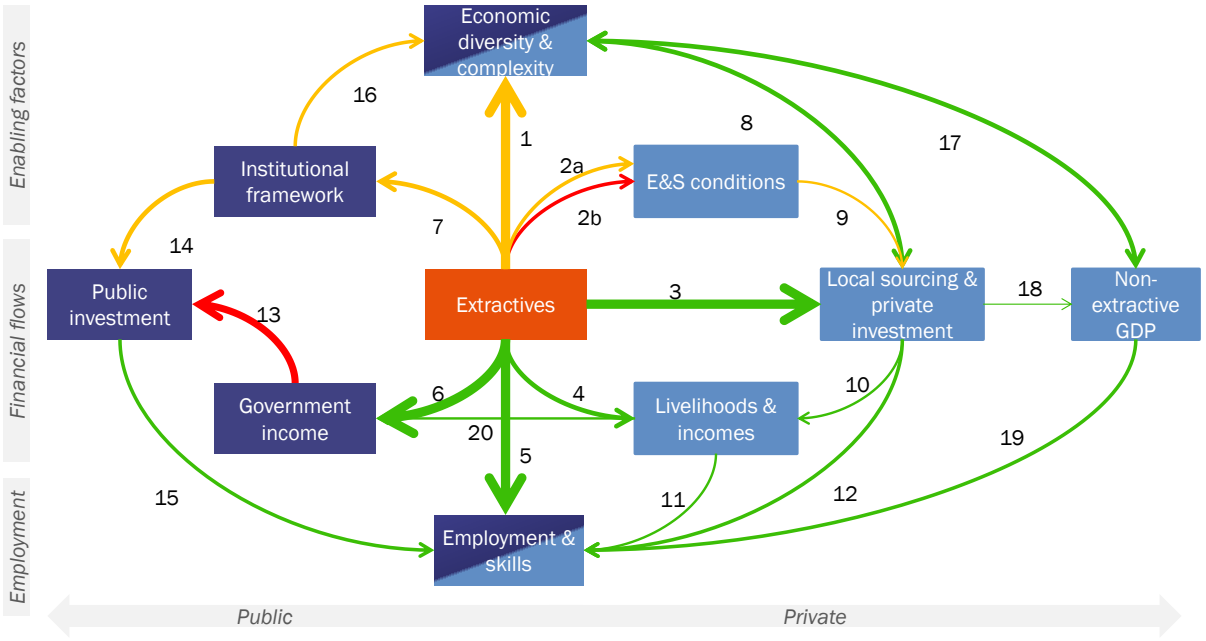

Exhibit 2: Evidence in literature (Arrow thickness indicates the attention in the literature, green indicates a positive, red a negative and orange a debatable relationship)

In the sections 2.3 through 2.5 the linkages in Exhibit 2 are discussed in three groups: (i) private sector (right side of the framework); (ii) public sector (left side of the framework); and (iii) the macro-level impact on economic diversification and complexity (upper side of framework).

2.3 Private sector linkages

The private sector linkages with the extractive sector are illustrated on the right side of Exhibit 2 (linkages 2-5; 8-12; and 18-20).

2.3.1 Effect on E&S conditions

Although the impact of extractives on social conditions ranges from somewhat positive (opportunities for skill enhancement/knowledge transfer) to negative (resettlement and migration influx), its impact on environmental conditions is certainly negative (linkages 2a and 2b). Negative impacts tend to be better mitigated nowadays than in the past because of stronger regulation and improved company operating standards (Eggert, 2002; Rios, 2015; Natural Resource Governance Institute, 2016). By investing in programs that improve social conditions and economic opportunities, extractive companies make an effort

to mitigate negative social impacts (linkage 9). For example, in 2000 Barrick Gold initiated the Cuncashca Business Development Project in Peru in collaboration with a small remote community of 64 farming families. Building on existing agricultural practices and expertise, the purpose of the project was to improve the skills of local farmers and to provide the necessary training and infrastructure, showing that agriculture can co-exist with mining (Ramdoo, 2013). In 2008, household incomes had increased to $166 (from $46 in 2002), the rate of chronic malnutrition reduced from 46% to 38%, and as a result of a new dairy plant, milk and cheese were being locally produced (Barrick, 2008). Similar initiatives often aim at increasing skills and result in improved opportunities for local procurement. It is noteworthy that the IFC has developed a Financial Evaluation Tool to quantify effects of sustainability and community investments (www.fvtool.com).

Child labor risk can be a significant risk in the supply chain of extractive companies, given that they hire many contractors and suppliers particularly during the construction phase. This risk can be partially mitigated by implementing appropriate oversight procedures of their contractors (Common Fund for Commodities, 2008; UNICEF, 2015). Another important issue, especially in Africa, is illegal mining. Illegal mining activity often develops around large mining projects, in part due to a difficult socio-economic climate and limited resources for law enforcement (Hilson, 2009; Chamber of Mines of South Africa, 2016). Many governments discourage illegal mining activities but focus legislation and law enforcement especially on foreign companies and individuals rather than local ones.

2.3.2 Effect on local sourcing and private investment

The studies reviewed confirm that countries are often able to attract FDI in the extractive industry even when other industries appear unattractive (linkage 3). For example, mining FDI often dominates the total flow of FDI (60% - 90%) in low-income economies (ICMM, 2014). As such, the extractive sector can be a catalyst for the development of a private sector in places where there hardly is one. However, the bulk of evidence indicates that it is essential that foreign investors foster linkages to the local economy for countries to benefit from extractive FDI. In Africa extractive FDI is often considered as the 'enclave economy par excellence'. It develops around upstream value chains that extract and export commodities with hardly any linkages to the local economy (Hansen, 2014). Other studies confirm that even when extractive companies invest in non-extractive sectors, companies tend to do this in their home countries. Almost 90% of their investments have been made in upper-middle-income and high-income countries (McKinsey Global Institute, 2013; Hailu et al, 2014). This implies a positive impact of the extractive sector on private investment in other sectors in upper/high income countries and a limited impact in low-income countries (linkage 18). In order to stimulate local linkages, loan agreements of development finance institutions increasingly include training and local content requirements, as illustrated by a local linkages program required by IFC in a loan made to Newmont in 2006. In the agreement both parties worked together in support of the mining sector by focusing on environmental and social standards, and ensuring that local communities also benefitted from the project (IFC, 2007).

There are however major bottlenecks that hamper local content: lack of capacity to produce high quality goods and services, lack of skills, insufficient access to credit, higher costs for companies and consumers, below standard infrastructure and an inadequate institutional environment (Taylor, 1998; Rockefeller Foundation, 2007; ADB, 2015). In Section 2.4.2 the institutional environment around local content will be discussed in more depth.

2.3.3 Effect on livelihoods and incomes

By offering direct employment, the extractive sector provides income and offers social security, health and education to their employees (linkage 4). A report published by the Bill and Melinda Gates Foundation (2015) finds that extractive companies spend at least as much on employment, procurement and infrastructure as governments receive in revenue from extractive projects, thereby contributing to growth and human development. A more recent study conducted by ICMM (2016) estimates that extractive companies spent some 10-20% of their revenues on salaries. An example of how the extractive industry can indirectly contribute to livelihoods (linkage 10) is illustrated by the Glamis Gold's Integrated

Community Development Program. In this program, Glamis Gold partnered with the IFC and Citizens Development Corps to benefit communities by providing health services, enterprise development, vocational training, agro-forestry, and environmental awareness (Wise & Shytlla, 2007). Procurement of goods and services of course also supports (indirect) incomes and livelihoods.

2.3.4 Effect on employment and skills

The literature distinguishes three forms of employment: direct, indirect and induced. Direct employment encompasses jobs that are directly created by the extractive sector (linkage 5). Many of the higher-skilled positions in mining companies are often (initially) filled by expatriates. Once mining and O&G skills are transferred to local employees, retaining them becomes difficult because of the global market for these skills.

Extractive companies can also create lower level and unskilled jobs through CSR programs or foundations that support local skill building. An example of this is the Newmont Ghana Gold's Ahafo Agribusiness Growth Initiative, which focuses on value added economic activities that are independent of mining activities (Ramdoo, 2013). Most literature sources agree that the number of direct jobs created by extractives is often small, with mining companies providing more direct jobs than O&G companies, especially offshore O&G projects (Wise 2007; Bill and Melinda Gates Foundation; UNCTAD, 2015). Indirect employment comprises jobs that are indirectly supported by the extractive sector through forward and backward linkages (linkage 12).

Many of the socio-economic studies on the impact of extractives estimate the indirect employment created by local sourcing (i.e. backward effects) and private investments (i.e. forward and backward effects), that can be quite significant (Oxford Policy Management, 2009; Oxford Policy Management, 2013; Steward Redqueen, 2013; ICMM, 2013; ICMM 2014; PWC, 2014). These studies tend to include induced employment (linkage 11) which is employment created by the re-spending of direct and indirect salaries[2].

Several studies estimate the socio-economic impact of the extractive sector including employment effects. For example, in 2015 the World Gold Council published a study on gold-mining and concluded that world-wide, the gold mining companies directly employed over one million people in 2013, with over three million people indirectly employed as a result of the industry's procurement activities. Interestingly, the study found that in most regions over 90% of the direct employment is local. A 2013 study by Oxford Policy Management indicated that in Congo, employment in mines accounted for one sixth of total formal employment in the country. Although mining generally supports a larger number of direct jobs than O&G, direct employment in the latter can still be considerable as shown by a study of Oxford Economics in 2015, which analyzed the impact of BP on the UK economy. Similarly, a PWC study (2013) analyzing the impact of the O&G found that the industry contributed to 5.6% of total employment in the US when including indirect and induced effects, although the study suffers from double counting.[2]

For every direct job in the extractive sector, the number of indirect jobs supported varies widely (Table 1). There is more information available in the literature for the mining sector than for the O&G sector. For example, the mining multiplier in Tanzania was found to be 3 (World Gold Council, 2009) and 4.45 in Romania (Oxford Policy Management, 2013). Because of the inclusion of informal employment in the agricultural and trade sectors, in Ghana the mining multiplier ranges from 15 (ICMM 2015) and 21 in the Newmont case (2013). Because of the low productivity of the informal sector, small amounts of procurement or household spending can support many informal jobs or livelihoods. The extractive multipliers are highly influenced by how direct employment is categorized. For example, the job multiplier increases when an extractive company outsources work that was done within the company (this increases the job multiplier but does not create employment). One should be aware that multipliers are highly context specific, and that they depend on the assumptions in models used to estimate them as well as on the outsourcing policies of companies. Multipliers should therefore be used with caution.

[2] Many studies also quantify induced value added. In doing so they effectively double count salaries: once as they are earned and a second time as they are spent.

Table 1: Job Multipliers in the Extractive sector (IFC, 2013; ICMM, 2012; OPM, 2009; Newmont, 2013; WGC, 2009)

Country	Mining	Oil and Gas
Scotland	2.5	7.5
US	5	13.4
Chile	7	X
Ghana	15-21	X
Tanzania	>3	X
South Africa	1.9	x
Romania	4-4.5	x

The extractive sector shares an interest with governments in regard to employing local workers. Governments want to maximize local employment to boost local economic development and for extractive companies local workers tend to be cheaper than foreign ones, provided they are equally capable. When the skill and or the capability gap is large, there may not be enough time for companies to skill-up inexperienced workers to the competency levels required, although in many cases the extractive sector invests in training, skill development and partners with local institutions as universities (Bill & Melinda Gates Foundation).

Irrespective of the context specificity of employment impacts, a few generalizations can be attempted:

- Employment created by the private sector is strongly driven by local sourcing, investment and the re-spending of incomes;
- Although large in number, jobs created during the development and/or construction phase are temporary in nature;
- A number of studies suggest that extractive industries generate little direct employment, particularly after the fields and mines start operating (Wise and Shytalla, 2007; World Bank 2012; VSO, 2015);
- The skill profiles of jobs in the extractive sector range from unskilled to highly specialized. In the less developed countries, most created jobs require few skills and are (thus) low-income. The absence of a skilled and specialized labor force is often indicated as a major bottleneck (UNCTAD, 2007; Rockefeller Foundation, 2007; Hailu et al, 2014; World Bank, 2014);
- Jobs created by the extractive sector do not typically contribute to gender equality; many jobs are for men (Efitime, Heller and Strongman, 2009; Moyo, 2011);
- Extractive projects imply some inward migration (to the mine site or O&G field), from the surrounding region or from the national labor pool. This inward migration was estimated to be 36% in a household survey done by Newmont (2013) in the area of its Ahafo mine in Ghana. Although there are potential social and other consequences of inward migration,[3] opportunities for indirect employment are significant.
- Child labour in the upstream value chain of extractive companies can be a risk, especially during the construction phase. Another phenomenon with substantial social consequences is illegal mining.

[3] Not least because of the temporary nature of the jobs (Oxford Policy Management, 2009).

2.4 Public sector linkages

The extractive sector directly contributes to government income and influences institutional frameworks (linkages 6-7; 13-15). Governments have a critical role in regulating the extractive industry to ensure positive effects on the economy while they are also responsible for the efficient use of fiscal and non-fiscal revenues from extractives to promote structural transformation. The latter can be achieved by investing in public goods such as infrastructure and education and through promoting industrial policies. We will first discuss the effects of the extractive sector on government income (linkage 6), before elaborating on the effects on the institutional framework (linkage 7) and the dynamics related to public investment and employment (linkages 13-15).

2.4.1 Effect on government income

Governments receive incomes directly from the extractive sector (linkage 6) and indirectly from supplying companies (not indicated in the framework) and households over their received incomes (linkage 20). As the extractive sector contributes the largest share of taxes and social security and its effect are studied more widely, the impact of household tax payment is not studied in detail, especially since the household taxes are typically paid directly by the withholding companies.

The ability to tax the extractive sector depends on the bargaining strength of governments. To reach its potential for revenue collection, even a well-designed fiscal regime needs to be fully complemented by an effective revenue administration. Given the often very large revenue potential of the extractive sector, an effective resource tax system has the potential to pay back the costs of running the entire tax administration many times over. A range of studies report considerable amounts of taxes paid. Overall, the extractive sectors often account for over half of government revenue in oil-rich countries, and for over 20% in mining countries (IMF, 2012). ICMM (2014) reported government revenues collected from mining in Zambia to have increased from 16% in 2008 to over 30% of total tax revenues in 2012. Oxford Policy Management (2013) found that mining companies in the Democratic Republic of Congo contributed US$773 million or 10% of total taxes to the government, with likely increases as production cycles mature. Smaller as a percentage of total government revenues but higher in absolute terms are the amounts reported by BP (2015) in the United Kingdom. It paid £2.4 billion in 2014 in taxes and dividends to the UK government.

Government revenue administration is complex, given the nature of the industry and its economics: non-renewability, high profits, uncertainty and risk, long periods of operation, and price volatility. Profit-based and other progressive taxes, while being more efficient than royalties in capturing rents arising from commodity price increases, tend to place a larger burden on tax administrations and are much more volatile (e.g. ICMM 2015). Some countries therefore choose to adjust tax policy to administrative capacity. The other option is to adopt more sophisticated and progressive fiscal regimes and to address the administrative challenges by establishing long-term policies for capacity building, combined with qualified external support (Halland et al, 2015; National Resource Governance Institute, 2015).

A common problem for developing countries is their lack of good governance to effectively deal with powerful (foreign) extractive companies. In some cases this enables these companies to lock-in low taxes and royalties or to achieve wide-ranging exemptions (Hailu et al, 2014). Regardless of significant incomes for governments, according to the National Resource Governance Institute, 80% of countries fail to achieve good governance in their extractive sectors (2016). Table 2 shows that developing countries score much lower on governance indicators.

Table 2: Selected average government capacity indicators (Bailey et al, 2015)

Country group	WGI 2013 Government Effectiveness Score -2.5 - 2.5	BTI 2013 Rule of law Score 1-10	TI 2014 Corruption Perceptions Index Score 1-100
High-income	1.09	7.12	65.62
Upper-middle-income	-0.17	5.51	39.70
Lower-middle-income	-0.56	4.86	34.42
Lower-income	-1.09	3.91	25.86
Fragile states	-1.24	3.39	22.96

Research indicates that there can be large discrepancies between the benefits that accrue at the national and the local levels. A significant effort is needed –particularly in optimizing local procurement and planning– to convert government revenue into actual local benefits (ICMM, 2012). According to Arellano-Yanguas and Mejía-Acosta (2014), the redistributive power is determined by both the bargaining power of subnational actors and the alignment between national and subnational political actors. It can be influenced by creating revenue sharing systems and making decision-making mechanisms transparent. A lack of consensus on how natural resources should be managed and the fragility of political systems exacerbate regulatory instability and tensions with investors. New producer countries are particularly at higher risk (Stevens at all, 2013). For example, the Newmont study in Ghana (Steward Redqueen, 2013) quantifies the benefits accrued at national, regional, and district level. At national level, the economy benefitted with USD 360 million of value added in economic activity (0.95% of national GDP) and 41,000 jobs (0.39% of national labor force). The Brong-Ahafo region benefitted with value added of USD 31 million (0.78% of regional GDP), of which USD 15 million (0.38% of regional GDP) and 8,700 jobs (0.86% of the regional labor force) were directly attributable to the project. The Asutifi district supported approximately 8% of the district's estimated GDP, and 10% of the estimated employment. The Newmont Ahafo Development Foundation (NADeF) value added implied additional 8 to 10%. However, virtually all taxes were accrued at the national level.

2.4.2 Effect on the institutional framework

The previous paragraph touched briefly upon the strength of an institutional framework related to ability to tax the extractive sector. When considering the institutional framework and the dynamics of the extractive sector it appears a substantial body of literature focuses on the power of governments to increase the scope and depth of linkages between multinational companies (MNCs) and local enterprises (linkage 7).

In recent years, resource rich African countries have made linkage promotion an important element of their industrialization strategies (Hansen, 2014). It is necessary that governments play a facilitation and coordination role to stimulate indirect employment by developing skills that are transferable to other economic sectors, according to a recent study by the African Development Bank and the Bill and Melinda Gates Foundation (2015). Over the years, more attention has been given to implementing local content policy, with the capacity of these policies influenced by the strength of the institutional framework. Local content legislation requires MNCs to increase the domestic share of inputs. From a public sector perspective, local content can be viewed as a type of public good generated through both backward (local suppliers) and forward economic linkages (local manufacturing), which aligns private sector development and competitiveness (ODI, 2007). The opportunities for local content policies appear to be larger in the mining than in the O&G sector, because the former uses more lower-skilled labor and dual-use technology. For example, regional policy investment incentives and trade policy had significant domestic effects in

Ukraine (CCSI, 2016). However, different and less impressive results were observed in other countries (Australia, Oman and South Africa).

Hansen et al (2014) argue that local content requirements can result in rent seeking because of a lack of competition. There is also a concern that ruling elites have little incentive to support linkage development for domestic economic entrepreneurs. Instead, ruling elites protect and engage with domestic economic entrepreneurs who have already captured the local content markets, because this is where rents can be extracted from entrepreneurs in support of elite political survival strategies. Corruption on the part of some economic agents may easily lead into a vicious circle. This is especially common in resource-rich countries, which is consistent with the observation that the opportunity to extract large rents favors corruption, patronage politics and autocracy (Altenburg, 2016).

The literature reviewed stresses that in order to achieve more local sourcing and jobs, more attention could be given to best-practices in the formation of collaborative public private partnerships, as the roles of government and companies are interrelated and complementary (Ramdoo, 2015; Unicef 2015). Increased collaboration could also lead to more streamlined investment in skills development and R&D, which would benefit both the public and private sector. In some cases, it is the extractive sector that is not aware of opportunities offered by government to stimulate an innovative culture in the sector (De Tomi et al, 2010). Another example of partnership is the Simandou Integrated Mining and Infrastructure Project, the largest planned integrated mining and infrastructure development implemented in Africa. It is a co-operation among government, public sector organizations, and private partners[4] aiming to support the development of long-term local employment and sustainable business relationships in Guinea.

2.4.3 Effect on public investment and employment

Public investment, influenced by budget (linkage 13) and the institutional framework (linkage 14) could increase societal benefits from extractive activities (linkage 15). Although one would expect the relationship between government income and public investment to be positive, in resource dependent countries this is often not the case. A sobering example is the current situation in Ghana, where in recent year civil servants wages have exploded while public debt is hovering at about 70% of GDP, and private sector companies consider moving to Ivory Coast given the lack of infrastructure (The Economist, 2016). In fact, in anticipation of oil revenues, Ghana's recurrent spending (notably on public sector salaries) increased which deteriorated its fiscal position, thereby reducing its ability to invest and ultimately leading to an emergency loan from the IMF.

According to Alba (2009), resource revenues can be used to: (i) meet basic needs (e.g. infrastructure, health services, and education) in low-income countries; and (ii) transit from a resource-based rural economy towards a human-capital and knowledge-based urban economy in middle-income countries. Unfortunately, research indicates that resource revenues do not always lead to increased public investment. A study by Phillipot (2009) found that although countries rich in natural resources are associated with higher current expenditure (particularly in the form of subsidies); resource revenue seems to have no significant effect on public investment. It is also associated with lower spending on transport and communications (a proxy for investment in public infrastructure). Collier et al (2009) made a similar finding; they argue that most of the resource-rich countries of Africa have not had investment rates commensurate with their rate of resource extraction. This was often due to the inability to structure investment processes in order to be able to cope efficiently with substantial fluctuations in revenues. In his book 'The plundered planet' Collier (2011) gives examples of how fiscal policy can become reckless when high natural revenues are expected, and increases recurrent spending to the extent that it results in zero savings and high debt (as illustrated by the previously mentioned situation in Ghana). Early IMF research (2007) indicates that although corruption increases public investment, it reduces its productivity, which possibly explains the negative impact of public investment on growth found in several studies (Abiad et al, 2015; Haque and Kneller, 2015).

[4] Any reference to the Simandou project however would be incomplete without also mentioning the allegations of substantial corruption in the public and private sector in Guinea.

Böhme et al (2010) investigated the effects of oil financed public investment on poverty. The study found that a surge in oil revenues leads to a real currency appreciation, distorting exports, agriculture and manufacturing activities, thereby increasing rural and national poverty. However, there is research that is more positive. A study conducted by Karimu et al (2016) using panel data for the period 1990–2013, found that: (i) resource revenues significantly increase public investment in sub-Saharan Africa (depending on the quality of political institutions), and (ii) a positive effect of public investment on economic growth. More detailed analysis of the components of public investment reveals that less is spend on "soft" infrastructure (e.g., health, education), and relatively more is spent on "hard" infrastructure investments (e.g., roads--Karimu et al, 2016).

However, when higher government revenues lead to increased public investments the outcome can be remarkable. Public investment has both macro effects, on growth and productivity, and micro effects, on household income, poverty and income distribution (ODI, 2006). Particularly at a micro level, public investments in (rural) infrastructure can lead to increased employment opportunities (linkage 15); roads appear to have strong direct and indirect effects on poverty reduction. This effect is even stronger when combined with complementary investments, such as schooling to produce more employment and skills (Ali and Pernia, 2003). Increased public infrastructure investment raises output in the shorter and the longer term, particularly during periods of economic slack. For economies with clearly identified infrastructure needs and efficient public investment processes, there is a strong case for increasing public infrastructure investment provided there is economic slack and monetary accommodation (IMF, 2015). The World Bank published a study in 2012 that revealed significant employment effects in the Middle East and Africa region (MENA) as a result of infrastructure investment. The employment responses induced by the investment are expected to result in 9 million additional jobs over the course of ten years in the region. These jobs account for approximately 30% of the jobs created in the region. It is important to ensure dual-use of infrastructure meaning that it is useful to the extractive and other sectors (Collier and Ireland, 2015) and that it can meet the development needs of communities.

Public investment also supports economic growth through technological innovation. Many innovations originate in the public sector (PSI, 2014) and investing in education nourishes scientific and technological capabilities enable an effective engagement in science, technology and innovation (STI) for development (Mugabe, 2011; Botta, 2015). World Bank research (2004) argues that the relationship between human capital and economic growth is highly conditioned by the quality and distribution of education in the labor force, and with the economic structure of each country. Investing in more accessible and better education helps create conditions that could lead to higher productivity and higher economic growth, but this is by no means sufficient. To translate human capital into economic growth, it is also necessary to adopt policies that lead to the creation of diversified, dynamic, and competitive sectors capable of absorbing the more educated labor force. The evidence supports the view that countries that combine both do better on average than those that do one without the other. General constraints to STI performance are inadequate research industry linkages, weak human capital, brain drains, deficiencies in physical infrastructure, a weak entrepreneurial culture, small domestic markets, and weak policy and institutional frameworks (Aubert, 2004; UNESCO, 2016). Improving STI performance requires action in several areas depending upon the particular circumstances in a specific country. Among them, financial innovation is likely to be relevant for a majority of countries, not exclusively for least developed countries (Miroux, 2013).

2.5 Economic diversity and complexity

This section focuses on the upper part of the framework, on the connections of economic diversity and complexity (linkages 1, 16 and 17). The possible contribution of extractives to economic diversity and economic growth is often touched upon in literature. Here we examine how the presence of extractive companies can influence long-term economic growth and contribute to economic transformation.

A relatively new concept in development economics is the concept of economic complexity, developed by scholars of MIT/Harvard (Hausmann, Hidalgo et al, 2007). Economic complexity derives from the composition of a country's productive output and reflects the structures that emerge to hold and combine knowledge. Complex economies are those that can weave vast quantities of relevant knowledge together,

across large networks of people, to generate a diverse mix of knowledge-intensive products. Simpler economies, in contrast, have a narrow base of productive knowledge and produce fewer and simpler products, which require smaller webs of interaction. Because individuals are limited in what they know, the only way societies can expand their knowledge base is by facilitating the interaction of individuals in increasingly complex webs of organizations and markets. Many resource intensive developing countries tend to have a low economic complexity score[5], because the cumulative productive knowledge that the extractive sector generates cannot be leveraged elsewhere in the economy (in Hausmann and Hidalgo's "product space" these sectors are located in the periphery). In a series of papers published since 2012, Pietronero and his group (e.g. Tacchella et al, 2012) have introduced a twist on Hidalgo and Hausmann's concept which reduces even further the complexity ranking of the mining and O&G sectors, reflecting the fact that these sectors are prominent in many countries which are only able to produce the simplest of products. It must be mentioned however that although the extractive sector produces few transferrable skills (i.e. are peripheral in product space) they are considered important in the World Bank's country analytics because of the (potential) linkages to other products when moving down the value chain.

The concept of economic complexity allows the identification of long-term growth opportunities for the economy. For example, resource-rich economies strongly rely on exports of resources. This renders them sensitive to fluctuations of the economic cycle caused by recessions or changing consumption patterns (Cristelli, 2014). However, when incomes of extractives are used well and invested (for example by developing opportunities to move downstream into e.g. chemicals and fertilizer), the development of non-extractive sectors can contribute to increase the complexity and sustainability of the economy, albeit when supported by strong institutions (linkage 1). For example, China in recent decades transformed from an agrarian, simple economy into a more complex, less vulnerable, industrial economy that produces manufactured goods and services. This was accomplished by leveraging resource revenues and foreign investment (Gatthi, 2013).

The resource curse and Dutch disease are recurring themes in the literature on extractives that relate to economic diversity. The McKinsey Global Institute (2013) argues that many resource-rich countries have failed to convert their resource endowments into long-term prosperity. The study indicates that about 80% of resource-rich countries have per capita income below the global average, and since the mid-90s, more than half of these countries have failed to match the global average growth rate. Resource-rich countries can be vulnerable to Dutch disease at both the national and sub national level. When natural resources are discovered, they can come to represent a large percentage of a country's GDP and government income. If the economy does not have the absorptive capacity to make efficient use of these revenues, the result can be inflation or exchange rate appreciation. As a result, the cost competitiveness of domestically produced goods decreases and harms exporters. In addition, the large revenues in the private sector often attract skilled workers to extractive industries. When the number of skilled workers in a country is small, this can make it more difficult for other sectors to find expertise. These trends can make it more difficult for other industries to successfully operate and can make a country more dependent on natural resources (Bature, 2013; National Resource Governance Institute, 2015). Literature points out that Dutch disease and problems with commodity price volatility are largely institutional rather than economic problems, recognizing the need for strong and transparent institutions that can mitigate harm while maximizing development benefits from extraction and are able to manage distributional consequences (Kaznacheev, 2013; Barma et al, 2014; Unicef 2015).

A solution proposed to better govern, and reduce volatility of natural resource revenues is by using sovereign wealth funds (SWFs), as a type of extra-budgetary fund that operates outside the annual government budget process. SWFs often support a macro-economic goal, for example mitigating Dutch Disease (Castelli and Scacciavillani, 2012). Nevertheless, a report of the Natural Resource Governance Institute (2015) claimed there are arguments against the use of SWFs when there are multiple objectives that can undermine public financial management systems, which could lead to poor investment decisions.

[5] Note that in some cases the average complexity scores are not entirely comparable, as for example India and Bahrain score equally despite their different economic structures, where Bahrain depends strongly on the Oil sector and India is more diverse beyond the extractive sector.

These risks are best mitigated by conflict of interest standards, strong transparency and clear mandates, in other words, a strong institutional framework.

On the more positive side, there seems to be limited evidence to show that countries always experience a net negative economic impact; most low- and middle-income mineral dependent countries have avoided a resource curse in the 21st century (McMahon and Moreira, 2014; Cust and Viale, 2016). In many countries, significant linkages and employment have been developed from extractive operations (mining in particular), and tax revenues have been used to build national and local capital, as for example in and Norway. Although the extractives are often accused of operating in 'enclaves', in more recent years extractive firms seem to have become a stronger partner for growth. This is a result of reforms initiated by governments in countries with a long history in extractives or public private partnerships (Bilal et al, 2013). Naturally, the impact of the extractive sector is stronger when there are substantial infrastructure benefits through dual-use of infrastructure, strong linkages to other industries through domestic procurement and local processing activities. Critical to increasing the strength of these linkages is the cooperation between public and private sectors, and the strength of the institutional framework in economies.

Summarizing, the study finds evidence of the extractive sector potential to positively contribute to economic development, as well as of potential negative effects on the economy. The more complex an economy, the larger is the opportunity for the extractive sector to source supporting goods and services locally, and the better the contribution to non-extractive GDP (linkage 17). Economic growth generates job opportunities and hence stronger demand for labor that enables human development. Strong growth and employment opportunities improve incentives for families to invest in education by sending their children to school (DFID, 2008). However, Hull (2009) argues that growth in one sector of the economy will not automatically translate into pro-poor benefits and that much will depend on the profile of growth, the sectoral location of the poor, and the extent of mobility across sectors. Employment growth can translate into poverty reduction in high productivity sectors; therefore, if the extractive sector can foster increased economic complexity and diversity, employment and skill development opportunities will become evident (linkage 19).

3 ESTIMATING EMPLOYMENT EFFECTS

3.1 Methodologies used to estimate employment effects

Predicting how a prospective investment in the extractive sector will impact development and employment is tantamount to the quest for the holy grail. Nevertheless, development institutions and the extractives industry need to assess ex-ante the effect on employment of extractive investments. The difficulty resides in that a number of individual linkages between extractives and employment are understood fairly well, but when all of them are taken together the complexity increases exponentially.

Three main methodologies allow for the estimation of job effects of investments in the extractive sector (Table 3). The first, a case study, requires one to gather data through qualitative and sometimes quantitative information (surveys, interviews). Case studies are mostly reliant on observations and require intensive on-the ground data collection and large samples for statistically significant results. The second is Input-Output (IO) modeling, a methodology that systematically quantifies the mutual interrelationships (in volume terms) between various sectors of an economy. It uses national statistics to construct a detailed picture of the economy. Finally, Computable General Equilibrium (CGE) modeling is akin to IO modeling, but it allows for price effects. CGE is theoretically superior to IO modeling, but is considerably more data intensive, costly, and time consuming (it requires intensive calibration).

Table 3: Methodologies used to estimate job effects

	Case studies	Input-Output/SAM modelling	Computable General Equilibrium modelling
Macro and micro economic foundation	• No sector interlinkages • Sometimes not consistent with micro economic theory • Detailed description of sector and firm specific behaviour	• Detailed sector interlinkages • Entirely demand driven and no supply constraints • Fixed prices & variable quantities	• Detailed sector interlinkages • Supply constraints • Includes macro and micro mechanisms • Quantities & some prices can change
Reliance on assumptions	• Not reliant on assumptions, but on observations	• Fixed supply chains • No technological change • Based on historic behaviour	• Macro relationships are consistent with micro theory • Competitive markets • Long-run equilibrium • No technological change
Data intensity	• Requires intensive on-the ground data collection • Requires large sample/coverage for statistically significant results	• I-O tables are widely available • Employment data are widely available (although less granular)	• Many parameters must be set • Many more variables than equations • Setting up, calibration and validation can take more than a year
Transparency and reproducibility	• Interpretation straightforward • Results are difficult to reproduce	• Results depend solely on quality of data and theoretical constraints • Interpretation straightforward • More easily generalised provided model constraints are considered	• Results depend heavily on calibration and estimation of parameters • Not externally consistent • Interpretation not straightforward • Difficult to generalise

All three methodologies present weaknesses when estimating job effects (IFC, 2013). Most importantly, there is often no properly established counter factual or base-line situation, making it challenging to attribute the impact of an intervention. In addition, employment effects due to training and skills building are often not included, thereby neglecting a potential long-term impact. Lastly, there is some concern about the overstatement of the multiplier effects as a result of assumptions that incoming firms provide a net new source of economic activity, and no correction is made for business that is taken away for other firms.

3.2 Proposed ex-ante employment impact tool

This study applies the IO methodology to design an ex-ante tool to estimate employment effects, because it was assessed as being pragmatic (in terms of data collection, reproducibility and budget) and results have proven to be sufficiently reliable (provided that the size of the intervention is small relative to the entire economy). The purpose of any ex-ante estimate is to gain a better understanding of the pathways through which an investment generates employment, the lower complexity of IO models makes it more relevant compared with a more involved alternative (i.e. CGE). Nevertheless, a note of caution is relevant because

the estimates derived from the application of the tool will be "good enough" estimates (directionally correct), but they will not be accurate predictions by any means. Due to the static relationships between sectors and the fixed prices for goods and services, the methodology is less suitable to quantify the effect of mining and O&G investments on a country's productive structure.

The tool estimates the private sector employment impacts (Section 2.3) in addition to the impacts derived from the revenues that flow from extractives towards the government (Section 2.4). The tool estimates direct, indirect, and induced employment, and distinguishes employment supported at various stages of an extractive investment (Exhibit 3). It also allows for add-ons such as gender and skill specific data. Consequently, the tool estimates exclude some important pathways such as the employment impact of public investment and economic diversity and complexity. Although the impacts of public investment could potentially be included, economic diversity and complexity and institutional capacity are beyond the scope of the tool.[6] The inclusion of public investment employment impacts will require a detailed spending breakdown. The tool provides a useful ex-ante estimate of the potential employment effects of extractives projects in the short to medium run, but the impact of the enabling factors must also be incorporated in a more qualitative manner when interpreting the results.

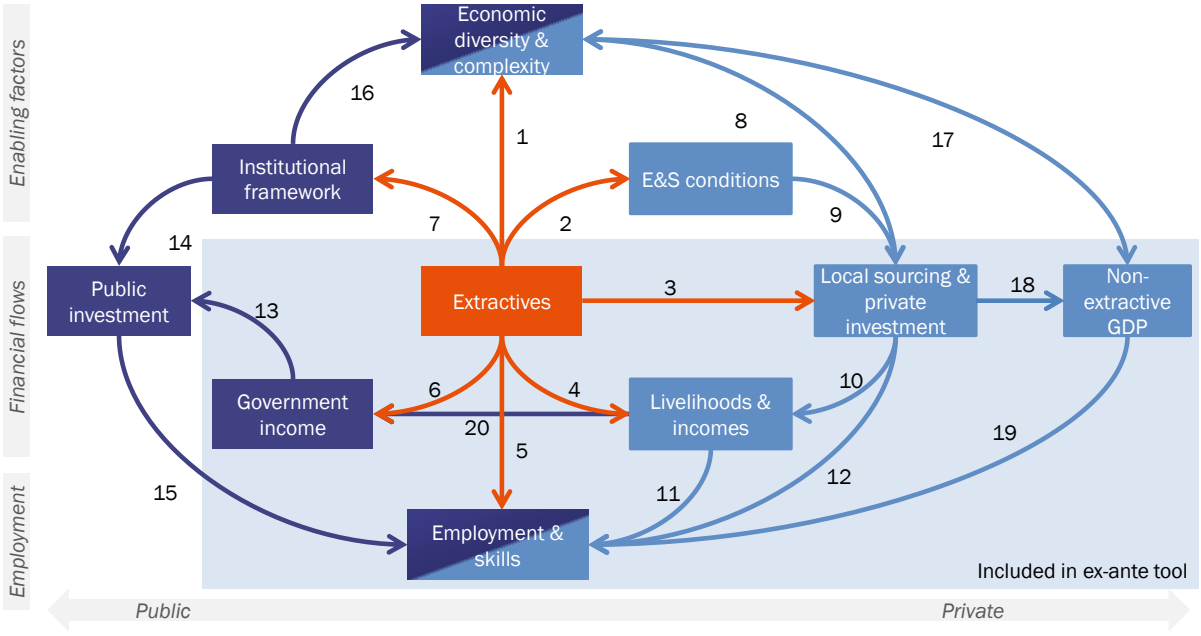

Exhibit 3: Connections inside and outside the scope of the ex-ante tool

[6] For that matter, also from the scope of CGE models as a result of data unavailability and the difficulty of incorporating (technological) shocks.

4 TOOL METHODOLOGY

The input for the tool is a projection of the spending profile of the investee company or project, and the Social Accounting Matrix (SAM) which is based on macro-economic statistics (Exhibit 4). The spending profile can be traced throughout the economy using the SAM model. The inputs, model, and impacts are further discussed below.

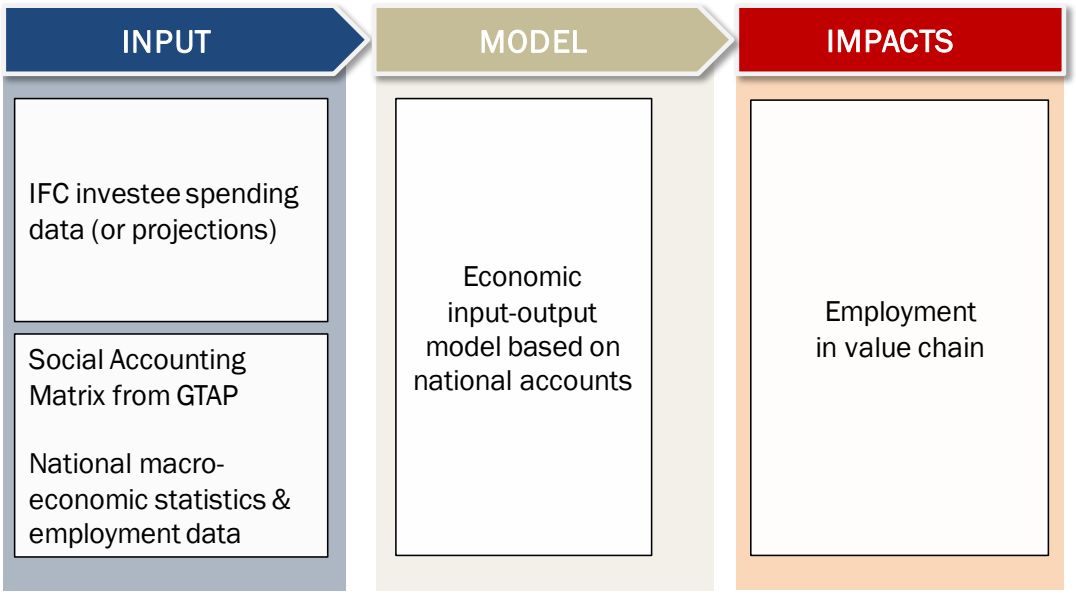

Exhibit 4: Overview of the SAM model used in the tool

4.1 Model input

IFC investment data

The tool input is the typical investment information gathered by IFC. To ensure that data collection is not overly burdensome for IFC, it was discussed and agreed with the IFC oil, gas, and mining specialists. More specifically, the input data needed is the following:

- Non-financial data: country of operation, sector (O&G, or mining) number of years per phase of the project life-cycle (i.e. Exploration and feasibility, Construction, Production and Closure) and number of directly employed people;
- Financial data: breakdowns of the cumulative (projections) of capital expenditures (CAPEX) and operating expenditures (OPEX) per phase of the life-cycle of the project;

Default values are built in the tool in case CAPEX and OPEX breakdowns were not available. Given the large variation of spending patterns between countries and investments, these default values must be used only as a last resort.

National macro-economic statistics

The tool traces project spending through the economy using a SAM (Section 4.2), and the sectoral breakdown of employment information taken from the ILO or from national statistics offices. If the

employment data contain gender and skill breakdowns, the employment impacts can also be specified in terms of these aspects as well.[7]

4.2 Model

The key ingredient of the input-output methodology is the so-called Social Accounting Matrix (SAM). The SAM describes the financial flows of all economic transactions that take place within an economy (Exhibit 5). It is a statistical and static[8] representation of the economic structure of a country, where the number of columns and rows are equal because all sectors or economic actors (industry sectors, households, government and the foreign sector) are both buyers and sellers. Columns represent buyers (expenditures) and rows represent sellers (receipts). Final *consumption* induces production that leads to financial *transfers* between the various sectors, which subsequently generate *incomes* for households, governments (taxes) and profits (dividends and savings).

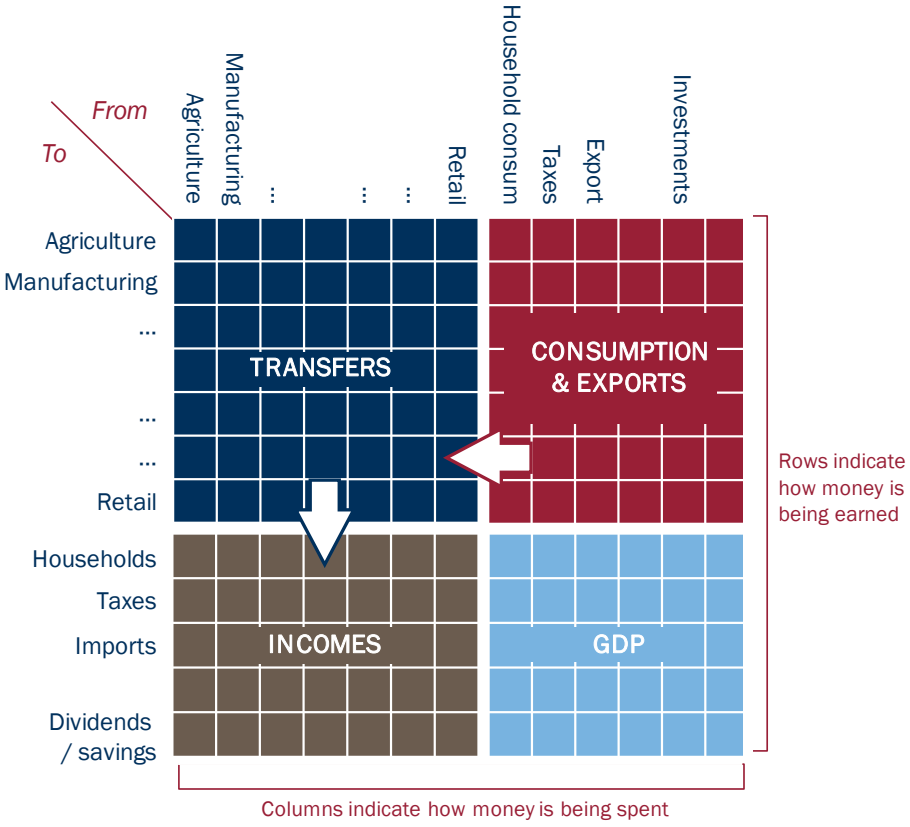

Exhibit 5: Social Accounting Matrix

This study used the most recent SAM from the Global Trade Analysis Project (GTAP) 9 Database.[9] It provides the macroeconomic data needed to compile the national and/or regional SAM, differentiating 57 sectors. The spending of the investee project is routed through the SAM in order to quantify the economic output of suppliers and their suppliers, that yields the total economic output and value added (i.e. salaries, taxes and profits) associated with the IFC investee. Using the employment intensities as described in the previous section, the economic output figures can be translated into employment numbers.

[7] The tool contains employment breakdowns per gender since this information is available for the two pilot countries, respectively Ghana and Peru.

[8] SAMs are valid for a specific year. Economies are subject to change and SAMs should preferably be updated periodically if possible.

[9] Global Trade Analysis Project, GTAP 9 Data Base.

4.3 Model output

The employment impact of an IFC investment includes the following (Exhibit 6).

- Direct employment – company or project level: direct employment generated at the mine or oil/gas field.
- Indirect employment– direct suppliers: employment effects in the direct suppliers of the extractives company;
- Indirect employment – indirect suppliers: employment effects that come about as suppliers inside the original value chain of an investee procure goods and services from suppliers outside the original value chain of the investee;
- Induced employment – re-spending of salaries: employment effects caused by the re-spending of salaries earned by employees of the investee and its direct and indirect suppliers whose jobs are supported by the investee.

The various impact levels can be aggregated to yield the direct, value chain and total employment impact.

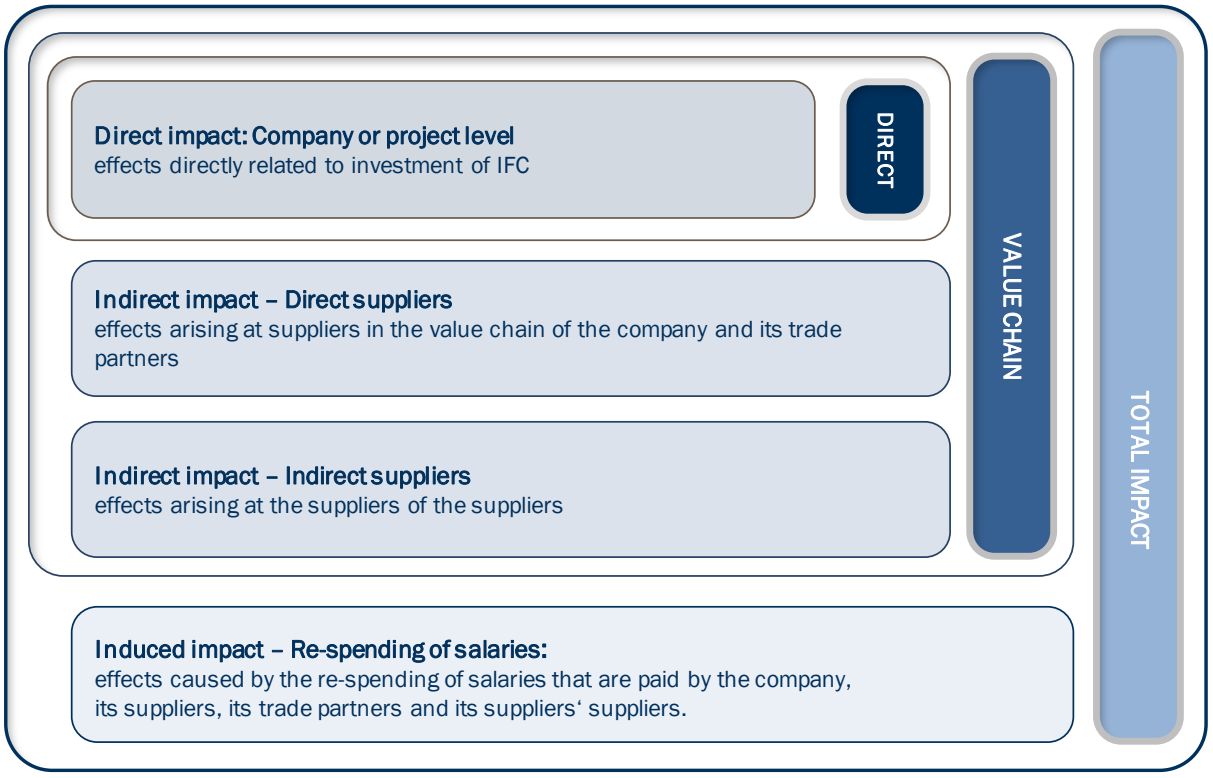

Exhibit 6: Employment results associated with the different impact rounds

4.4 Limitations of the model

Though the methodology used is rigorous and widely recognized (Wassily Leontief received the Nobel prize in 1973), it is important to point out the two most important limitations of this methodology:

1. Given that the analysis is conducted for a specific moment in time, it does not take into account any structural changes of the economy (e.g. increased productivity, or substitution between inputs);

2. Prices are assumed to be constant. Although this may not be overly restrictive when the size of the project is small compared with the overall economy, we know that extractive companies can cause price increases for scarce resources (e.g. skilled labor) and/or in the specific regions.

These assumptions tend to cause some overestimation of the results. It is hard to quantify the magnitude of this because the results depend so much on the quality of project specific financial data (typically fairly good), the quality of the country's economic statistics (quite often somewhat problematic, especially in Africa due to the large informal sector) and the reliability of the sector employment intensities in a country (limited granularity).

Nevertheless, the method has been proven directionally correct by many different researchers, and given the uncertainty in data quality (both at investment and macro-economic level), the tool delivers acceptable results. The fact that the tool does not consider important (public sector) pathways is an important limiting factor. However, incorporation of these linkages is well outside the scope of even the most advanced of economic models (with the possible exception of public investments). A qualitative assessment of the missing pathways however is crucial in order to contextualize the ex-ante employment results of the tool presented here.

4.5 Stylized facts

Although the quantitative results from the toolkit depend on project financials and are country specific, some stylized facts can be given on what drives the magnitude of the impact. The employment impact is higher when:

1. The size of a project is larger relative to the size of the economy (although the larger this relative size, the more severe the limitations of the methodology become, e.g. fixed prices and production structures);
2. The local sourcing as a percentage of all procurement is higher;
3. The economy is relatively more diverse or complex, meaning that there are more opportunities for local sourcing, either from the extractive company directly or from its suppliers;
4. The extractive sector has been important in the country for longer, which increases the ability to source mining and O&G specific products and services;
5. Labour productivity is low, which of course would reduce the quality and income level of the jobs created and therefore reflects more the limitations of a country than the impact of an extractive company.

Of course, some of these drivers are contradictory: a low labour productivity (point 5) is often found in less developed (and therefore less diverse or complex) economies (point 3). It is therefore advisable that one interprets the employment results of the toolkit in conjunction with the value added results. Or to put it in an oversimplified way: the best way to create employment in the extractives sector is to deploy manual labour with pick axes but it is obvious that this deepens the development trap rather than it helps to alleviate it.

5 CONCLUSION

The objective of this literature review was to summarize the current state of economic research and literature regarding the potential and actual employment creation by the extractive sector. In addition, this review aimed to provide an overview of methodologies used to estimate indirect and induced employment as well as to understand their respective strengths and weaknesses. A framework has been developed in which the many linkages are aggregated into three domains; private sector linkages, public sector linkages and linkages that relate to the macro level impact of extractive activities on economic complexity and diversity.

The literature related to private sector linkages focuses on the influence of the extractive industry on E&S conditions, FDI and types of employment created; direct, indirect and induced. It was found that a significant share of the jobs is created during the development or construction phase and that extractives tend to generate little direct employment after operations commence. Opportunities for indirect employment are significant but depend on the state of an economy and the strength of the institutional framework. Skill profiles of jobs in the extractive sector range from basic to highly specialized and jobs created by the extractive sector do not contribute to gender equality per se. It was also found there is a significant risk of child labor in the (construction) supply chain and illegal mining. The review of the public linkages showed the challenges and opportunities associated with the resource revenues received by governments. Well discussed topics in literature are efforts of governments to implement local content requirements; evidence of resource curse; rent seeking; Dutch disease; and the extent to which resource revenues are used for public investment. The employment effects of public investments can be substantial but are strongly dependent on governments and their accompanying institutional framework. It was found that higher extractive income for governments does not produce (or is counterproductive to) more or better public investment. Last, the literature on the impact of extractive activities on economic complexity and diversity focuses on the potential for the extractive sector to deliver broad-based (non-extractive) economic development. In terms of employment it was found that the higher the complexity of an economy the extractive sector operates in, the greater the opportunities for local sourcing and contribution to non-extractive GDP and, hence, job creation.

The study identified three main barriers that prevent the development of stronger linkages between the extractive sector and job creation. The first one relates to the extractive sector and country economic complexity/diversification. In developing countries, the research points to the negative effects of extractive sector investments in the development of other sectors of the economy. The second addresses the influence of the extractive sector in the countries' institutional framework. The extractive sector, in some cases, allows for the proliferation of corruptive practices and unfair income distributions. The study found that 80% of the countries researched fail to achieve good governance of their extractive sectors. The third barrier relates to the spending of government revenues (originated from the extractive sector) in public investment such as infrastructure and education. The study found that the effectiveness of these linkages has significant implications on long-term employment creation. However, the study also found that even when they are ineffective, the private sector could still contribute to job creation.

Considering the various methodologies used to estimate employment effects, we feel that input-output modeling is an appropriate approach for an ex-ante tool because it is pragmatic (in terms of data collection, reproducibility and budget) and results have proven to be sufficiently reliable. The impact captured in the tool focuses on the private sector side of the framework shown in chapter two plus the revenues that flow from extractives toward the government. The tool calculates direct, indirect and induced employment, distinguishes employment supported in the different stages of extractive activity and allows for add-ons as such as gender and skill specific data. Although the employment effect of public investment could potentially be included if detailed information on extractive revenue spending of governments available, inclusion of economic diversity and complexity and institutional capacity are beyond the scope of the tool. A qualitative assessment of these aspects however is very important and ex-ante quantifications of employment impact would be incomplete without it.

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APPENDIX 1: DEFINITIONS

Economic complexity and diversity	A measure of how many different types of products a country is able to make. The production of a good a specific set of know-how; therefore, a country's total diversity is another way of expressing the amount of collective know-how within that country.
Environmental and social conditions	The state or condition of the natural environment and local communities
Employment and skills	Direct, indirect, induced jobs and the skill level available in the economy
Extractives	Oil, gas and mining sectors
Government income	Income received in the form of rents through royalties and a range of other taxes
Institutional framework	Laws, regulations and policies set in place by government institutions and oversight bodies in a country
Local sourcing and investment	Procurement of local goods and services and investment in local infrastructure
Livelihoods and incomes	Capabilities, assets and income of households to make a decent living. Specifically, income refers to the payments households receive in return for labor
Non-extractive GDP	The monetary value of all the non-extractive related finished goods and services produced within a country

APPENDIX 2: ESTIMATION TOOL FOR PERU AND GHANA

In addition to the literature review, a tool to estimate job effects has been constructed for IFC.

The tool, based on the methodology described in section 3 and section 4, provides a practical, flexible solution to estimate employment impacts, notably indirect and induced, across different jurisdictions where it invests.

Exhibit 7 shows the employment effect for a random investment in the mining industry in Ghana. The large rectangle shows the annual average number of jobs per phase (i.e. Exploration & Feasibility, Construction, Production and Closure) of the life-cycle of the mine and distinguishes between jobs at the mine (dark blue), direct and indirect suppliers (blue) and due to the re-spending of salaries (light blue). The four small rectangles show in more detail the employment effects per life-cycle; the exact number of direct, indirect and induced jobs (bar chart) and the gender distribution (pie chart).

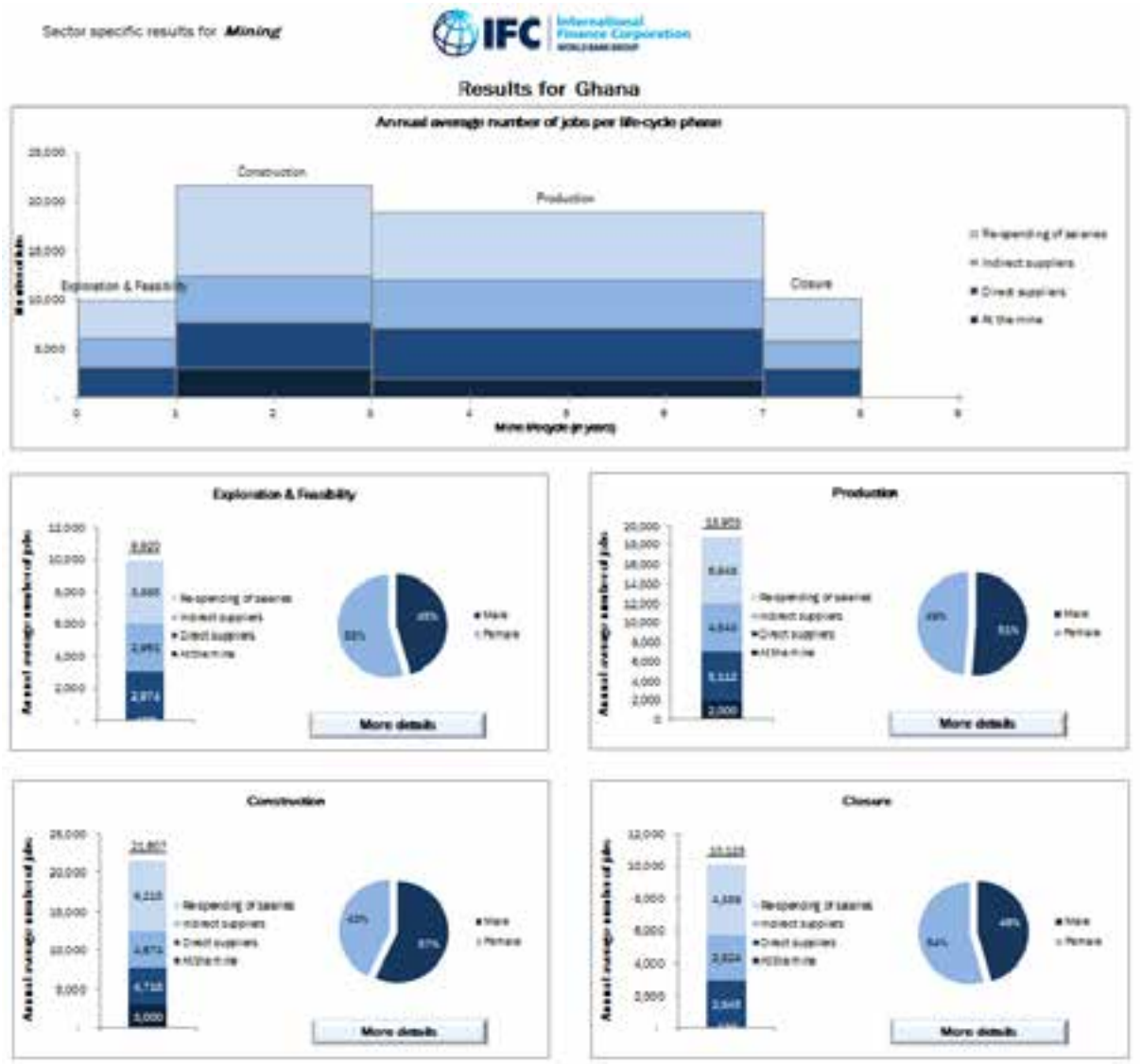

Exhibit 7: Example of tool output

For more information on (access to) the tool, please contact the members of the core team (see page i).