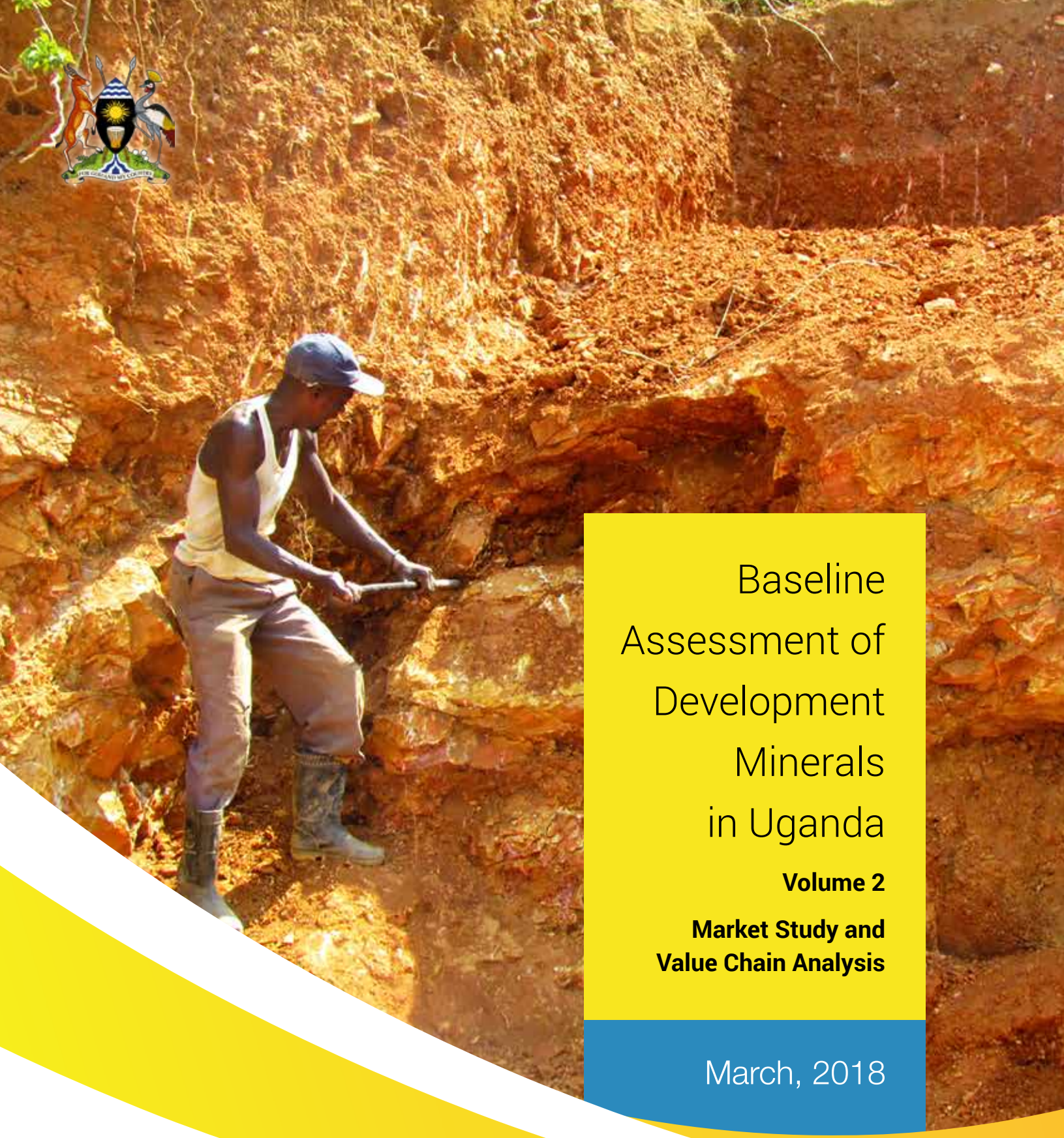

Baseline Assessment of Development Minerals in Uganda

Volume 2

Market Study and Value Chain Analysis

March, 2018

Programme Partners:

ACP-EU Development Minerals Programme.
Implemented in Partnership with UNDP

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J.H., O.L., A.R., L.P., C.N. and D.F designed the research; J.H., O.L., J.K, M.N., G.N, A.R., and F.K. performed the research; J.H., O.L., M.N., G.N, A.R., F.K. and D.F analysed the data; J.H., O.L., J.K, M.N., G.N, A.R., F.K., K.M., H.G, H.K., L.P., C.N. and D.F wrote and edited the study.

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Cover Photo: Aggregate miner, Masaka, Uganda. Credit Olivia Lyster; 2017.

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About the ACP-EU Development Minerals Programme: The ACP-EU Development Minerals Programme is an initiative of African, Caribbean Pacific (ACP) Group of States, coordinated by the ACP Secretariat, financed by the European Commission and United Nations Development Programme (UNDP) and implemented by UNDP. This €13.1 million capacity building program aims to build the profile and improve the management of Development Minerals in Africa, the Caribbean and the Pacific. The sector includes the mining of industrial minerals, construction materials, dimension stones and semi-precious stones.

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Acronyms and Abbreviations

ACP	African, Caribbean and Pacific Group of States
AFD	Agence Française de Développement
AfDB	African Development Bank
AGF	African Guarantee Fund for Small and Medium-sized Enterprises Ltd
ASM	Artisanal and small-scale mining
BUBU	Buy Uganda Build Uganda
COBE	Census of Business Establishment
CWG	Country Working Group
DGSM	Directorate of the Geological Survey and Mines
DRC	Democratic Republic of Congo
ECO	Ecological Christian Organisation
EU	European Union
FGD	Focus Group Discussion
FY	Fiscal Year
GDP	Gross Domestic Product
GoU	Government of Uganda
KG	Kilogrammes
LFC	Light-firing clays
LSM	Large-scale mining
MEMD	Ministry of Energy and Mineral Development
MFI	Microfinance Lending Institutions
MGLSD	Ministry of Gender, Labour and Social Development
MoH	Ministry of Health
MLHUD	Ministry of Lands, Housing and Urban Development
MoFPED	Ministry of Finance, Planning and Economic Development
MSEs	Micro- and small- enterprises
MSM	Medium-scale mining
MT	Metric Tonnes
MTIC	Ministry of Trade, Industry and Cooperatives
NDF	Nordic Development Fund
NDP	National Development Plan

NEP	National Employment Program
NEMA	National Environment Management Authority
NGO	Non-governmental organisation
NMMPU	National Mining and Minerals Policy
PLA	Platform for Labour Action
POS	Points of Sale
Rural SPEED	Rural Savings Promotion and Enhancement of Enterprise Development
SACCOs	Savings and Credit Cooperative Organization
SDGs	Sustainable Development Goals
SGBV	Sex and Gender-Based Violence
SGR	Standard Gauge Railway
SME	Small and medium-scale enterprises
UAE	United Arab Emirates
UGX	Ugandan Shillings
UIA	Uganda Investment Authority
UBOS	Ugandan Bureau of Statistics
UNDP	United Nations Development Programme
UNHS	Uganda National Household Survey
USD	United States Dollar
VCA	Value Chain Analysis
VSLA	Village Savings and Loan Association
WDA	Workforce Development Authority

Introduction

The ACP-EU Development Minerals Programme, a pioneering three-year, multi-country initiative implemented by the UNDP, seeks to build the profile and improve the management of Development Minerals. Development Minerals include industrial minerals, construction materials, dimension stones and semi-precious stones.[1]

With support from the European Union (EU) and United Nations Development Programme (UNDP), this African, Caribbean and Pacific (ACP) Group of States initiative is operating at both regional levels, where capacity is being built in 40 ACP countries, and national levels, through more extensive support provided to six focus countries: Cameroon (Central Africa); Guinea-Conakry (West Africa); Uganda (East Africa); Zambia (Southern Africa); Jamaica (Caribbean); and Fiji (Pacific).

Through capacity building of a diverse range of stakeholders in government, private sector and civil society, the ACP-EU Development Minerals Programme aims to: (i) Enhance employment and incomes, including employment and incomes of women; (ii) Improve the policy and regulatory environment; (iii) Minimize environmental impacts on communities ; (iv) Address individual and community rights and preventing conflict; (v) Ensure decent working conditions and (vi) Facilitate South-South cooperation and cross-country learning.

In order to support these aims and, in particular, country-level efforts in Uganda, Levin Sources has been contracted to undertake a comprehensive "*Baseline Assessment and Value Chain Analysis of Development Minerals in Uganda*". The accompanying *Baseline Assessment of Development Minerals in Uganda* outlines the main characteristics, challenges and opportunities of the Ugandan Development Minerals sector, covering 8 minerals that commonly occur in the country. This study, on the other hand, expounds the value chain aspects of the sector, examining its macro- and micro-economic characteristics, impacts, challenges and opportunities. The report is split into two sections – a market study providing an overarching picture of the Development Minerals market in Uganda, and specific value chain analyses of 4 focus minerals – clay, sand, stone aggregate and dimension stones[2] - chosen from the 8 minerals covered in the Baseline Assessment.

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[1] Development Minerals are minerals and materials that are mined, processed, manufactured and used domestically in industries such as construction, manufacturing, infrastructure and agriculture (Franks, Pakoun and Ngonze, 2016).
Industrial minerals: substance of economic value, exclusive of metal ores, mineral fuels, and gemstones (e.g. barite, bentonite, borates, calcium carbonate, clays, diatomite, feldspar, granite, gypsum, industrial sand, kaolin, silica, soda ash, talc, wollastonite and zeolite).
Construction material (a sub-category of industrial minerals sometimes called 'industrial rocks'): substances used in the construction of infrastructure, housing and other built structures (e.g. gravel, limestone (cement), construction sand, aggregate, glass, ceramics, bricks).
Dimension stones (a sub-category of industrial minerals and construction materials): rock quarried for the purpose of obtaining blocks or slabs that meet specifications as to size (width, length, and thickness) and shape (e.g. granite, marble, slate, sandstone).
Semi-precious stones: a mineral crystal or rock that is generally cut and polished to make jewelry, but that does not include diamond, ruby, emerald and sapphire (precious stones). Examples of semi-precious stones include quartz, amythyst, garnet, aqua-marine, opal and pearl.
Source: UNDP (2016), Terms of Reference: Baseline Assessment and Value Chain Analysis of Development Minerals in Uganda.

[2] For more information on why these minerals were chosen, refer to Section on "Approach and Methodology: Scope of Work".

The following section lays the foundation for the Market Study and Value Chain Analysis by providing insight on the Ugandan context and the current status of the Development Minerals sector.

The Development Context

The Republic of Uganda, a land-locked country located in East Africa, is at a critical juncture in its economic transformation. Following nearly a decade of exceptional GDP growth (7% per annum) that ended in 2010, the economy has since slowed to 3.9% in Fiscal Year (FY) 2016/17[3,4]. The population of 34.6 million, 53% of whom are between 0-14 years[5], is one of the fastest growing in the world. Urbanisation rates in Uganda are soaring, with a predicted urban population of 20 million by 2040, over a three-fold increase from 2013.[6] Furthermore, an estimated 700,000 Ugandans annually enter a job market with limited capacity to absorb new entrants[7].

In response to this and other development imperatives, the Government of Uganda (GoU) has identified massive infrastructure improvements as one of the main stimuli needed to achieve industrialization, job creation, robust economic growth and, ultimately, to fulfil the nation's ambitions of middle income status by 2020[8]. These aims are operationalized through the 2015–2020 National Development Plan (NDP II), which prioritizes the strengthening of Uganda's competitiveness for sustainable wealth creation, employment and inclusive growth.

Development Minerals are poised to substantially contribute to these endeavours. Public investments in roads, bridges and hydroelectric dams coupled with escalating demands for housing and other key products present important opportunities for Uganda's Development Minerals sector. At 6% growth per annum, the construction sector continues to be strong and, with it, a market for a broad range of "building minerals" including sand, clay, limestone, marble, kaolin and sources of stone aggregate[9,10]. Agriculture, which provides a source of livelihood for 65% of Uganda's labour force[11] and constitutes 26% of the GDP,[12] will increasingly call for a range of agromineral inputs, such as phosphates, vermiculite and lime, as needed to spur agricultural

3 World Bank. "Uganda Overview." Accessed November 1, 2016. http://www.worldbank.org/en/country/uganda/overview. "GDP per Capita (Current US$) | Data." Accessed November 1, 2016. http://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=UG.

4 PwC (2017) "Uganda Economic Outlook 2017: Q3: July-September 2017", Accessed Nov. 1, 2017, www.pwc.com/ug.

5 UBOS (2014): National Population and Housing Census 2014. Provisional Results. Uganda Bureau of Statistics, Republic of Uganda. Kampala (UG) http://www.ubos.org/onlinefiles/uploads/ubos/NPHC/NPHC%202014%20PROVISIONAL%20RESULTS%20REPORT.pdf.

6 World Bank (2015). Managing Rapid Urbanization Can Help Uganda Achieve Sustainable and Inclusive Growth. http://www.worldbank.org/en/news/press-release/2015/03/03/managing-rapid-urbanization-can-help-uganda-achieve-sustainable-and-inclusive-growth

7 World Bank (2016) and UN Data and cited in: Barreto et al. (2017).

8 PwC (2017)

9 Cathy Nyakecho, Directorate of Geological Survey and Mines, presentation to UNDP.

10 Hinton, J. (2009) National Strategy for the Advancement of Artisanal and Small Scale Mining in Uganda, Report to Ministry of Energy and Mineral Development (MEMD), 144p.

11 UBOS (2017). Uganda National Household Survey. Accessed 8th December 2017. http://www.ubos.org/onlinefiles/uploads/ubos/pdf%20documents/UNHS_VI_2017_Version_I_%2027th_September_2017.pdf

12 Deloitte (2106). Uganda Economic Outlook 2016, The Story Behind the Numbers, 15p. https://www2.deloitte.com/content/dam/.../Economic%20Outlook%202016%20UG.pdf

production, to counter depleting soil fertility and to maintain food security. Other sectors such as the plastics, pharmaceuticals and oil well drilling that also contribute to industrialization objectives, require salt, kaolin and bentonite, respectively, providing a glimpse into the range of industrial applications of Development Minerals.

Although these opportunities yield insight, recognition of the current contributions of Development Minerals, and from artisanal and small-scale mining (ASM)[13] in particular, is warranted. As detailed in the companion report "*Baseline Assessment of Development Minerals in Uganda"*, the sector is already an important source of non-farm rural and peri-urban employment and the value of ASM production alone is estimated to dwarf those of metallic minerals (such as gold, cobalt and tin) by a factor of 7. Potential multiplier effects across Development Minerals value chains are expected to be substantial, particularly given that primary production alone is estimated to directly and indirectly benefit approximately 5% of the Ugandan population.

Overview of Development Minerals in Uganda

This study's companion report, the '*Baseline Assessment of Development Minerals in Uganda*', provides a foundation for evidence-based policy and decision-making in Uganda by profiling the economic significance, scope and potential of the Development Minerals sector, as well as by fostering an understanding of the sector's technical, legal, social, occupational and environmental challenges and opportunities. This section introduces some of the foundational insights derived from the baseline assessment as a precursor to understanding the potential for value chain development.

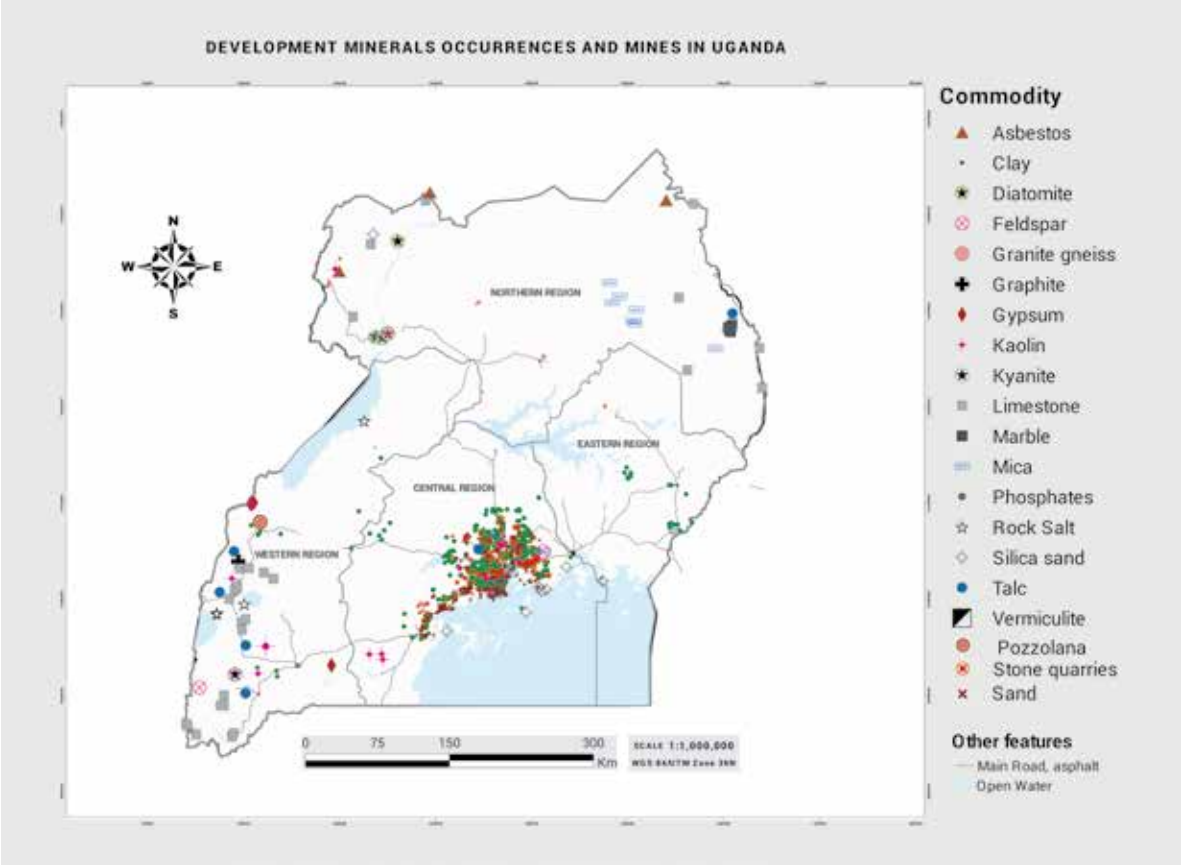
Diversity and Distribution of Development Minerals in Uganda

The main Development Minerals found in Uganda include common clays, specialty clays (including kaolin and bentonite), sand, a range of rocks used for stone aggregate and dimension stone production, limestone and marble, pozzolanic ash, gypsum, semi-precious gemstones as well as other agro-minerals and industrial minerals, such as vermiculite and phosphate.

The map of Uganda below displays the distribution of these Development Minerals throughout the country. Occurrences and production of certain Development Minerals is most intense in and around urban areas (see for example production in the Kampala region) while others (e.g. kaolin, salt) are only in specific localities, as determined by less common geologic conditions.

[13] ASM is generally considered to be the manual or semi-mechanized production of a certain mineral, with low up-front investment and limited environmental, occupational or social risk management. ASM operations are often informal and sometimes illegal. Workforce size differs between sites and commodities, ranging from 2 people to over 1000 at any particular site. Given that the sector is commonly informal (including in terms of the way in which labour is organized), ASM actors are often vulnerable to external shocks and exploitation. See Annex 1 for more details.

Figure 1: Map of Development Minerals Occurrences and Mines in Uganda (Kombo, F. And Naulo, G., 2017).



Key geologic and geographic characteristics of the main Development Minerals in Uganda are summarized below:

Clays	Most Ugandan clays are of sedimentary origin and well-suited to moulding and production of ceramics such as bricks, pots, drainage pipes and floor and wall tiles. Many clays assessed in Central Uganda are “fire clays” suitable for production of refractory (high temperature resistant) bricks. ASM extraction of ball clays takes place in and adjacent to streams, rivers and wetlands, particularly in close proximity to urban centres. The area within and around the capital city Kampala has, by far, the largest concentration of activities, with a total of 576 active and abandoned clay sites within a 150km radius of the city. Other areas of highly concentrated activity are found in the southwest of the country (Ntungamo and Bushenyi Districts) and Western Region (Mityana and Mubende Districts).
Sand	Sand occurs similarly and often adjacent to clay deposits in and on the margins of wetlands throughout the country as well as on lake shores, with extraction most intensive along Lake Victoria south and east of Kampala. A total of 346 active and abandoned sand extraction sites can be found within a 150km of the capital city, with intensive sand production found in Masaka, Wakiso, Buikwe, Mayuge and Jinja Districts. Most Ugandan sand is used as fine-grained aggregate in the production of concrete.

Stone aggregates	Stone aggregates are stones that are crushed within specified size ranges in order to meet the requirements of the construction sector, mainly for use with cement and sand in the production of concrete. ASM extraction favours slightly softer, weathered rock, whereas large-scale extraction, which uses more sophisticated technology, favours harder rock such as granitoids. ASM extraction of rock for use in stone aggregates in Uganda is primarily of quartzite, slate quartzite, sandstone, phyllite, pozzolanic ash and to a lesser extent granodiorite, granite and gneiss. Although stone aggregate quarries are dispersed throughout the country, exploitation is most intensive within and around densely populated urban centers (Figure 7). At least 316 stone quarries (both industrial and ASM) can be found in a 150km radius of Kampala. Some temporary industrial quarries are opened throughout the country to meet the needs of specific infrastructure projects.
Dimension stones	Dimension stones refer to slabs or blocks produced from natural stones that meet basic dimension requirements (length, width, thickness, shape) and suitable for use as rough or cut tiles, countertops, tabletops and similar applications. In the case of ASM, the majority of dimension stones in Uganda are produced at stone aggregate sites, with only a tiny fraction of sites dedicated solely to dimension stones. Only a small percentage of ASM produced dimension stones are cut into tiles – most are sold 'rough'. Despite the broad range of dimension stone-worthy rock in Uganda, most cutting and polishing companies import their stone, the exception being a handful of companies.
Limestone and marble	Limestone, a hard calcium carbonate sedimentary rock, and marble, its metamorphic equivalent, are key constituents in the production of cement. Important deposits are found in Western Region (Hima, Dura, Muhokya, Kaku River), Eastern Region (Tororo), and the Northern Region (Moyo and, in the Karamoja sub-region: Rupa, Koseroi, Tank Hill, Matheniko, Pule and Lolung). ASM production of limestone is limited to specific sites in Western Uganda (Muhokya in Kasese District) and Eastern Uganda (Tororo), mainly for the production of lime, and as marble and limestone, in Northern Uganda (Moroto District) mainly under concessions held by large, formal companies.
Kaolin	Kaolinite is a clay mineral found throughout the country, most notably at Mutaka, Kibalya and Koki in Bushenyi, Sheema and Rakai Districts (Southwest Uganda), Moni in Mbale District (Eastern Uganda), Buwambo and Migadi Hill in Luweero District (Central Uganda) as well as pockets of small, sporadically exploited kaolin throughout Kabale District in the southwest. These deposits differ substantially, producing kaolin suitable for a wide range of uses such as in paint, ceramics and pharmaceuticals. Currently, the Kibalya deposit is being exploited at a small scale, all of which is sold to Hima Cement Ltd. for use in the production of Portland Cement.
Pozzolanic Ash	A type of volcanic ash, pozzolanic ash (pozzolana) produces a strong, chemical resistant cement and reduces requirements for costlier limestone. Exploited deposits are found on the western and to a much lesser degree, eastern flanks of the Great Rift Valley in Kabarole and Rubirizi Districts, respectively, as well as in Kapchorwa on the slopes of Mount Elgon in Eastern Uganda. In Kabarole, approximately 90% of pozzolanic ash production is attributed to mechanized companies while the remaining 10% is extracted by ASM producers, both of which sell mainly to Hima Cement Ltd. and Kampala Cement Ltd. Production in Kapchorwa is undertaken by Tororo Cement Ltd. for their own purposes.
Bentonite	Another type of clay mineral used for medicinal purposes, drilling, foundry and cosmetics, among others, is being extracted at a small scale in Rukungiri District in Southwest Uganda from two deposits, Burama and Ntungwa.
Gypsum	Gypsum is a relatively soft sedimentary rock that is in huge demand, mainly as it comprises about 5% of cement. The only known deposit occurs at Kibuku in Western Uganda (Bundibugyo District), where 300-400 tonnes per annum (tpa) were previously produced by artisanal miners and sold to Hima Cement Ltd. Given that HIma's annual consumption requirements exceed 40,000 tons, exploitation at Kibuku has stopped and the company is relying on imports.

Salt	Salt deposits are located in Western Uganda at Lake Katwe and Lake Kasenyi in degazetted areas within Queen Elizabeth National Park in Kasese District, and at Kibiro in Hoima District. All current production is at an ASM level. At Lake Katwe, previous attempts to set-up an industrial plant to produce iodized table salt for human consumption (sodium chloride) failed due to technical design errors although larger investors are currently seeking the mineral rights for the area.
Semi-precious gemstones	Semi-precious gemstones (e.g. opals, labradorite) have been reported to occur in the Karamoja Sub-region. Although geologic conditions are conducive to such occurrences, it is difficult to confirm whether their origin is Ugandan rather than Kenyan.
Agro-minerals	Agro-minerals are rocks with potential to provide essential nutrients or favourably amend chemical or physical conditions of soil. Deposits occur in Eastern Uganda (phosphates at Sukulu and Bukusu and vermiculite at Namekhara) while potassium enriched volcanic rocks occur throughout Western Uganda (Kabale, Kabarole Districts) and under-explored occurrences of diatomite and zeolites are found in the north.
Other minerals	Other Development Mineral occurrences throughout the country which also have potential industrial applications include talc, mica, feldspar and fluorspar.

Greater detail on the geologic, mineralogic and geographic characteristics of these minerals can be found in the companion report "*Baseline Assessment of Development Minerals in Uganda, Volume 1*[14]".

Current Macroeconomic Contributions of Development Minerals Production

Production of Development Minerals represents a major contribution to the Ugandan economy, and is undertaken by operators of various scales, from ASM to medium-scale mining (MSM) and large-scale mining (LSM) (see Annex 1 for definitions of mining by scale). This study takes into account the contributions of artisanal- to small- and medium- to large-scale operations, as each play a significant role in the contributions of the sector to the Ugandan economy.

Greater emphasis has nevertheless been placed on ASM operations. This is largely because, although 84% of Development Minerals extraction in Uganda can be attributed to ASM, the significant contributions of the ASM Development Minerals sector to local economies and employment go largely undocumented. This study attempts to fill some of these data gaps by presenting an overarching picture of the Development Minerals market in Uganda, but with a particular focus on ASM and related SMEs in the downstream.

Key findings detailed in the companion "*Volume 1: Baseline Assessment*" report estimate that:

- **Almost 390,000 Ugandans are directly employed in ASM production of Development Minerals, equating to almost 3% of the country's working age population**[15]. This is particularly significant considering high levels of under- and unemployment and the growing proportion of youth entering the workforce annually. Considering an average household size of 4.7, production of ASM Development Minerals directly benefits about 1.8 million Ugandans or almost 5% of the total population.

[14] See Section on "Diversity and Distribution of Mineral Occurrences and Deposits" and Annex 1 in the companion report for additional details.

[15] Based on a total working age population of 13,896,000 (Source: UBOS Statistical Abstract (2015).

- **Cash injected into local economies from miners' incomes amounts to over $123 million USD per annum.** This stimulates local MSMEs and, as a consequence, local economic development. This also increases the capacity of individuals and families to educate and provide health care to their children, with an intergenerational multiplier effect on poverty reduction and holistic human development. Additionally, it enables investment in other economic activities, including agriculture.

- **If ASM production of Development Minerals were officially captured, the GDP would increase by about 1.4% percent.** An increase in the GDP is critical to the achievement of national development goals especially those related to aims to achieve middle-income status including through intensive infrastructure development, broad-based employment creation and enhanced purchasing power of the population.

- **Miners are already significant tax payers.** Based on household consumption patterns, miners contribute $9.9 million USD per annum to VAT. Although it is difficult to affirm the levels of VAT collection from local SMEs where miners spend their incomes, if all were collected, this would constitute 2% of all VAT collected in Uganda in 2016, greatly impacting on government's domestic resource mobilization targets. This creates space for higher spending by government on social services such as education and health.

While contributions at the level of ASM production are already substantial, by mapping the value chains of clay, stone aggregate, sand and dimension stones (Section on Analysis of Selected Value Chains), the magnitude of these contributions is amplified even further. The crucial role played by ASM in the production of Development Minerals means that it is essential that viable opportunities for market entry for ASM stakeholders are found.

Development Minerals Products: A Glimpse into Opportunities for Diversification

Whilst Uganda is producing and adding value to a diverse range of Development Minerals, a vast number of products that could be produced in-country continue to be imported. Table 1 outlines some of the current and potential uses of the 4 focus Development Minerals in Uganda, providing an indication of important gaps in the market that Development Minerals products have the potential to fill, given the right environment and support.

Despite potential opportunities for value addition, significant challenges remain. Factors to consider include market demand for different products, as well as the ASM Development Minerals sector's technical and financial capacity to compete, both in terms of domestic demands for quality and quantity of various products and in terms of competitiveness compared to neighbouring countries. The examination of Development Minerals markets and ASM value chains provides insight into potential entry points for technical and financial support, with a view to increasing production and incomes and ultimately improving the lives and livelihoods of those working in the sector.

Table 1: Selected Development Mineral Commodities and their Products in Uganda. Source: MEMD (2008)

Current Products and Main Uses in Uganda	Other Potential Products
FOCUS MINERAL: Clay	
Bricks: construction of houses and other structures; ventilators: aeration; half bricks: decorative covering (mainly exteriors); Pots, charcoal stoves, water storage; Pompe: kitchen aeration; roofing tiles; refractory bricks	Sanitary ware, porcelain, hobbyware, dinnerware, coatings.
FOCUS MINERAL: Sand	
Concrete production; Construction for grit and in bricks, plaster, concrete and mortar. Agricultural uses (growing certain types of crops, dairy farming).	Common glass (high quality silica sand), textured paint, train wheel traction
FOCUS MINERAL: Stone Aggregate	
Concrete production; manufacturing of concrete blocks, pavers, culverts etc. Applications typically according to size. Stone dust: base material for asphalt roads; toilet slabs, flower pots, decors, pavers, culverts etc.; Fine to coarse aggregate: concrete, drainage rock, road ballast, foundations.	Used with a binding in walls for shorelines and railroad construction, used a flux for blast furnaces used for septic systems and self-contained sewage treatment systems.
FOCUS MINERAL: Dimension Stones (Slaty quartzite, Slates, Sandstone, Phyllites, Gneiss, Mudstones, Siltstones)	
Rough stones and slates (exterior walls/cladding, flooring, pathways, boundary walls, etc). Some blocks (e.g. welded volcanic tuffs) used for house construction (walls, floors). Minor production of cut stone or cut and polished stone tiles, countertops, tabletops etc (mainly from imported blocks).	Terrazo cement tiles, marble chips and marble powder. Cut and polished stone tiles, countertops, tabletops, windowsills etc.

Objectives of the Market Study and Value Chain Analysis

Development Minerals value chains hold considerable potential to support the fulfilment of Uganda's short, medium and long-term development goals. In order to realize this potential, a broad range of opportunities, barriers and constraints along all nodes of Development Minerals production and value chains must be understood.

This study analyses and builds upon the findings presented in the Baseline Assessment. It focuses on four key minerals and seeks to understand the numerous factors that drive the incentives, growth and competitiveness of the Ugandan Development Minerals sector, identifying opportunities and challenges to the benefits of stakeholders at key stages along the value chain, and to the performance of the value chain as a whole.

Approach & Methodology

Scope of Work

The aim of this study is to provide a thorough analysis of value chain performance and potential of Development Minerals in Uganda, with a particular focus on four key minerals.

The objectives of the study have been fulfilled by way of an iterative process in consultation with a range of sector stakeholders all along the Development Minerals supply chains, from mine to final market. Both primary and secondary data were collected. Primary data collection consisted of site assessments, focus group discussions and interviews at ASM sites and Points of Sale (POS) of Development Minerals as well as consultative meetings with central stakeholders and local government representatives. Existing secondary data has been used to supplement the primary data collected during the field phase of the project.

Whilst there are many different kinds of Development Minerals, eight were chosen as focus minerals for the Baseline Study, and four of these eight for the value chain analysis. The focus minerals for Uganda were selected in consultation with the ACP-EU Development Minerals Programme Country Working Group (CWG) by way of a participatory ranking exercise based on an anonymous vote and subsequent debate during the inception phase of the project.

Figure 2: Selected Minerals for the Baseline Study and Value Chain Analysis

The CWG is a multi-stakeholder group that provides technical oversight of implementation Programme in Uganda. Members include 21 representatives from the Ministry of Energy and Minerals Development, Uganda Chamber of Mines and Petroleum, Civil Society representatives, Ministry of Works and Transport, Ministry of Lands, Housing and Urban Development, an apex association of miners and the Uganda Local Government Association.

Research Activities

Central Stakeholders

Central stakeholders (key informants) were interviewed to supplement field and secondary data. 9 interviews were conducted with 7 officers in the Directorate of Geological Survey and

Mines (DGSM) representing offices concerning geology, cartography, licencing, geodata as well as the National Bureau of Standards, Central Materials Laboratory, National Environmental Management Authority (NEMA), Makerere University (College of Engineering, Design, Art and Technology, and the Department of Geology and Petroleum Studies). Public secondary data from central stakeholders (e.g. Ugandan Bureau of Statistics (UBOS)) was also used to supplement, triangulate and extrapolate field data.

Field Research

Field research was conducted in each region of Uganda, in a total of 22 districts. All researchers attended a two-day research and ethics training workshop, which addressed issues around gender and human rights. All primary data collection tools were field tested before the start of the main fieldwork phase. Fieldwork was conducted simultaneously by two teams, covering the southern/western regions and the northern/eastern regions respectively. The central region was assessed by one team.

Field research comprised of the following activities:

- Consultative meetings and interviews with local government
- ASM site assessments, comprising of individual interviews and focus group discussions (FGDs)
- Interviews with owners and employees of SMEs engaged in the trade of Development Minerals.
- Rapid enumeration of ASM sites and POS

A total of 434 stakeholders participated in interviews and focus group discussions across 42 mine sites and 73 points of sale. The number of districts, sites and SMEs or POS assessed can be found in Annex 2, along with a map of ASM site and POS locations.

Sampling

Selection and number of ASM sites and nearby trading centres where points-of-sale are located was based on:

- Statistically representative regional coverage
- Purposive sampling with respect to commodities of interest.
- Purposive sampling on the basis of areas of intensive, contentious or previously neglected activity
- Purposive sampling on the basis of single or few production areas for some commodities
- Resources and time to carry out the work

Sampling of participants within ASM sites and communities for the ASM site assessments was conducted using three strategies: snowball sampling, purposive sampling and self-selection by ASM community members for FGDs, complemented by purposive sampling by the researchers -as needed. For an in-depth explanation of sampling and research methods, see the Methodology Section of the Baseline Assessment of Development Minerals in Uganda.

Downstream Private Sector Stakeholders

In order to supplement the data collected during field research and central stakeholder meetings, nine interviews were conducted with private sector stakeholders from five construction companies, two of which specialised in the production of stone aggregate and three of which engaged in construction at different scales (micro, small and large), two clay production companies, two-dimension stone production companies and 1 university. This allowed a deeper analysis to be conducted along the whole Development Minerals Value Chain from mine site to final consumer.

BOX 1: APPROACH TO ESTIMATION ACROSS ASM VALUE CHAINS

Given that the majority of the Development Minerals ASM sector[16] is operating informally, data concerning the magnitude of the sector's activities is extremely limited. This lack of information generally extends to on-site traders and transporters as well as micro- and small- construction sector SMEs. Methods varied with each step in the value chain and drew from, wherever available, official statistics with assumptions and resulting calculations informed by the following:

- **ASM Sites**. Methods for estimated of employment and production are detailed in the companion *Baseline Assessment Report.* Costs of operations at various steps were based on averages of reported costs (e.g. of labour) and local costs of basic tools used and estimates of their consumption (e.g. 2 pickaxe heads per mineworker in extraction per annum). "Taxes" or revenue shares accruing to landowners were based on those reported and accounted for the percentage of sites where no landowner share was reported.
- **Transporters and Traders**.The numbers employed were based on reported numbers of trips per week, although data was from a limited number of transporters. Lorry hire costs were reported by some traders. Fuel costs per annum were calculated based on consumption of 6 km/L, number of trips estimated per annum (based on rainy and dry season) and average distances to main markets (nearest urban centers). Maintenance costs were based on full maintenance every 5,000 km. Loading costs were reported by both ASM producers (who were paid for this service) and, where data was available traders/transporters for the different commodities. Gross margins were based on reported sales prices at different sites, reported purchase prices by traders and sales prices by traders (and purchase prices by downstream SMEs).
- **Points of Sale and SMEs**. Commodity-specific assumptions concerning the share of these products sold on off-site SMEs (and sales per week or annum) are provided in the relevant sections. On average, 4 employees per SME/POS, thus enabling estimation of the numbers employed. Costs concerning overheads were roughly estimated. Gross margins were based on reported purchase and sales prices for different products.
- **Construction SMEs**. Interviews with small-, medium- and large construction companies enabled estimation of team size (e.g. bricklayers, concrete mixers and pourers) and their daily production capacity (e.g. 1000 bricks per day). Assuming all production is sold, this enabled estimation of the total number of workers directly involved in the use of these products. Costs (overhead, taxation) and gross margins (typically on labour and materials) were reduced in accordance with the prevalence of smaller enterprises in use of these minerals.

Stakeholder Validation

Stakeholder validation was conducted during a multi-stakeholder validation workshop in Kampala on November 14th and 15th, 2017. The event drew almost 70 participants from central and local government, civil society, private sector, and ASM communities who reviewed and provided

[16] Please note that any reference to 'ASM' in this box refers to Development Minerals ASM

concrete input to inform finalization of this report. The Uganda Country Working Group also validated the report during a November 13, 2017 meeting in Kampala, prior to the National multi-stakeholder validation workshop.

Research Limitations

Limitations and challenges encountered during the project include the following:

- The Development Minerals sector, particularly with regards to ASM, is very poorly documented in Uganda, meaning that the collection of primary data was essential for all parts of this study. The study was not intended as a census. Instead, robust sampling strategies and triangulation of data allowed for a representative picture of the sector.

- The large size of some sites (e.g. stone quarries employing up to 1,000 workers) precluded extended assessments of the whole site. Geo-data was used to extrapolate the data collected at these sites.

- Access to sites was limited and travel times increased in some cases by heavy rains, long-distances between regions and districts, vehicle problems and a delay in team member mobilization. This issue was overcome by building contingency into the research timeline and ensuring that the team has the relevant authorisation to access sites in advance.

- The huge variety in terms of organisational structures and benefit distribution in ASM presented a challenge for systematic data collection across sites. Other challenges included interviewee time, interviewee transparency or knowledge about certain issues (some interviewees did not know their own income or cash flow), and fluidity of roles, where the same individual might perform different roles and earn different amounts on the same mine site at different times. The team resolved to maximise sample size without undermining the quality of each interview, the guidance for which was shared with the research team in advance of the fieldwork during the training workshop. Furthermore, the validity of data collected was checked through extensive triangulation in during the data analysis phase, leading to reliable and defensible results.Inadequate record-keeping at ASM sites or POS posed a challenge to the validation of historic data. This data shortage could not in itself be overcome. However, it meant that the emphasis on primary data collection was reinforced to make up for the lack of availability of alternative data sources.

- Whilst the field research used methods to assess the impact of seasonality of production, workforce etc. the fieldwork was conducted over a 1 month period and therefore cannot be said to map in detail changes in profile over the course of the year. Due to this uncertainty, related estimates were conservative. For example, where rainy season production and workforce was reported to drop by about 50%, it was assumed that, of the workforce working in that season, their individual productivity was also halved (resulting in overall production decreases of 75%). Such uncertainties were accounted for on a site-by-site basis according to the reliability of the data sources (e.g. capacity to effectively triangulate responses) at different sites.

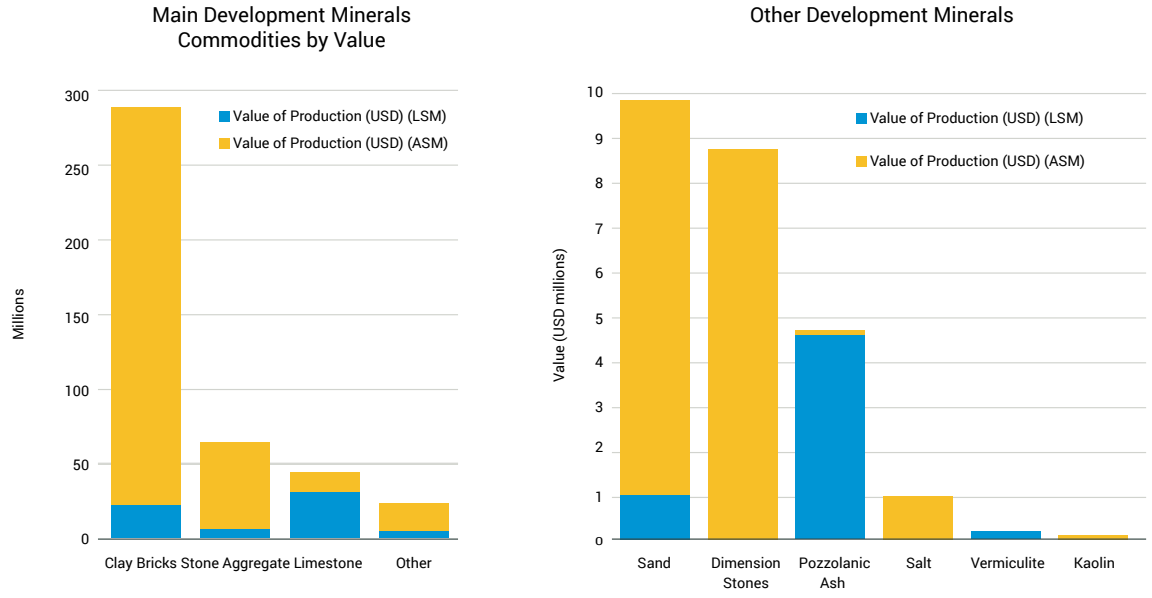
The Development Minerals Sector in Uganda

As a precursor to mapping issues within commodity-specific value chains, this Section seeks to provide an overview of (i) current production, trade, markets and market structure for Ugandan Development Minerals; and; (ii) factors affecting short- to medium-term trends in production and demand, including as it relates to economic and non-economic factors influencing the investment climate and regional competitiveness.

Current Market for Development Minerals and their Products

This section provides an overview of the Development Minerals sector in terms of its contributions to Ugandan mineral production and the balance of trade and additionally describes the size, nature and structure of the market.

Figure 3: Value of Development Minerals Commodities in 2015 (in millions of US dollars). Figure at left shows most valuable commodities and figure at right shows lower value commodities. Detailed statistics and estimates are provided in Annex 3. Source: Present Study and DGSM Annual Reports (2015/16)



Production

Whilst Development Minerals are sometimes referred to as 'low value' minerals, their global value is significant and, particularly given that mineral transformation and use primarily takes place in the countries where these minerals were produced, the sector is clearly a force driving economic development. The global production of Development Minerals, in terms of both total volume and value, dwarfs global production of metallic minerals that commonly yield far more attention worldwide. For example, global sand and gravel production has been estimated at around 40 billion tonnes annually, with a value of over $280 billion USD[17]. The rough global value of gold and

[17] Franks, D. (2017) Development Minerals. Matter for the SDGs. Intergovernmental Forum for Mining, Minerals, Metals and Sustainable Development. Geneva, Switzerland.

copper production, on the other hand, are only approximately $170 and $120 billion USD respectively[18]

Figure 4: Individual per person production is low, as found in this stone quarry in southwestern Uganda. Despite this, due to the large number of sites and mineworkers, cumulative production by ASM operators across the country is substantial. (Photo: Levin Sources. 2017)

Similar trends can be found for Ugandan production and value of Development Minerals when compared to metallic mineral production with even more compelling insights when ASM production is compared with LSM and MSM (Figure 3).

Detailed estimates and statistics on production and value of these commodities are provided in Annex 3.

In total, 84% of the value of all Development Minerals production in Uganda is attributed to ASM, with an estimated value of 350 million USD in 2015. This equates to 5.3 times the value of estimated medium and large-scale production for these minerals (officially reported and unofficial estimates).

Furthermore, estimated ASM production amounts to over 7 times the value of *officially reported* production of *all* mineral commodities, including limestone, pozzolana, kaolin, vermiculite, aggregate, gold, tungsten, tantalum, tin and cobalt. It is also 4.2 times the value of estimated (unofficial) artisanal gold production[19]

Imports and Exports

The trade deficit from Development Minerals and related products in Uganda amounted to 82.6 million USD in 2016[20]. This constituted 2.5% of Uganda's total imbalance of trade of 2.56 billion USD in that year[21]. The sector therefore provides an important opportunity to mitigate the trade deficit thereby increasing its macro-economic contributions further. Commodity specific differences provide important insight into potential priorities for support.

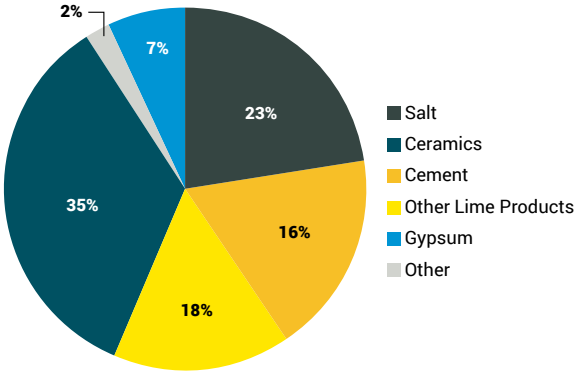


Figure 5: Main Development Minerals contributing to the trade deficit (by % of total deficit attributed to Development Minerals)

[18] Franks, D (2017)

[19] Barreto, M, P. Shein, J. Hinton, F. Hurschka .(2017), Economic Considerations of Artisanal and Small-scale Mining in Uganda: Gold and Clay. Alliance for Responsible Mining.

[20] Based on cumulative value of imports and exports for selected Development Minerals as presented in Annex 3.

[21] Global Edge. Global Insights. Uganda. Accessed 24th November 2017. https://globaledge.msu.edu › Global Insights › By Country › Uganda

In terms of contributions to the trade deficit, only vermiculite and stone aggregate exports exceed the value of imports and therefore positively contribute to the balance of trade. Excluding those commodities, the most significant trade imbalances are associated with ceramics, salt, cement and other limestone products (e.g. lime, flux) while gypsum, which is largely imported to meet cement production needs, is also significant. Minor deficits (imports exceed exports) are also associated with clay bricks, sand, dimension stones, kaolin and phosphates.

The main opportunities and limitations of Development Minerals associated with the most substantial trade deficits above are summarized in Table 2, below. Detailed import and export data is presented in Annex 3.

Reduced reliance on imports through in-country product diversification and improved capacity to meet quality and quantity demands would provide an important means to mitigate the trade deficit. Additional opportunities are presented through development of export markets, with most Ugandan Development Minerals products currently exported within the region. Related opportunities and constraints to increase regional competitiveness and export market potential are examined further in the Section on "The Investment Climate: Access to Finance and Competition Policy".

Table 2: Opportunities and Limitations related to Main Development Minerals Contributors to the Trade Deficit 22

Product	Opportunities and limitations for addressing the trade deficit
Ceramics	Although ASM production of ceramics from clay seem to be on the rise, the nature, design, quality and price of these products are more suited to local markets (e.g. charcoal stoves, pots), rather than more "specialized" items (dishware, cookware, sanitary ware, e.g. bathtubs, toilets) that are expected to make up a large proportion of imports. A diversity of kaolin-rich ball clays and other clays with suitable mineralogic characteristics suited for production of higher value ceramic products can be found in certain localities of the country. Furthermore, a number of known kaolin deposits are currently unexploited and, although some possess sufficient quality as needed to address the ceramics deficit and other markets (e.g. paint, pharmaceuticals), production continues to be far less than that required by the in-country cement industry. Cement, which is strategic to national economic development, nevertheless requires specific grades and characteristics of kaolin thus alternative applications of non-cement grade kaolin (which often occurs in specific zones of currently exploited deposits) could be examined.
Salt	Current in-country salt production amounts to ca. 25% of import volumes[22], yet Ugandan salt products require further refining to meet standards for iodized table salt. Reportedly, Ugandan investors are examining the potential to establish iodized salt manufacturing at Lake Katwe, by far the largest known source. A rigorous cost benefit analysis of this venture is warranted with due consideration of the sites cultural value (given the 300+ year history of production), expected loss of over 10,000 direct livelihoods and inevitably severe economic impacts on the surrounding town. This should include an assessment of feasibility of increasing production and diversifying salt products (e.g. via sequential extraction) through appropriate, intermediate ASM technologies.

[22] Based on estimated ASM salt production at Lake Katwe (Annex 3) and official salt imports cited in ITC Trademap, (2016) http://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1|800||||25|||4|1|1|2|2|1|1|3|1

Product	Opportunities and limitations for addressing the trade deficit
Cement	The large-scale cement industry is looking to almost double in-country production through development of new limestone mines, mainly in the Karamoja Sub-region, and expansion or construction of new cement manufacturing plants. While the need to import key inputs (e.g. kaolin, gypsum, clinker) likely plays some role, the trade deficit associated with cement could be partly attributed to exceptionally high energy and fuel costs in-country (accounting for approx. 35-40% of production costs)[23], which substantially weakens the competitiveness of Ugandan products.
Lime	ASM lime producers in Tororo and Kasese have a solid understanding of standards for a range of products but there is a need to: improve capacity to compete in markets; improve access to economical testing for certification purposes; and to reduce the variability between the technical capacity of different producers to consistently meet standards and consolidate production volumes to fulfil contract requirements. In Muhokya in Kasese District, in particular, lack of attention to product requirements by a few active producers seems to have undermined confidence in all producers in the area (even those producing lime to specifications), resulting in sharp declines in production since 2008.

Domestic Consumption and Demand

Current market demand is the main driver for production and imports outlined in the previous two sections. It additionally provides: (i) a baseline from which future changes can be measured; (ii) insight into which types of economic shocks can result in reduced demand; and (iii) some indication into where important opportunities for market expansion and mitigation of the current trade deficit may lie.

With emphasis on the Development Minerals considered within the value chain analysis, main demand is associated with the construction sector, including residential and non-residential structures and civil works, as described below. As cement and related inputs in concrete production (stone aggregate and sand) are essential to both, additional focus is given to cement demand.

Construction of Residential and Non-Residential Buildings

Clay bricks dominate the residential construction market in urban areas. Although 36.4% of houses across the country used burnt/stabilized bricks for construction of walls in 2015, usage as an overall proportion of construction was much greater in urban areas (58.1%) than in rural areas (29.4%)[24]. Similarly, in 2011, 28.8% of all Ugandan houses were built using cement flooring, which has much higher rates of use in urban (76.1%) than rural (17.9%) areas[25]. Further to this, rates of housing construction in urban areas (4.2%/a) are almost double that of rural areas (2.4%/a), thus rates of urbanization (4.8%/a)[26] are critical to current and future demand.

[23] Petterson, D. (2016) The Cement Industry in Uganda, Presentation to the Presidential Industrial Roundtable on Minerals Value Addition, Jan. 26, 2016.

[24] UBOS (2016). Ugandan National Household Survey 2016/2017. Accessed 20th November 2017. http://www.ubos.org/onlinefiles/uploads/ubos/pdf%20documents/UNHS_VI_2017_Version_I_%2027th_September_2017.pdf; UBOS (2015): 2015 Statistical Abstract. October 2015. Uganda Bureau of Statistics, Republic of Uganda. Kampala (UG).

[25] UBOS (2012), Uganda Demographic and Health Survey 2011. Accessed 8th December 2017. https://dhsprogram.com/pubs/pdf/FR264/FR264.pdf

[26] By 2040, an urban population of 20 million is predicted, a rapid increase from 6 million in 2013. Source: World Bank (2015)

The demand for bricks and cement and demand for stone aggregate and sand are closely linked. In the case of clay bricks, mortar (used in bricklaying) requires approximately 150 kg of cement and 1.5 tonnes of sand for every 1,000 bricks. Although mixes vary depending upon those engaged in concrete mixing, typically every tonne of cement used requires about 1.7 tonnes of sand and 3.3 tonnes of stone aggregate. Since cement is manufactured using capital intensive technologies, it is the reserve of the large Development Minerals mining and manufacturing firms. Conversely, clay bricks and inputs into cement to produce concrete used in residential and non-residential construction are dominated by ASM production, and in some cases MSM. for instance related to the higher quality clay brick market.

The concentration of clay, burnt brick, sand and stone aggregate production around urban areas is not surprising. Around Kampala alone, the country's largest and fastest growing city, a total of 576 active and abandoned clay sites within a 150km radius of the city, drawing from within Kampala and in neighbouring districts (e.g. Wakiso, Mukono, Seeta, Mityana and Masaka) (Figure 6).

Nevertheless, clay brick, sand, stone aggregate and dimension stone activities are widely dispersed throughout the country, with concentrated clusters of activities in relatively close proximity to growing towns and trading centers.

Figure 6: A familiar scene in Fort Portal, one of Uganda's many rapidly growing towns. Locally sourced bricks are used for construction as workers use a small cement mixer in the distance. (Photo: J. Hinton, 2017)

While urbanization is clearly a driver for demand for construction sector inputs, increased demand in rural areas cannot be overlooked, especially considering that 84% of the Ugandan population are estimated live in rural areas.[27] In 2015/16, 73% of the estimated 187,500 new houses built were constructed in rural areas[28] and clay brick usage (and correspondingly sand and cement in mortar) is generally increasing at a faster rate in rural rather than urban areas. Specifically, between 2007 and 2011, burnt/stabilized brick usage increased by 17.2% in rural areas and only 5.4% in urban areas.[29] Cement flooring also increased (by about 6.4% overall), with less pronounced differences between urban and rural areas, which increased by 6.4% and 4.3%, respectively.[30]

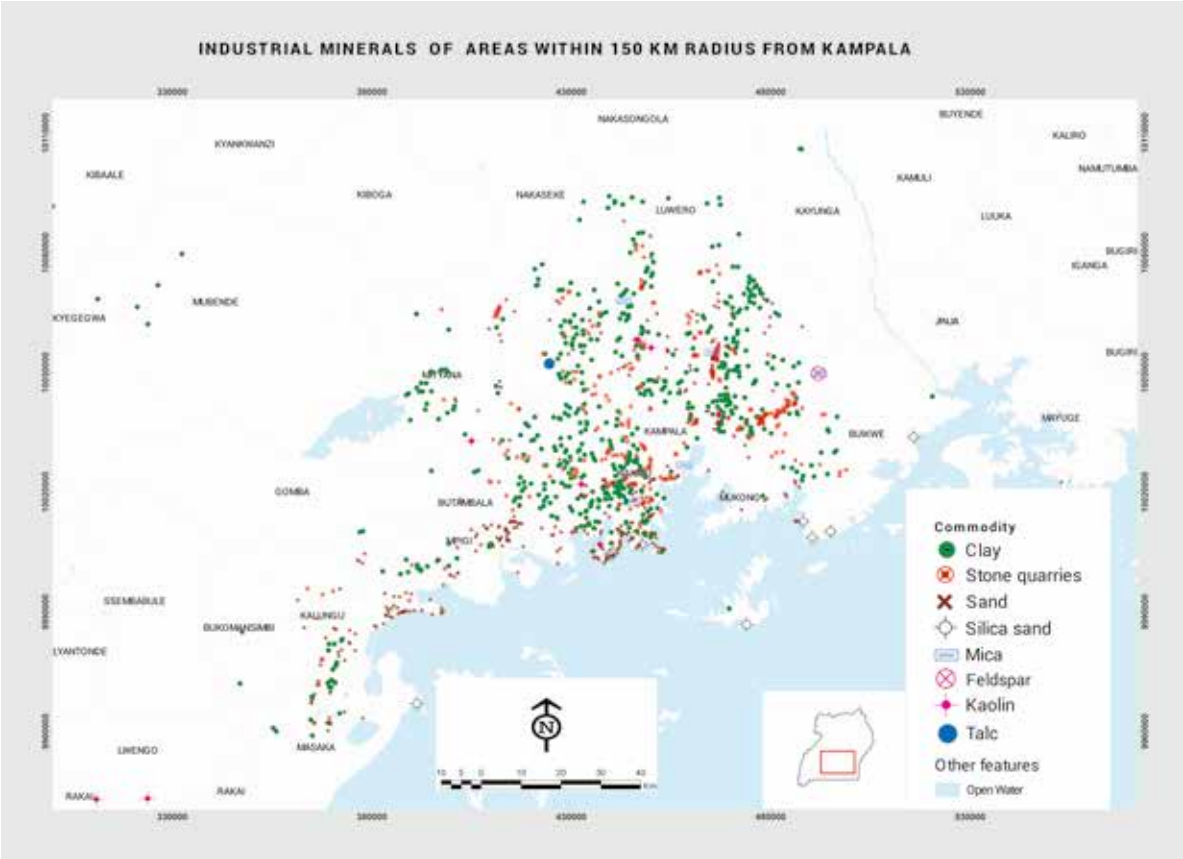
[27] World Bank Open Data. Accessed 8th December 2017. https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS

[28] Ministry of Lands, Housing and Urban Development (MLHUD), 2016, LHUD Sector Performance Report, 2006/07 – 2015/16.

[29] UBOS, 2016, UBOS (2014) and UBOS (2007). Statistical Abstract 2007. Accessed 7th December 2017.

[30] UBOS Demographic and Housing Surveys in 2006 and 2011 indicate that the proportion of houses with cement floors increased overall from 22.4% to 28.8% in this period with urban use increasing from 69.7% to 76.1% and rural use increasing from 13.6% to 17.9%.

Figure 7: Distribution of Development Minerals Sites in the Kampala Region (within 150km radius). (Source: F. Kombo and G. Naulo, 2017)



Whilst there has been a steady decrease in the percentage of Ugandan's living in rural areas – from 96% in 1960 to 84% in 2016[31] – the rural population remains significantly larger than the (growing) urban population. In real terms, therefore, at the present rate of urbanisation, rural consumption of Development Minerals for constructions looks set to remain the major market. Nonetheless, with a higher percentage of urban dwellers using Development Minerals for construction, and the continued (albeit steady urbanisation of the population), the outlook for demand for Development Minerals in urban areas is robust and growing.

Statistics on rural and urban construction methods for non-residential structures are limited and likely under-approximate the actual magnitude of construction rates. In 2013, only 2,705 applications for permits for construction of non-residential structures (i.e. commercial, industrial, institutional and other) were received by 9 municipal and 60 town council governments. Between 2009-13, the number of plans submitted to nine municipal councils increased for commercial and industrial structures by 401% and 205%[32], respectively, providing some indication of increased construction rates. However, it is evident (by way of observation), that in towns and trading centers throughout the country, burnt clay bricks constitute the walling materials for a significant proportion of storefronts, shops, lodges, hotels, petrol stations and other structures.

[31] World Bank Open Data. https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS [accessed 7th December 2017]

[32] UBOS, (2015). Of note, "plan submission" likely is less an accurate capture of construction sector growth as it may actually rely more heavily on legal, procedural or enforcement of building plan requirements

Based on the above construction rates and criteria detailed in the companion "*Baseline Assessment*" report, consumption of clay bricks, sand and stone aggregate in 2016 were estimated at:

- Clay bricks: 5.4 billion bricks, valued at $289.2 million USD.
- Sand: 3.5 million tonnes, valued at $9.9 million USD
- Stone aggregate: 6.8 million tonnes, valued at $64.7 million USD
- Dimension stone: 1.5 million tonnes, valued at $8.9 million USD

The emergence of concrete blocks and other concrete products provides some competition for bricks, but demand will likely be determined by growth of the middle class, who are better equipped to pay for the slightly more expensive albeit more durable concrete alternatives. Nevertheless, concrete or concrete blocks comprised walling material for only 5.3% of houses in 2015. Although not quantified, the number of non-residential structures using concrete blocks rather than bricks appears to have increased substantially, particularly for construction of more up-scale structures (e.g. apartments, hotels, shopping malls, office buildings).

A more rigorous analysis of actual growth in the use of concrete blocks would provide a clearer picture of potential future competition that concrete blocks pose for clay bricks and corresponding increases in demand for cement, stone aggregate and sand in the future. This trend may have an increasing effect on the burnt, clay brick market in the long-term, particularly in response to growth in the middle and upper class who are typically better equipped to pay higher construction costs. Nevertheless, given the rate of population growth overall, in the absence of substantial increases in GNI per capita, demand for ASM production of solid, burnt clay bricks is likely to see continued growth in the short- to medium-term with MSM and LSM of most speciality products likely limited to markets provided by those occupying the middle class and above.

Civil Works

Civil works projects will provide considerable demand for items such as cement and aggregate over the coming years. The GOU allocated 31% of its 2016/2017 budget to road and energy infrastructure (including hydroelectric power plants), by far the largest allocation of any sector; thus, demands on construction materials are expected to increase even further[33]. The following discussion provides an appreciation of the degree to which Development Minerals will be needed in Uganda for development of civil works in the near future.

Kilometres of road: Civil works projects to be undertaken pertaining to roadways is considerable in Uganda over the coming years. To date the country has committed to performing upgrades and maintenance to nearly 15,000 kilometres of roadway in the country. This includes 2,205 kilometres of gravel roads scheduled to be upgraded to tarmac, 700 kilometres of old paved roads scheduled for rehabilitation, 2,500 kilometres of paved roads scheduled for maintenance and 10,000 kilometres of unpaved roads scheduled for maintenance.[34]

[33] Export.gov, 2017, Uganda Country Commercial Guide: The Construction Sector, https://www.export.gov/article?id=Uganda-Construction

[34] Uganda Works and Transport Sector (2017). Overview of 2017/18 Grant and Budget. Accessed 8th December 2017. http://budget.go.ug/budget/sites/default/files/PP.pdf

These civil works projects will undoubtedly also increase demand for items such as cement for culvert and sidewalk construction as well as aggregate stone, an input with multiple purposes in the construction of roadways (e.g. road ballast, concrete).

Rail Infrastructure and hydropower dam construction: Railway infrastructure in Uganda will also drive consumption of development minerals in the near future. As an example, Hima Cement is expected to secure a contract to supply cement for the $3.2bn Standard Gauge Railway (SGR) project, which is estimated to require 800,000 tonnes of various types of cement. Currently the company is supplying up to 6,000 tonnes of cement every month to the Karuma hydropower dam construction project. It should be noted that contractors in previous years procured much of the inputs for the dam from Kenya and China, however, the government is placing pressure on these companies to ensure local procurement occurs whenever possible.[35]

Given the complex and highly competitive requirements for bidding and procurement processes, including the need to meet national standards for quality, these contracts are likely to be dominated by LSM producers, both foreign and domestic. In most cases, new industrial stone quarries are established as major road works and other projects come on-line, with ASM operators additionally lacking capacity to meet quantity requirements.

Opportunities may be found in the example provided by the September 2016 Local Content Strategy for the Standard Gauge Railway Project in Uganda. The Strategy explicitly highlights the importance of a) putting in place mechanisms for local businesses to supply materials to the project such as gravel, sand, aggregate, and ballast, and b) engaging local cement manufactures to ensure that cement can be locally sourced.[36] Importantly, the Strategy does not effectively capture opportunities to redress gender inequalities in the country (i.e. via allocation of a certain percentage of contracts to women-owned SMEs or women suppliers).

Elsewhere, opportunities for ASM engagement in civil works project, in the short- to mid-term, may be found in smaller, local government tenders, particularly given that certain district governments have expressed interest in such an arrangement. An additional opportunity yet to be explored in Uganda involves aesthetically beautiful, environmentally beneficial and often cost-effective employment generating initiatives using cobble- and paving stones as found in Ethiopia, Zambia and Rwanda (Box 2). Such an initiative could be piloted in conjunction with civil works investments (e.g. schools, government offices, hospitals).

Although a platform for ASM companies to access contracts associated with the Standard Gauge Railway or other civil works projects may exist or local governments may source from ASM in the near future, the right training, support and likely some degree of advocacy on the part of Development Minerals champions will be needed to ensure that standard and quantity requirements can be met.

Finally, despite investment in infrastructure being a clear policy priority of the GoU (and therefore likely ringfenced in the to medium term), macro-economic indicators that allude to the health of the Ugandan economy (as discussed below) indicate that this level of spending will not be sustainable in the long-term. An increasing debt burden, high-levels of inflation and declining

[35] The Observer (2017). Accessed 8th December 2017. http://www.observer.ug/fids/business/51818-hima-kampala-cement-gear-up-to-supply-sgr

[36] Ministry of Works and Transport (2016). Local Content Strategy, Standard Gauge Railway Project. Accessed 8th December 2017. https://sgr.go.ug/downloads/LOCAL_CONTENT_STRATEGY.pdf

GDP growth rates all underline future limitations on the central government budget, from which large investment projects will not be immune.

Market Structure

The Development Minerals sector is made up of an array of different types of businesses, from totally informal, artisanal sites to semi-industrial, medium-scale dimension stone producers to the largest cement producers in the country. This section outlines the characteristics and operations of some of these businesses. For the purposes of this report, businesses have been divided into two categories – medium and large-scale businesses, and artisanal and small-scale businesses, that operate within two distinct market segments.[40] In reality, however, the space occupied by small-to-medium producers, in particular, exhibits considerable variability and falls somewhere within the spectrum between the categories presented.

BOX 2: EMPLOYMENT AND ENVIRONMENTAL BENEFITS OF COBBLE & PAVING STONE ROADS

A number of projects in urban centers around the World involve the use of cobbles (naturally rounded, large stones) and paving stones for construction of roads, parking lots and walkways. In addition to their natural beauty, these projects provide an important environmental benefit. Unlike impermeable asphalt or tarmac roads or surfaces, in the case of cobblestone and paving stone surfaces, rainwater can percolate through soils and recharge the groundwater system rather than being collected into via wastewater collection systems and discharge into lakes or rivers. Furthermore, these road projects use local materials and labour for ongoing and low-cost maintenance. A few examples are highlighted below.

Ethiopian Cobblestone Programme[37]
The programme was initiated by the Federal Government of Ethiopia to use cobblestones to pave walkways, roads and courtyards on new university campuses at 15 separate sites across the country. With help and expertise supplied by GiZ, the aim was to encourage the formation of small local companies which would be awarded contracts on these campuses, and whose employees would be taught how to make and maintain the roads.

Pave Zambia[38]
Pave Zambia started in 2011, with the main objectives of (i) improving the condition of the Urban Road Network using concrete block paving and cobblestones technology to rehabilitate and construct urban and township roads; and (ii) creating employment for the Zambian youths. The 5 year project us currently being implemented following procurement of equipment (2013), installation of brick plants (2014) and road construction (2015-2019).

Cobblestone Road Construction begins in Kigali[39]
Cobblestones road construction started in 2016 in some of Kigali's inter-city roads with 500 people who received short course training in laying cobbles under the National Employment Program (NEP). Trainings were conducted by Workforce Development Authority (WDA) in collaboration with NPD COTRACO ltd, a Rwandan

[37] Addis Happening. Cobblestone construction in Ethiopia. Accessed 8th December 2017. http://www.addishappening.com/store/Magazine/cobblestone-construction-in-ethiopia

[38] Road Development Agency (2016). Pave Zambia 2000 Road Project. Accessed 8th December 2017. www.rda.org.zm/index.php/acts/doc_download/459-pave-zambia-brouchure

[39] Workforce Development Authority (2016). Cobblestone road construction begins in Kigali. Accessed 8th December 2017. http://www.wda.gov.rw/en/content/cobblestone-road-construction-begins-kigali

[40] It is important to note that these classifications have been made in relation to the production rates of organised, unified entities. In terms of total production and employment, the ASM sector would certainly be classified as 'large-scale'. However, low levels of formalisation in ASM, and lack of structured organisation of extraction, processing and commercialisation activities, means that ASM entities as businesses have been classified as artisanal or small-scale in nature. Consequently, officially registered companies with recorded production (either with DGSM of the Ministry of Trade) have been classified as medium to large-scale businesses.

The analysis of the market structure is both a reflection of the present state of play of the sector and a useful analytical tool, which can help us to catalogue the market opportunities and barriers facing the sector's different producers and manufacturers.

Medium to Large Scale Businesses

According to the 2010/11 Census of Business Establishments (COBE), of the 713 businesses in mining and quarrying, 61% were involved in Development Minerals production, namely the quarrying of stone, sand and clay. The highest proportion of these (41%) are located in the Western region, and only 1% in the Northern region. Total registered employment by these businesses was only 2,124 in 2010, 25% of which were women. In addition to this, Uganda's cement industry reportedly employs an estimated 2,300 permanent staff and contractors[41], giving a total estimated MSM-LSM workforce of roughly 4,500 Ugandans. As for formality, some businesses, particularly in the dimension stone, marble and limestone and kaolin sectors, are listed on the Mining Cadastre, whilst others operate under other licenses granted by the Ministry of Trade, Industry and Cooperatives (MTIC), or in some cases through permissions from local government. A reasonably comprehensive list of companies can be found in Annex 4.

Overall, there is a high degree of formality within the LSM / MSM sector, when compared to the ASM sector. Nonetheless, as the baseline report demonstrates, as many as 56% of this market segment (principally MSM) operate outside of the current mining legal framework (despite many holding trade licences and working via formally registered companies).

Of course, the MSM and LSM market segment is not homogenous. Sub-dividing this market segment, we can note that on the LSM end of the spectrum, there are few economic actors, mainly limited to Hima (Lafarge), Tororo and the relatively recent Kampala cement companies. These large actors are principally manufacturers of cement, although in a number of instances they are directly involved in the production of primary inputs, such as limestone and, in the case of Tororo Cement Ltd., pozzolanic ash. Other cement inputs are sourced from other producers, including kaolin (by ASM), pozzolanic ash (by MSM and ASM) and, in the case of Tororo cement, limestone from ASM producers working on their concessions in the Karamoja Region. These companies heavily rely on imports, in particular of gypsum and kaolin, in order to meet production needs. These larger actors also market and sell their products (cement) directly to distributors and buyers.

The small number of large businesses can be described as "oligopolies", meaning that the market consists of few sellers who each hold a significant market share, can exert strong influence over national market price for cement (e.g. by increasing or decreasing production in response to market fluctuations) and who are highly sensitive to each other's pricing and marketing strategies. Due to the capital-intensive requirements of this facet of the Development Minerals industry, it is difficult for new actors to enter the market.

Table 3 below outlines the main market structure characteristics of these operators.

[41] Petterson, D. (2016)

Table 3: Main market structure characteristics of MSM-LSM operators

Market Structure	Oligopoly
Market Characteristics	Hima, Tororo, Kampala Cement etc.
Market Share of Largest Firms	Large (with respect to cement production)
Nature of Costs	Few companies because economies of scale are necessary to participate due to capital requirements.
Market segment	Generally, civil works contracts for railways, roadways or hydroelectric power dams and the production of cement for domestic construction, which is generally bought by wholesalers who then sell to individuals.
Market Competition	Primary competition comes from foreign infrastructure companies and development minerals imports. There has however been a policy emphasis on promoting access to contracts for domestic companies (see Buy Uganda, Build Uganda below).
Vertical Integration	Minimal vertical integration exists with many of the minerals imported from neighboring countries. With increasing demand for cement in the country backward integration may be viable for these companies as development minerals are required to produce cement.
Product Differentiation	Low, though there are different grades of cement necessary for specialized projects such as the building of hydroelectric dams.
Power of Buyers	Medium to high as large buyers who are generally more sophisticated and understand international prices of products sold. Thus, buyers could choose to import, rather than purchase domestically if price is deemed unreasonable.
Customer Turnover	Medium as companies compete for both residential and larger non-residential building contracts as well as civil works contracts.

These characteristics impact directly on market access points for the larger operators. On the whole, their market touches almost every facet of the construction sector that relies on cement production. It is additionally dominated by large civil works projects such as railways, roads and hydroelectric dams, which as stated above is seeing significant government backed investment and therefore growth.

The main competition for these contracts comes from foreign infrastructure firms and suppliers although larger, domestic MSM businesses may increasingly edge into these markets. In order to increase the domestic share within procurement of goods and services, the GoU is proactively pursuing a policy to promote domestic capture of such contracts (see for example, Buy Uganda, Build Uganda in the Section on "The Investment Climate: Access to Finance and Competition Policy). In addition, the domestic construction market is served by these firms, usually through intermediaries such as wholesalers (hardware stores), from which individuals purchase cement as part of housing construction projects. For larger building development projects, bilateral contracts between construction firms and the larger suppliers are commonly established.

By contrast, MSM operations may operate as producers and/or manufacturers. This category of business varies drastically, depending on the mineral being mined and/or product being manufactured, as well as which end of the spectrum they occupy in terms of size compared to other MSM actors. Examples include, but are far from limited to, larger clay product manufacturers (e.g. Uganda Clays Ltd, Lweza Clays Ltd,), businesses engaged in dimension stone cutting, polishing and (in a few cases) extraction (e.g. Jomayi), and a number of industrial stone aggregate operations.

This plurality of MSM operators means that it is very difficult to classify them into either the oligopolistic market structure (detailed above), or the "price taker" market structure into which ASM operations can largely be described (detailed below). This of course does not lead to neat conclusions. However, the variety of examples provided below should demonstrate how the MSM sector can sometimes operate as an effective oligopoly (e.g. recent growth of Jomayi in the dimension stone business), whilst elsewhere it may be heavily influenced by (and therefore unable to influence) market prices. Elsewhere, MSM may bridge the gap between the two market sector categories used herein, such is the complexity of the sector and the limitations inherent in classifying it:

Artisanal to Small Scale Businesses

Table 4: Estimated Direct Employment and Incomes in ASM Development Minerals Production in Uganda (2017)[42]. Source: Present Study

	Direct Employment (2017)[1]			Mineworkers Incomes (2017)[1]		
Commodity	Total	Men	Women	Average (USD/a)	Men (USD/a)	Women USD/a)
Clay Bricks[2]	**197,782**	156,315	39,467	**275**	299	182
Sand	2,550	2,236	314	**585**	585	585
Stone Aggregate	168,750	50,126	118,623	**351**	389	335
Dimension Stones[3]	**30,064**	27,058	3,006	**170**	178	89
Limestone	**8,455**	4,455	4,000	**347**	347	383
Kaolin	**80**	70	10	**312**	356	91
Salt	**10,591**	2,836	7,755	**112**	152	102
Pozzolanic Ash	**265**	265	0	**242**	242	0
Total	389,479	219,010	170,470	299	319	221

Notes:

1 See Box 2 in the companion *"Baseline Assessment of Development Minerals in Uganda"* for detailed description of the methodologies used to derive these estimates.

2 Total Employment accounts for dual roles for sites where both dimension stones and stone aggregates are produced (i.e. mineworkers are only counted once).

3 Please note that the mineworkers' incomes presented here are only those earned directly from mining. Given the prevalence of supplementary incomes from other livelihoods amongst the ASM population in Uganda, actual total income per capita may be much higher (see accompanying Baseline Assessment for more information).

In 2008, the Development Minerals ASM sector was estimated to directly employ 180,000 people, 90 times more than the LSM / MSM sector at that time[43]. This study estimates that the current

42 Source: Levin Sources, 2017, Baseline Assessment of Development Minerals in Uganda, Report submitted to UNDP and the Government of Uganda in conjunction with the ACP-EU Development Minerals Programme.

43 Ministry of Energy and Mineral Development (2009a): National Strategy for the Advancement of Artisanal and Small-Scale Mining (ASM) in Uganda. Ministry of Energy and Mineral Development (MEMD), Republic of Uganda. Entebbe (UG)..

number of people directly employed in the sector reaches at least 390,000 (see Table 4), a 116% increase on 2008 estimates, with many more who rely on it indirectly. The commodities that have seen the highest levels of growth include clay bricks, which is in part driven by a 203% increase in clay brick index prices, and salt at Lake Katwe, where the workforce has increased an estimated 50% over the last decade.

With regards to formality, 98% of the sector operates outside of the current mining legal framework, with only an estimated 2% of operators holding a location licence.[44] This is comparatively high when considered in relation to MSM / LSM businesses, which creates difficulties in particular with accessing formal contracts (e.g. as part of tendering projects) as ensuring consistency and quality control needed for product standardisation undoubtedly more difficult to achieve, particularly wherein the systems of labour organization have not been formalized.

Figure 8: Women and men extract and crush rock in one of many steep-sloped quarries in the vicinity of Kabale Town. (Photo: Levin Sources 2017)

The sheer number of ASM Development Minerals producers (390,000), as well as the individualised nature of production and commercialisation of minerals, means that individual operators in this market segment are unable to influence product prices. If a producer wants to sell their product to a consumer at above market price, then the consumer will simply go elsewhere to buy what they want. The abundance of producers and therefore consumer purchase options (see maps of mineral occurrences and production above) means that the ASM Development Minerals market segment can be described as close to "perfect competition", in contrast to the oligopolistic situation described above.

This fact is further influenced by the homogeneity of the product produced, which on the whole, precludes product differentiation within present markets to achieve a competitive advantage. Rather than being able to influence prices, individual ASM operations are beholden to prevailing market prices – if these rise, incomes go up and the sector becomes more attractive to ASM operators; if prices fall then incomes go down and by contrast the sector becomes less attractive to ASM operators.

On the other hand, it would be inaccurate to say that ASM Development Minerals production does not have an influence on market prices *per se*. The rise in the population and production of ASM Development Minerals operations between 2008 and present is at least in part a reaction to the high market price inflation for inputs into the construction sector (see Section on "Factors Affecting Domestic Demand" on residential and non-residential market prices indices). Later in

[44] Certainly, this is in part due to the fact that the 2001 Minerals Policy (in the process of revision) excluded licencing opportunities for clay, stone aggregate, sand and other "building minerals" as per a Constitutional provision defining them. However, this is also a broader reflection of the spread, number and growth of operations, the pace of which is not being met with increased institutional capacity.

this time period (2010-2015), inflation for Development Minerals inputs in this sector started to fall year on year, and in the case of the residential and non-residential construction costs, fell in real terms in 2013 and 2014. This suggests that supply better reflected demand (and perhaps even outstripped it) in these years, whereas in 2010-11 inflationary pressures were high (in part driven by underproduction of Development Minerals vis-à-vis demand).

The reversal of the trend of inflationary pressures during this period seems to be primarily driven by increased numbers of ASM Development Minerals workers (and therefore overall production) rather than increased productivity per capita, which would require investment in operations, the conditions for which are not optimum for small-scale producers (see section on interest rates). Nevertheless, if we consider the cost of inputs to the construction sector (Section on Factors Affecting Profitability and Investment in the Sector), we can once again see that inflationary pressures on Development Minerals start to take hold in 2015-16 (the latest for which data is available). This suggests ongoing growth potential for the sector, in order to meet growing market demand.

In terms of market segment access, ASM production principally supplies residential and non-residential construction (stone aggregates, sand, clay bricks) and in some cases, inputs for large-scale businesses, including cement producers (kaolin, limestone etc.). As such, drivers of growth (or contraction) in cement dependent industries (including infrastructure development and all construction projects) as well as in economies that are supplied directly by ASMs, in particular domestic residential construction, are good indicators of the present and future demand of ASM produced Development Minerals (see for example the section above on domestic consumption and demand and the section below that considers demographic indicators of market demand).

Table 5 below outlines the main market structure characteristics of ASM operators.

Table 5: Main market structure characteristics of ASM operators

Market Structure	Perfect Competition
Market Characteristics	ASMs
Market Share of Largest Firms	Small share of individual operations; large market share cumulatively
Nature of Costs	Land ownership or agreement with landowners is one of the primary requirements in order to participate in operations. There are many individuals that own and run small mining operations in this sector. Costs are generally not considered material in this context.
Market Segment	Domestic, residential construction and inputs for cement manufacturers.
Market Competition	Principally other ASM operators.
Vertical Integration	Vertical integration downstream is minimal and unlikely for different commodity-specific reasons: (i) some value chains are already short (ASM products immediately purchased for use in construction); (ii) high capital costs necessary to participate in the absence of adequate technical and financial support (e.g. cutting and polishing dimensions stones). Future areas of forward integration might include purchasing transportation or point of sale locations.

Market Structure	Perfect Competition
Product Differentiation	Low, though there are different grades of Development Minerals products that could be in focus when targeting buyers.
Power of Buyers	Medium as buyers have considerable choice with regard to who they can purchase development minerals from. (e.g. many producers of clay bricks). Buying power also varies with the socio-economic status of consumers.
Customer Turnover	High as production and sale of Development Minerals is confined to generally the domestic market for small scale usage (such as clay bricks for residential homes).

In addition to the above characteristics of ASM businesses, a number of other considerations impact on both market performance and market opportunities. Key related findings are presented below.[45]

- **Levels of formalization vary among sites, but are in general extremely low.** This acts as a significant barrier, amongst others, to local construction and other more sophisticated markets, where stringent quality and quantity standards may need to be met. Updates to the mining policy and legal framework to include hitherto excluded Development Minerals, improved availability of and ease of access to mining permits, support for organization of miners and improvement of access to credit, and improved institutional capacity of government to support and regulate formal entities, are among the suit of measures that are necessary to improve levels of formalization and therefore the long-term prospects of access to formal markets.

- **Organisational structures of ASM sites, and the distribution of benefits between key stakeholders, vary by site, by commodity and seasonally.** This can make it difficult to design interventions to support market access that are uniformly applicable. Understanding these aspects of the Development Minerals sector and their impact on servicing market demand is essential to designing interventions to access to markets, particularly in a manner that is sensitive to the marginalized members of the workforce.

- **Gender inequity is widespread.** Women's participation ranges from almost non-existant (pozollanic ash) to above 70% (stone aggregate and salt). On average, female employment in the development minerals sector is much higher than the LSM / MSM sector (average of 25%), which presents a significant opportunity. However, there is a significant gender imbalance in the distribution of benefits from the Development Minerals sector, as women and men do not tend to perform the same jobs, and the 'women's jobs' are generally lower paid. Women earn, on average, only 62% of the earnings of men. Value chain and market initiatives need to take account of this and seek to redress the gender inequity in terms of income and access to employment.

[45] For a more detailed description of the Development Minerals ASM workforce, please refer to the accompanying Volume 1 report, '*Baseline Assessment of Development Minerals in Uganda*' (2017).

- **The presence of children is common on ASM Development Minerals sites, either in part due to absence of alternative childcare arrangements, or due to children working to supplement family income.** This may impact access to more formal markets, in particular, export markets. Initiatives and holistic programmes to monitor the presence of child labour and eliminate its worst forms will need to combine with market promotion initiatives to ensure improved market access.

- **The majority of the ASM workforce do not earn significant income from ASM (about $300p/a). This is mainly due to seasonality and the proportion of ASM revenues accruing to landowners and site owners**. Although monthly, dry season incomes can be reasonably high, reduced production in rainy seasons reduce annual averages considerably. Another critical factor is the distribution of revenues, with between 9-73% of revenues accruing to site owners and landowners, averaging about 48%. Capturing more of this revenue by workers would further improve wages. Value chain and market promotion activities should therefore consider how to maximise incomes for the miners themselves, in addition to aggregate improvements to access to market segments for the ASM sector.

- **Levels of dependency on the Development Minerals sector differs regionally and by commodity, and sometimes even within mine sites.** Mining is the primary source of income for around 70% of miners, but it is the sole source of income for only 19%[46]. Support to the sector should take into account the important interlinkages between the Development Minerals sector and other rural and peri-urban employment activities, particularly as it relates to the organization and availability of labour. Importantly, the prevalence of supplementary income earned from alternative livelihoods beside mining means that actual income per capita could be as high as $418p/a and $385p/a for men and women respectively, when possible additional income is taken into account.

Development Minerals Sector Outlook

Based on findings presented above, the impetus for supporting the advancement of the Development Minerals sector is clear, particularly if reinforced by contributions across value chains as examined throughout the Section on "Analysis of Selected Value Chains". This section describes the factors likely to significantly affect market trends and the future growth and development of the Development Minerals sector. Although these issues are more broadly expected to impact all Development Minerals, cross-cutting implications for clay bricks, sand, stone aggregate and dimension stones are emphasized.

Factors Affecting Domestic Demand

Main factors that provide insight into future domestic demand relate to trends in GDP growth, GDP per capita, inflation rates, construction sector growth and population growth and shifting demographics, each of which provides some indication of purchasing power of the population.

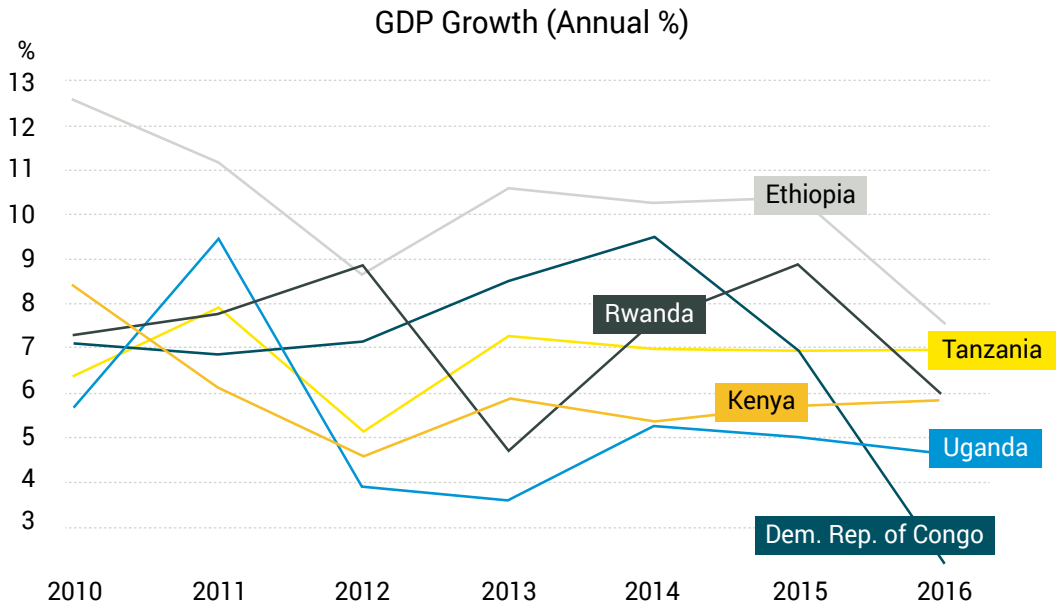
[46] Baseline Assessment of Development Minerals in Uganda (2017)

GDP Growth

The Development Minerals sector is very much exposed to changes in Uganda's macro-economy.[47] Positive GDP growth statistics indicate a growth trajectory of the national economy, and therefore are a good indicator of increased demand, particularly in sectors such as construction and infrastructure. Nonetheless, since GDP does not account for inflation and income distribution across the population, its impact on purchasing power should be considered against other economic performance indicators such as domestic inflation rates, GDP per Capita and the Gini coefficient48. Nonetheless, nominally at least, we can draw significant insight from comparing GDP indicators over time and against regional competitors.

It can be seen from Figure 9 that GDP growth in Uganda has been strong.[49] However, when contrasted against its peer group (neighbouring Kenya, Tanzania, Rwanda, DRC and nearby Ethiopia), Uganda ranks fifth of six relative to the five comparator countries in terms of GDP growth.

Figure 9: GDP Growth (annual %). Source: UN Data



In 2012, budget support by development partners slowed substantially as a result of financial mismanagement and governance issues in a number of Government departments within Uganda50. Subsequent to this withdrawal of foreign direct investment, the Ugandan government began exploring non-traditional financing options such as non-concessional borrowing and using

[47] GDP is the single most commonly referenced figure to cover the entirety of a national economy and its trajectory in a single statistic. South Africa Data Portal (website) http://southafrica.opendataforafrica.org/mhrzolg/gdp-by-country-statistics-from-the-world-bank-1960-2016?country=Uganda

[48] The Gini coefficient is one of the most widely used indicators of the degree of income inequality in a country. World Bank (2013). "World Development Indicators 2013." Washington, D.C.: World Bank. http://data.worldbank.org/data-catalog/world-development-indicators

[49] World Bank Open Data – The World Bank Group (2017): https://data.worldbank.org/

[50] PwC (2017)

domestic debt to finance the budget. This marked the beginning of the rapid growth in public debt which has risen to close to 40% of GDP in the year 2017[51].

Long term, this is likely to impact on Uganda's ability to sustain strong GDP growth, as the country services a growing debt. However, government policy priorities suggest that this will not affect, at least in the medium term, investment in government funded infrastructure projects that rely heavily on Development Minerals inputs.

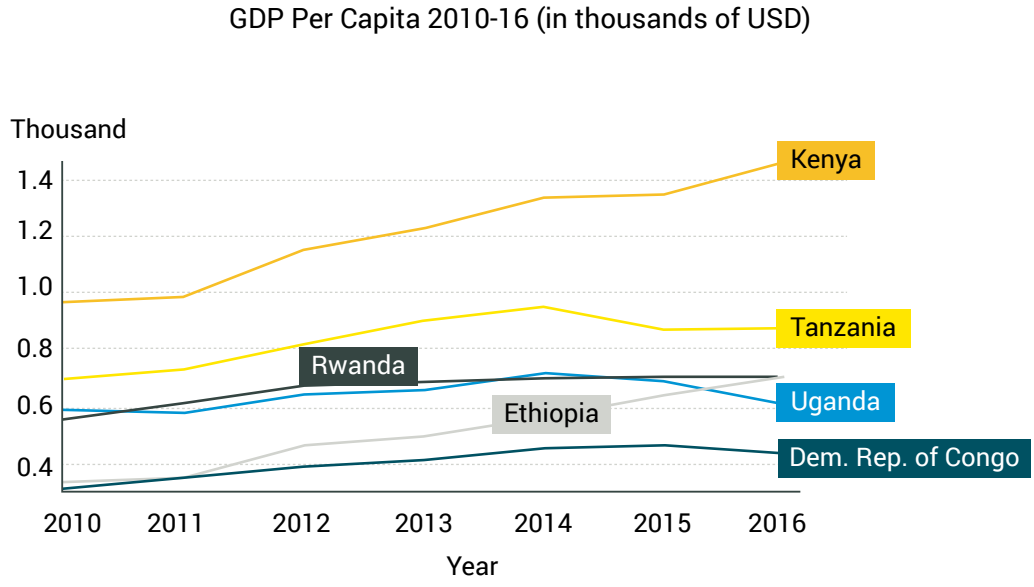
As discussed in the section "Development Minerals Sector Outlook", the market share of civil works projects largely accrues to LSM actors in Development Minerals value chains. To understand the implications of macro-economic conditions on residential and non-residential construction (and related effects on the market for ASM products), the GDP per capita provides deeper insight.

GDP per capita

GDP per capita is used as a measure of national economic 'well-being' because it provides an indicator of income and, hence, the ability of the population to buy material goods and services.

Figure 10 provides an overview of movements related to GDP on a per capita basis[52]. This graph demonstrates how the use of non-concessional borrowing and use of domestic debt to finance public spending began to impact GDP per capita starting in 2014 as evidenced by the declining trend which has persisted through 2015 and into 2016.

Figure 10: GDP Per Capita (in thousands of US dollars). Source: UN Data



Interpreted in the light of ongoing inflation levels of approximately 5%, these statistics demonstrate a significant decline over the last two years in the average purchasing power of the population. Specifically, the average GDP per in Uganda was $600 USD in 2016, down from over $700 USD just 2 years prior.

[51] Ibid.

[52] World Bank Open Data – The World Bank Group (2017): https://data.worldbank.org/

With a high Gini coefficient of 44.4,[53] it can reasonably be assumed that this decline has had the greatest impact on the purchasing power of the poorer segment of the population in the country, from which, as this market assessment has explored, the greatest demand for many ASM Development Minerals is found. By contrast, in Kenya, the average per capita GDP was $1,400 USD; this significantly higher level of per capita income would contribute greatly to domestic spending in the country and would fuel construction projects and correspondingly the demand for Development Minerals.

In short, presuming Ugandan citizens have less money in real terms, it can also be expected that lower levels of expenditure would be earmarked for domestic and commercial construction activities, at least amongst the lower income segments; all of which are likely to consume cement, sand, aggregate and other construction minerals. Other factors such as high rates of urbanisation and population growth may serve to counteract the impact of reduced purchasing capacity, but it will nonetheless exert a downward pressure on future growth rates of the ASM Development Minerals sector market size.

Decreasing purchasing power of the local market could similarly be expected to impact the attractiveness of Uganda as a destination for other industries that would utilize industrial minerals. These may include, for example, salt used in plastics manufacturing, kaolin used in production of paint and porcelain (e.g. dishware, kitchen sinks, toilets) or pharmaceuticals, among others.

Construction Sector Growth

Producers of Development Minerals are exposed to decisions made by individuals, commercial entities and governments who purchase Development Minerals products. Drivers in the product market would include domestic and foreign (export) consumption of Development Minerals. In Uganda, however, the bulk of Development Minerals is consumed by the domestic private, business sector and government entities, who construct residential and non-residential buildings and undertake civil works projects, respectively.

Figure 11 illustrates a sharp increase in the cost of construction for both residential and non-residential buildings and civil works between 2010 and 2011 followed by two very different trends. For residential and non-residential construction, costs declined since 2013 until 2015. In the case of civil works, however, construction costs have steadily increased in this period, likely in association with the GOU's continued infrastructure commitments.

The decline in construction costs for residential and non-residential structures could be indicative of important trends: (i) reduced demand for all products due to a decline in economic fundamentals (reduced foreign investment and domestic consumption capacity) and/or (ii) a growing capacity of the Development Minerals sector to supply the demand during this period.

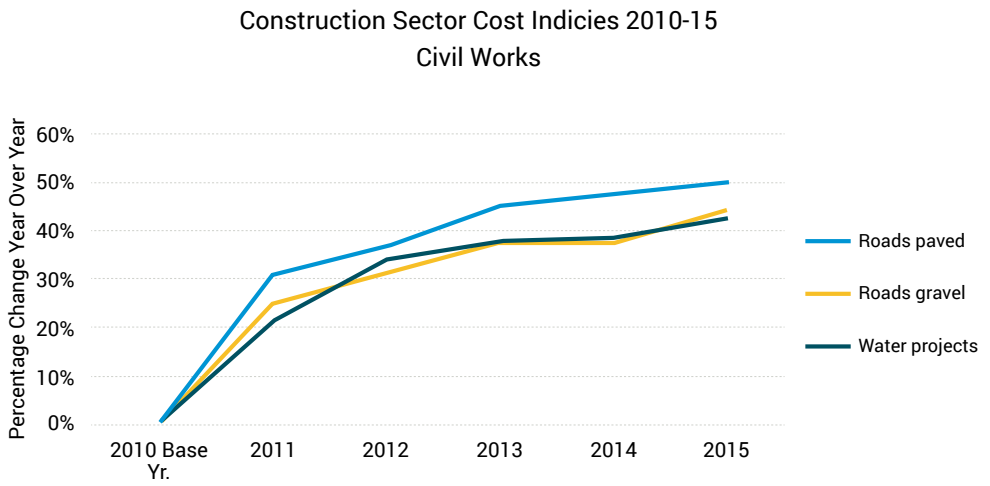
The latter is strongly suggested by increases between 2008 and 2017 in the ASM workforce (+115%) and ASM production (+33%) of Development Minerals, well in excess of the 17.5% increase in the national housing stock in the same period[54]. This is consistent with findings from a number of (although not all) ASM stone aggregate sites, where mineworkers would continue to

[53] World Bank Open Data. Accessed 8th December 2017. https://data.worldbank.org/indicator/SI.POV.GINI?end=2015&start=2015&view=bar

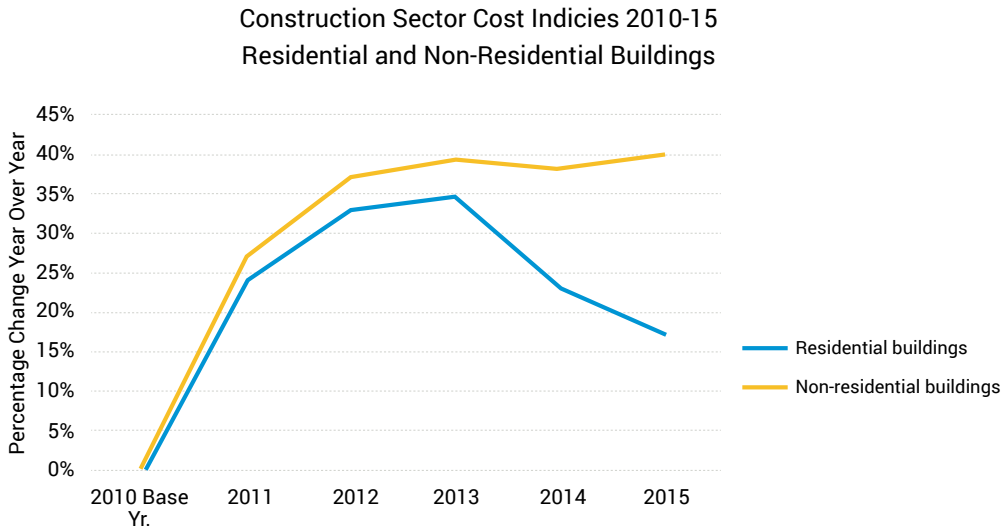
[54] Ministry of Lands, Housing and Urban Development (MLHUD), 2016, LHUD Sector Performance Report, 2006/07 – 2015/16.

produce and stockpile material, in some cases awaiting buyers without sales for a period of a few weeks.

Figure 11: Construction Sector Cost Indices for Civil Works (top) and Residential and Non-Residential Buildings. Source: UBOS Statistical Abstracts (2010-15)



Civil Works	2010	2011	2012	2013	2014	2015
Roads paved	0.0%	25.1%	37.8%	37.8%	37.6%	44.0%
Roads gravel	0.0%	30.4%	37.0%	45.5%	47.9%	50.0%
Water projects	0.0%	21.4%	33.7%	38.1%	38.8%	43.2%



All Buildings	2010	2011	2012	2013	2014	2015
Residential buildings	0.0%	23.9%	32.9%	34.6%	23.2	17.1%
Non-residential buildings	0.0%	25.7%	35.6%	39.3%	38.4%	31.5%

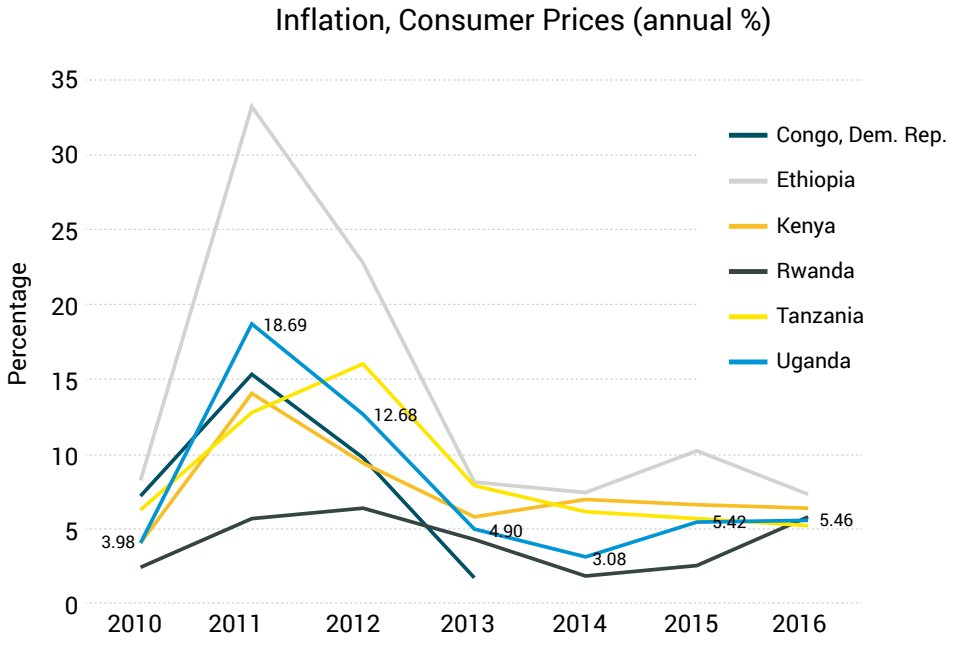
In the case of LSM, however, demand is more closely tied to government investment in civil works, the emergence of a stronger middle class and, to some extent, growth in export markets. Cement industry growth was 9% in 2014 and over 15% in 2015, well in excess of GDP growth in those years[55]. Confidence in future demand is such that both of the Uganda's major cement producers are undergoing expansion, with production capacity increasing from 2.65 million tonnes per annum up to 5.05 million tonnes per annum.[56]

Although this gives confidence in the growth of the middle class, these trends suggest that ASM may be more vulnerable to declines in the domestic consumption capacity (and therefore reduced demand) from the poorer segments of society and/or are less equipped to meet demands for higher quality products from the growing middle class. Although reduced building costs may enable more Ugandans to build, other inflationary pressures still persist such as the increase in food costs due to drought in the northern parts of the country, a situation that could be made even more precarious in response to climate change (See section on "Exogenous Factors") and put increased pressure on households expendable incomes.

Inflation Rates

The rate of inflation can have both positive and negative impacts on an economy. Low positive rates of inflation are generally considered to be preferable[57] and therefore one indicator of the economic health of a country. Of primary interest for the present market study is that excessively high inflation may result in decreased purchasing power of the population, especially when wage inflation lags behind price inflation. Nevertheless, if high inflation translates into higher prices paid for Development Minerals, this would ideally result in higher incomes for workers in the Development Minerals sector.

Figure 12: Inflation Rates in Uganda and neighbouring countries. (2010-15) Source: UN Data



[55] Pedersson, D. (2016)
[56] Pedersson, D. (2016)
[57] Abel, B. Bernanke B. Croushore D. (2014) Macroeconomics

If we compare rates of inflation in 2011 with statistics on the cost inputs to the construction sector (see below), we can see that this holds true. As the cost of inputs increased dramatically in 2011, it holds logically that the per unit incomes of Development Minerals producers increased significantly during this period; prices have also remained significantly higher than their 2010 baseline ever since (despite witnessing some small year-on-year reductions in selected years). Correspondingly, it would appear from the data presented above, as well as the growing population (see below) that the overall purchasing capacity of the average Ugandan has declined vis-à-vis price of goods (and services).

Overall, as detailed in the accompanying *Development Minerals Baseline Report,* the growing population of Development Minerals producers, as well as their total output suggest that this has done little to dampen demand. Nevertheless, this consideration may be increasingly relevant should inflation rates return to 2011 levels, combined with decreasing per capita income, since expendable incomes have already decreased significantly. This is an important consideration to take into account when the GoU considers the impact of its policy on interest rates on inflation.

By October 2017, Uganda's inflation rate stood at 3.5%; well below the Bank of Uganda's target rate of 5%. This return to steady, but positive inflation can be read in a positive light since it gives consumers and producers, as well as investors and savers increased confidence in the decision they make within the market place. It is also indicative of greater macro-economic stability. Nonetheless, it may well be symptomatic of a more generalised slowdown in growth, which is mainly due to a combination of domestic factors. These include; the long drought of 2016 which affected agricultural output, tight financial conditions that culminated into low private sector credit growth and the slow implementation of government infrastructure projects which in return has delayed the realization of the economic benefits expected from these investments[58]. It could be argued, however, that with inflation under control. the government can afford to pursue its policy of interest rates cuts to stimulate spending, which is likely to increase market demand generally and demand for Development Minerals more specifically.

Population Growth and Demographics

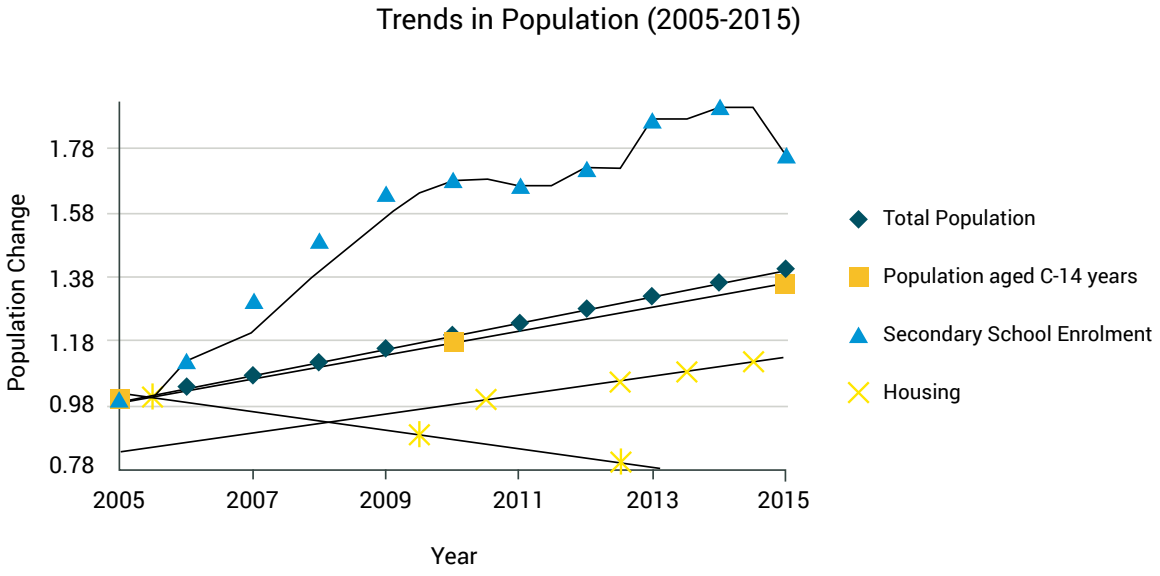
According to a Pricewaterhouse Coopers analysis of Uganda's Economic Outlook for 2017 "*Private consumption which is by far the largest component of GDP by expenditure, will continue to be the primary engine of economic growth over the next few years*" (PwC 2017, p. 10). The future consumption capacity of Uganda's rapidly expanding population will undoubtedly be impacted by differing rates of growth in different segments of the population. As described in previous sections, the rate of growth in the middle class will affect the market size for higher quality products whereas, the rate of growth of upwardly mobile but still relatively poor segments of the population will affect demand for cheap products. Whilst previous sections provide some indications in overall demand and consumption capacity, a closer look at shifting demographics is warranted.

As shown in Figure 13, Uganda's population is steadily increasing and, with it, the need for housing, infrastructure (roads, schools, hospitals, etc), food and other key requirements for development. While this undoubtedly shall be a key driver for growth of the Development Minerals sector, a more nuanced analysis brings to light to following:

[58] Source: PwC (2017)

- Population growth (about 3.3% per annum) is increasing at a rate faster than housing construction rates (2.7% per annum), implying a growing housing deficit that in turn suggests that a greater proportion of the population (in real numbers) do not have the financial resources (and/or land) to build.
- Population growth generally parallels growth of the 0-14 year old segment of the population[59], which currently comprise 53% of the total population. If fertility rates are to continue on this trajectory, purchasing power at a household level may, on average decline.
- Secondary school enrolment (as % of the total population) has steadily increased from 2005-2010 at which point it leveled off, saw some increases from 2012-14 and then saw a decline. Although increased enrolment (relative to the 2005 baseline) is undeniably impressive, this slight decline coincides with those declines observed in certain economic indicators (e.g. GDP growth, GDP per capita), suggesting a more direct correlation with economic wellbeing of the poorest Ugandans.

Figure 13: Selected indicators illustrating of population, education and housing trends (normalized to a 2005 baseline) Source: UBOS Statistical Abstracts (2005-15)



Taken together, if a growing number of Ugandan's lack the education and skills to access more lucrative work, they may be increasingly drawn into the ASM sector as a livelihood alternative. If growth in ASM production (supply) due to growth in the workforce exceeds the capacity of the market to consume ASM products, then ASM incomes may decline even further than those presented in the Section on "Market Structure". This would result in a surplus Development Minerals availability at lower prices, which could offset, at least temporarily the impact of reduced purchasing power amongst lower income segments of the population, thereby sustaining demand, albeit at a lower overall value to the sector.

[59] UBOS (2014)

This argumentation, can, however, only go so far. Lower market prices received by Development Minerals producers will naturally, at a certain point, undermine the economic viability of the activity for miners, assuming that other employment opportunities are available. At this point, we are likely to see a reduction in the Development Minerals workforce and therefore a declining production, which will result in a recalibration of the value of Development Minerals products.

Nevertheless, although economic growth has recently slowed, the outlook for Uganda is still relatively positive. Uganda is regarded as being macro-economically stable and inflation has been kept in check[60]. Furthermore, domestic demand is only one determinant of the potential trajectory of the Development Minerals sector and economic actors therein. Subsequent sections illustrate some important trends affecting the cost of production and other factors likely to affect investment in the Development Minerals industry by actors of all scales.

Factors Affecting Profitability and Investment in the Sector

Trends in costs of inputs into the production of Development Minerals commodities provide an indication of the ease with which operators can sustain production at a profit and/or invest in improved productivity and performance. If production becomes too expensive, this typically translates to increased sale prices and, in the case of clay bricks, sand, stone aggregate and dimension stone, may lead to reduced demand. This is mainly because companies and consumers will demand Development Minerals products to the point where the extra benefit from the input justifies the extra cost. The influence of exchange rate fluctuations on costs of imported inputs and trends in prices of key commodities are examined below.

Exchange Rate Fluctuations

Exchange rate fluctuations are a key issue for many countries, especially those heavily engaged in the importing of raw materials or components. An example of why exchange rates can have such a profound impact on the appropriate functioning of an economy refer to the graph below, which evidences the devaluation of currencies in East Africa (five peer countries) relative to Uganda when compared to the US dollar. It can be seen that in nominal terms Uganda's currency has devalued vis a vis the US dollar by more than 60% since 2010, followed by Ethiopia, DRC, Tanzania and Rwanda who have seen devaluation of their respective currencies by 62%, 58%, 55% and 43% respectively. Kenya has realized considerably less devaluation of its currency which has only realized a decline of 28% vis-à-vis the US dollar.

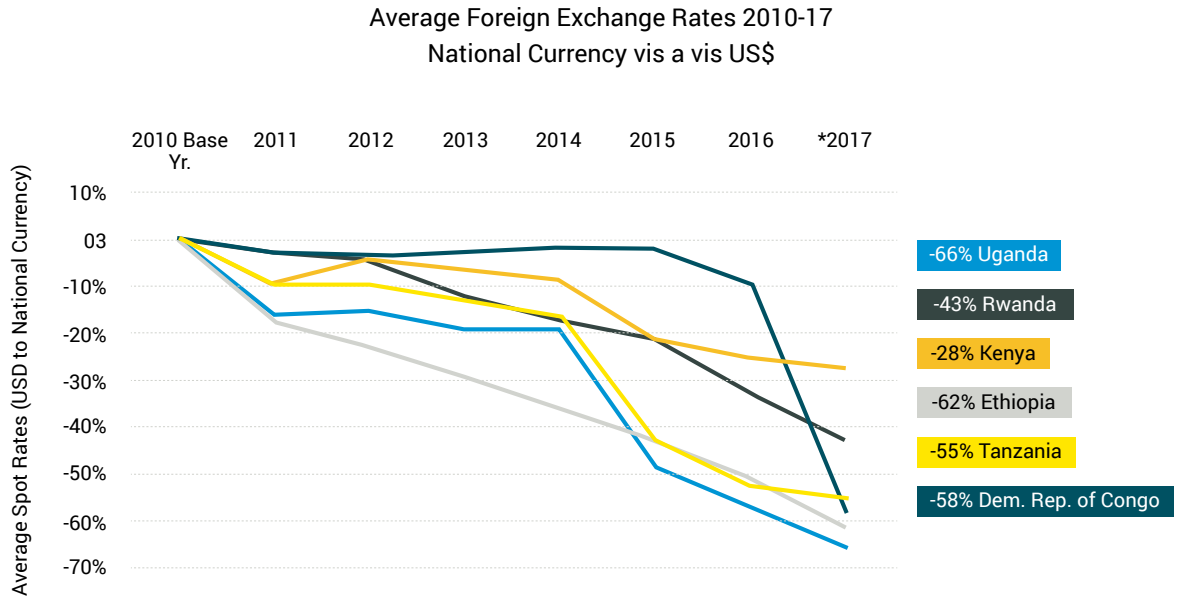
It is important to note that the increase in the US interest rate resulted in an appreciation of the US dollar relative to other national currencies globally. This partially explains the recovery of the US dollar, and the decline of peer group countries considered above, as interest rates in the US increased in 2015 and 2016. Nonetheless, these statistics are strongly impacted by the relative health of the sample economies, for which Uganda is place six of six amongst its peers in terms of foreign exchange. Equally, the impact on the cost of imported goods is real and significantly impacts purchasing power of imported goods.

The significance to the Ugandan economy for those industries that rely on imports for inputs into production cannot be overstated. As the Ugandan Shilling has devalued more than 60% vis-à-vis the US dollar, this means that imports are now 60% more expensive to purchase. Thus, from a

[60] PwC (2017)

Development Minerals perspective, if new equipment were to be acquired for stream lining mining processes to gain efficiencies and bolster output it would now be considerably more expensive to do so. As an example, cement represents 31% of net imports relative to all minerals brought into Uganda. If this commodity were priced in US dollars this would represent a considerable increase in operating costs for cement consumers in the country.

Figure 14: Percent Change since 2010 in Foreign Exchange Rates in Uganda and neighbouring countries. (2010-15) Source: www.Oanda.com



Of course, not all imports of Development Minerals commodities and inputs are priced in USD (although it tends to be common practice in inter-country trade in the region). Nevertheless, devaluation in Uganda has been higher than all other sample countries. Noting the margin of difference between Kenya and Uganda respectively (under 30% vs. over 60% devaluation vis-à-vis the dollar), and considering that Kenya is a principal supplier of Development Minerals to Uganda, the impact of the devaluation of the Ugandan shilling has also had an impact in real terms on the cost of imports of Development Minerals.

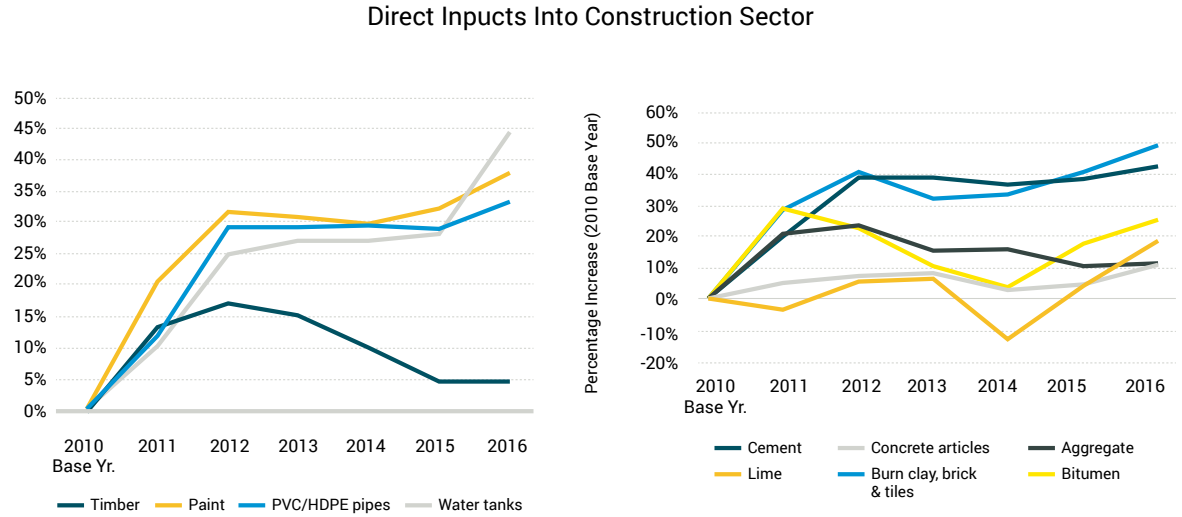
Finally, it is important to note that Uganda *does* import manufactured goods from the US and other countries whose currencies are tagged to the dollar (especially capital intensive manufactured goods for use in production and manufacture of minerals and mineral based products). Further, Uganda imports from European markets, whose exchange rates with the dollar have not seen such marked devaluation. This will have a pronounced effect on purchasing power of manufactured goods from these markets and may lead to restrictions in investments in technology for improved productivity. Importantly this does not preclude improvements to productivity of Development Minerals producers *per se*; rather, it would suggest that low-cost technologies, that are locally manufactured, are more realistic capital investments for Development Minerals producers. This has important implications on the form of support that Development Minerals producers would benefit from through technical capacity building programs, as well as an indicator as to the levels of finance producers would need to access to scale their operations.

Costs of Inputs to the construction Sector

As discussed in the previous Section, costs of construction of residential and non-residential buildings declined during the period 2013-14 while the cost of civil works construction witnessed steady increases. As Development Minerals would be some of the key inputs (such as lime, cement, aggregate, sand, etc.) this could theoretically have a dampening effect on their prices. The following tests this for a range of different direct inputs used in construction. It should be noted that inputs identified below are not considered to make up all of the necessary inputs but are considered to provide a high-level proxy for items used within residential, non-residential buildings and civil works projects; all of which will impact commercial firms and artisanal and small-scale miners involved in production across related value chains.

As observed in Figure 15 below, with the exception of timber, other key sector inputs including paint (which utilizes kaolin), PVC/HDPE pipes (which utilize sand and salt) and water tanks (also utilized in primary production and at different steps across Development Minerals value chains) have appreciated considerably. As shown in Figure 15 (right), burnt clay, bricks and tiles as well as cement have seen the most significant increase over the past six years with appreciation of each greater than 40% since 2010. Bitumen and Lime have also appreciated by 20% while aggregate and concrete articles show a modest increase of 10% over the same period. It would seem therefore that the price trends do not match with the overall decrease in residential and non-residential construction sector cost indices 2013-15, as detailed above.

Figure 15: Change in the price of key construction sector inputs (source: UBOS Statistical Abstracts 2010-16, Consumer Price Indices).



However, taking a closer look for all minerals and materials in the sample other than lime, there is rapid appreciation in their value between 2010-11 (bitumen) and 2010-12(cement, concrete articles, clay bricks aggregate), similar to the spike witnessed in overall residential and non-residential construction sector costs. Thereafter, there is a general year on year price depreciation until 2014 (with the exception of lime, prices of which recover slightly over this period). This being said, price decreases are not as dramatic as overall cost depreciation for the residential and non-residential construction sector.

This suggests that: 1) the Development Minerals sector demonstrated strong resilience to price shocks during this period vis-à-vis other sectors; and 2) declining housing sector construction costs are not principally attributable to a decline in the prices of Development Minerals. This is significant because it suggests that lower construction costs overall may stimulate increased construction (and therefore demand for Development Minerals), whilst Development Minerals prices remain on an upward growth trajectory.

The one anomaly is stone aggregate, which, although a slight overall price increase since 2010, declined year on year between 2012 and 2016, potentially suggesting some over-production. This is consistent with observations at a number of ASM stone aggregate sites, where a number of miners report sitting on production for, in some cases, 1 to 2 weeks or more until buyers would source from them.

Costs of Inputs to Development Minerals Production: Equipment

Another significant factor which affects costs of Development Minerals production is the cost of equipment used for mining and value addition. For Development Minerals, this could include stone crushers, water pumps, offloading machinery and stone cutting machines, among others. Machinery is used to varying degrees by Development Minerals operators, depending on the scale of the operation. The historically low levels of mechanisation at artisanal mine sites is largely down to the prohibitive costs required to purchase, service and maintain equipment, as shown in Figure 15.

Prices for imported Development Minerals production equipment can high, depending on the size of the machines introduced, requiring significant upfront costs. For example, a small 50-100 kilogram per hour jaw crusher can cost in excess of $5-8000 US or a large water pump of a sufficient size to drain a clay pit can exceed $3000, particularly when additional hoses and requirements are included[61]. The prohibitive nature of the costs has likely become more pronounced over the last few years due to the devaluation of the Ugandan shilling vis-à-vis the USD. Those who are likely most vulnerable to this currency devaluation are SSM and MSM operations, who are unlikely to see a return on their rising investment in imported machinery, given that the primary consumer is the local Ugandan market.

For the artisanal Development Minerals sector, in a climate where finance is not available at rates that can be absorbed, this means purchasing equipment to improve productive efficiency represents a major challenge. This limits the potential for ASMs to improve quality, increase productivity and diversify products, which in turn decreases their likelihood of accessing middle class markets and potentially even small civil works projects. Under such conditions, increased demand is likely to be met by increased employment within the sector rather than increased productivity.

High (and rising) costs of imported equipment (of both regional and global provenance), then, limits capacity for increased productivity, quality and efficiency as well as for product diversification, posing a further barrier to the competitiveness of the Ugandan Development Minerals sector to enter the export market and reach new markets domestically.

[61] Based on the author's personal experience procuring equipment in Uganda.

Nevertheless, the above analysis should not obfuscate the potential improvements that can be made to productivity of Development Minerals operations using low-cost, locally sourced equipment, the availability of which is growing[62]. In fact, it would suggest that efforts to improve productivity, and therefore aggregate per capita outputs and incomes, should focus on the use of locally fabricated, low costs and ASM appropriate equipment, noting that the market will only support the increased investment to the point which its value (increased production) is not exceeded by the capital costs (resulting in higher per unit costs despite increased production). The point here about ASM operators as "price receivers" is once again pertinent.

Finally, a growing body of evidence suggests that the benefits of projects, policies and efforts to mechanize ASM are likely to accrue to mine site owners rather than mineworkers, many of whom may lose their employment. Women, in particular, who typically face greater barriers in accessing financing and who are less likely to hold positions of authority in the mines are often performing tasks and functions that are suited to mechanization (e.g. in crushing or brick moulding)[63]. Risks of exacerbating inequalities through mechanization therefore must be mitigated through conscientious design of any initiatives that seek to increase access to appropriate technology and equipment, including via women's improved access to financing and training and targeted efforts to ensure they hold beneficial, leadership roles in ASM operations.

The Investment Climate: Non-Economic Conditions

For both foreign and domestic investors of all scales, the overall investment climate provides an indication of the ease (and profitability) of investing in certain countries, sectors and specific target markets therein. This section outlines important non-economic aspects of the investment climate, including the ease of doing business, the policy and legal framework governing the Development Minerals sector and mechanisms for sector support. The following section provides additional detail on investment conditions related to access to finance and elements of the Uganda's competition policy aimed at supporting investment in the country.

Ease of Doing Business

When considering the investment climate, a ranking of the ease of doing business provides a comparative view of where Uganda stands relative to both East African countries in scope and the world as a whole. The following table has been adapted from the World Bank Ease of Doing Business Index[64]. Economies are ranked on their ease of doing business, from 1–190. A high ease of doing business ranking means the regulatory environment is more conducive to the starting and operation of a local firm[65]. The rankings for these are benchmarked to June 2017.

Table 6, below, evidences that Uganda is 3rd, relative to its chosen peer group overall, and 122nd globally when considered for ease of doing business globally.

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62 Based on observations by the authors over the past decade of increased availability of small jaw crushers and increased rates of local fabrications of presses, semi-manual sieves and other machines, in particular, by metal workers who seem equipped to adapt some technologies used in farming.

63 See gender analysis in companion Baseline Assessment of Development Minerals in Uganda (2017).

64 World Bank (2017) Business Ease of Doing Business 2017 Accessed 1st December 2017. http://www.doingbusiness.org/rankings?region=sub-saharan-africa

65 Ibid.

Table 6: Ease of Doing Business in Uganda. Source: World Bank

World Bank Ease of Doing Business Rankings 2017	Uganda Ranking Relative to Peer Group	Rwanda	Kenya	Uganda	Tanzania	Ethiopia	DRC
Ease of Doing Business Rank	**3rd**	**41**	**80**	**122**	**137**	**161**	**182**
Registering Property	2nd	2	125	124	142	139	158
Paying Taxes	2nd	31	92	84	154	133	181
Enforcing Contracts	2nd	85	90	64	58	68	172
Getting Credit	3rd	6	29	55	55	173	142
Protecting Minority Investors	3rd	16	62	108	129	176	164
Trading across Borders	3rd	87	106	127	182	167	188
Dealing with Construction Permits	4th	112	124	148	156	169	121
Resolving Insolvency	4th	78	95	113	108	122	168
Starting a Business	5th	78	117	165	162	174	62
Getting Electricity	5th	119	71	173	82	125	175

It should be noted that some of the elements used to determine ease of doing business are critical variables when considering issues associated with production and sale of Development Minerals and have cross cutting effects. As an example, the speed and ease with which construction permits can be issued likely impacts the rate at which investment in that sector takes place, therefore, having an implication for Development Minerals sourced for related projects. Furthermore, the ability of ASM enterprises in the Development Minerals value chain to gain credit is fundamental to expansion of this industry domestically within Uganda. Other considerations include ease of trading across borders which is paramount when considering how to manage the trade deficit in Uganda.

Policy, Legal and Institutional Framework

The Development Minerals sector occupies a unique role in the policy and legal frameworks of Uganda. Under the 1995 Constitution of Uganda, building minerals such as "*clay, murram, sand and any stone commonly used for building or similar purposes*" were not defined as minerals and therefore constitutionally excluded from the jurisdiction of mining authorities. However, the GoU has taken steps to address policy and legislative gaps with respect to Development Minerals, recently embarking on a process for reforming the current policy and legal framework, which has culminated in a draft National Mining and Minerals Policy of Uganda (NMMPU).

Given that 84% (by value) of Development Minerals in Uganda are produced by ASM operations, regulations that govern the ASM sector are also applicable to the Development Minerals sector. Whilst the current legal and policy framework explicitly recognises ASM for its contribution to the economy, there remain several challenges with current ASM legislation that pose barriers to the growth of ASM stakeholders operating in the formal sphere. The fact that 98% of ASM Development Minerals producers currently operate outside of the legal framework poses a challenge to the formal growth of the sector, and as such to its economic impact at a national level.

Aside from the current exclusion of many Development Minerals from the prevailing legal framework, the main challenges encountered with the current policy and legal framework are as follows:

- **Ugandan legislation does not distinguish between 'artisanal' and 'small-scale' mining**, with only one type of licence – a location licence – available to ASM operations. As well as discouraging entry to the formal sector for artisanal miners, it precludes any location license holders from 'stepping up' their operations, and therefore acts as a barrier to growth.

- **Location licenses impose an investment cap on operations of roughly $3000**. This cap is very low, particularly given the fact that inflation has risen dramatically over the past decade (discussed further above), driving up prices of consumer goods. As such, the cap is easily exceeded by a reasonably-sized water pump, stone cutting machine or jaw crusher, and acts as a constraint to the growth of formal ASM Development Minerals operators.

- **License area and duration limits do not reflect the realities faced by Development Minerals stakeholders**. Given that ASM Development Minerals sites have often been operating for more than 20 years, limited duration location licenses are not appropriate to their context. The duration of 2 years does not reflect the normal life-cycle of a mine, where upfront costs can be high, and operations take time to become economically viable. This acts as a barrier to long-term planning and therefore investment by current operators.

- **The location licence application process is prohibitively expensive and complicated** for many Development Minerals stakeholders, especially women, given gender disparities in language, literacy and socio-economic status.

- **Current compliance capacity.** Less than 5% of all Ugandan ASM production is licensed under current mining legislation, and many stakeholders in the sector are unaware of any legal requirements for their activities[66].

- **Lack of fiscal incentives to formalise.** There are very few fiscal incentives available to Location License holders. In a sector where income per capita is low, fiscal incentives would incentivise stakeholders to apply for licenses that they currently see as nothing but a burden.

- **Lack of clarity around government mandates with regards to the Development Minerals sector,** especially at local level, introduces unpredictability into the Development Minerals market, both at the level of the mine-site and during transport of the minerals. This acts as a barrier to long-term planning and investment for ASM operators and Development Minerals traders.

Given the government's aim to regularize and improve the ASM[67] sector, the above factors of the current legal and policy framework act as barriers, rather than incentives, to both the

[66] UNEP (2012). Analysis of formalization approaches in the artisanal and small-scale gold mining sector based on experiences in Ecuador, Mongolia, Peru, Tanzania and Uganda: Uganda Case Study.

[67] MEMD (2008). The Mineral Policy of Uganda.

formalisation and the growth of the sector. The current framework does not provide sufficient incentives to encourage unlicensed operators to apply for licenses, and it imposes barriers to growth and investment for licensed operators. This can potentially increase negative impacts by Development Minerals stakeholders, as growth outside of the formal sector is less likely to be sustainable or include environmentally or socially responsible practices.

Recognizing the changing context and need for updating of the current policy and legal framework, the GoU has embarked on the process of reforms that, thus far, has culminated in a draft National Mining and Minerals Policy of Uganda (NMMPU), now in its final phases of review and soon to be followed by promulgation of a new body of minerals sector law and regulations[68].This provides an unparalleled opportunity to support inclusive development and wealth creation within the Development Minerals sector. The draft NMMPU has discernibly shifted in its recognition of both Development Minerals and ASM and is poised to address current gaps and provide the ongoing support needed for sector development. Objectives and strategies defined in the NMMPU of greatest relevance concern those specific to Development Minerals, ASM, licencing and promotion of minerals value addition, among others.

Institutionally, however, major gaps still exist. Roles and responsibilities of and coordination mechanisms between key sector institutions, including DGSM, local government and many others (e.g. NEMA, MGLSD, etc) need to be clarified and – much like the ASM sector – formalized. Although not a solution to all institutional constraints, one opportunity may be provided by GOU plans to create "one-stop shops" in major regional centers throughout the country, with 5 already established thus far.

As presented in the previous section, compared to its peer countries, Uganda ranks last in terms of ease of starting a business. If such processes are cumbersome for savvy investors, hurdles facing ASM enterprises and downstream micro- and SMEs are likely even greater. One-stop shops plan to include officers from all key line ministries as needed, enabling Ugandans to speedily register a company, apply for and obtain necessary registrations (e.g. tax numbers, VAT) and permits (e.g. water) in a central location, among other functions. Development Minerals sector stakeholders have called for inclusion of DGSM Regional Officers within these centers, including as a means to improve outreach and services to ASM Development Minerals SMEs[69]. Within Rwanda, one-stop shops also provide access to social protection services, and could be integrated within the Ugandan model, including as a means to help tackle gender inequalities within ASM operations, as highlighted within the companion *Baseline Assessment* report.

Access to other forms of support

There are a number of opportunities for the provision of other kinds of support to Development Minerals stakeholders in Uganda. These include trade fairs, training centres, business incubators and other kinds of business and vocational support. However, the biggest challenges encountered

[68] The ACP-EU Development Minerals Programme supported the consolidation of stakeholder feedback into the draft 2016 Mining and Minerals Policy. In addition, the Programme supported the generation of information towards provision of a Certificate of Financial Implication by the Line Ministry. This support was provided to contribute to the finalization of the Policy before presentation to the Cabinet for consideration.

[69] Recommended during the national, multi-stakeholder validation workshop in Kampala, Nov. 14-15, 2017. In addition, multiple local governments interviewed throughout field assessments requested that District DGSM Officers (as found for other line ministries) should be appointed at district level.

in this study revolve around the fact that very few of these support services are tailored to the ASM sector, and even fewer to Development Minerals.

Notable exceptions include government-funded vocational institutions, such as Kabale Vocational Institutes in South-Western Uganda, which run some brick-making courses for ASM operators; government grants that are available to registered Community Organisations, and have in the past been granted to brick-making organisations; support offered to ASMs by NGOs, for example the ECO (Ecological Christian Organisation) in partnership with PLA (Platform for Labour Action) project in Karamoja, which aims to prevent child labour in the mines through education and skills development programs; and the ACP-EU Development Minerals Programme participation at the 2016 & 2017 editions of the Annual Mineral Wealth Conference that significantly enhanced the profile of the sector to key stakeholders.

These examples can enable Development Minerals stakeholders to gain access to markets through increased financial and technical capacity and improved awareness of the sector amongst relevant stakeholders, and are therefore crucial to the growth of ASM operators. The provision of more services that are directly tailored to the Development Minerals sector, especially ASM, is urgently needed for the sustainable growth of the sector.

The Investment Climate: Access to Finance and Competition Policy

This section examines other critical parameters to facilitate investment in Development Minerals value chains, namely access to finance and competition policies in place. Opportunities presented under the ACP-EU Development Minerals Programme are also highlighted.

Access to Finance

Access to finance is a significant factor in the growth of businesses within the Development Minerals sector. Particularly in the mining sector, up-front investment can be significant. Although many ASM operators do not have the capital resources to invest in their operations up front, access to finance would allow them to do so, creating more potential for productivity and efficiency within their operations. The impact of interest rates and role of key financing mechanisms in highlighted.

Interest Rates

Interest rates are also a significant determinant of how accessible credit is to businesses, since they determine how affordable loans can be. Whilst private loan facilities are not tagged to central bank interest rates, they are heavily influence by them. If central bank rates go up, private lending terms will become more demanding and less attractive for borrowers and *vice versa*. This section explores the trends in interest rates in Uganda in recent years and how this impacts on the financing options available to ASM Development Minerals entities.

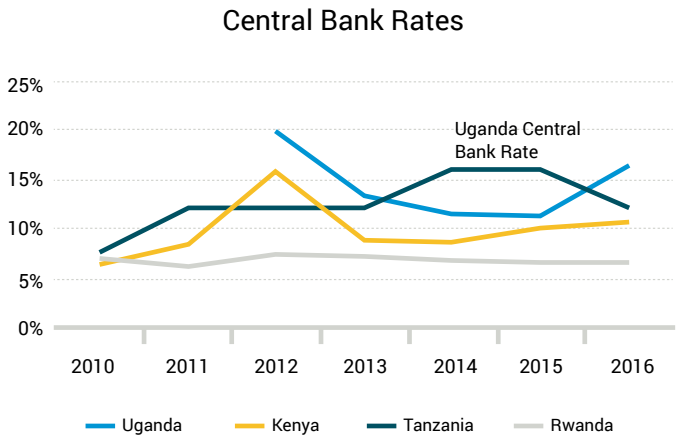


Figure 16: Uganda Central Bank Rates 2010-2016. Source: Bank of Uganda

The rate of interest is a determinant of aggregate demand within an economy and is driven by central banks who control the money supply within an economy. Thus, central banks lend to private banks within an economy who charge slightly higher interest rates to their clients. For this reason, central bank rates have a significant impact on an economy as increases in this rate raise the cost of borrowing both to private banks and their respective clients.

When considering the central bank rates (Figure 16), it can be seen that Uganda has, historically, had high interest rates when contrasted with its peers. However, a substantive reversal of this trend occurred over the past two years, with the Bank of Uganda enabling a drop in interest rates from approximately 17% in early 2016 to 9.5% as of October 2017[70].

From a Development Minerals perspective, historically high interest rates seen in Uganda, may have had a negative impact on the economy as borrowing was prohibitively expensive; all of which reduces the amount of fixed investment demand within an economy. At the same time, higher interest rates decrease consumer demand for goods and services, including construction projects. As construction is one of the key drivers of demand for Development Minerals this will in turn reduce demand over time as lower rate of residential and non-residential construction will occur within the Ugandan economy as a proportion of the overall population.

Nonetheless, as described in more detail above, population growth is likely to effectively counteract this market limiting pressure. Also, as funding for larger civil works projects are generally budgeted well in advance of the inception of these projects, interest rates may not be impacted to the same extent in the short-run.

To help visualize the impact prime lending rates have on the cost of borrowing the following example has been provided evidencing the cost of borrowing $5,000 in order to buy a typical piece of equipment for small scale mining, such as a large water pump or small dimension stone cutting machine. Table 7 shows a payment schedule over five years at 17% and evidences the payment (made each year by the borrower), interest paid each period, principle paid and residual balance at the end of each period. This is contrasted with a second payment schedule seen right where interest is set at 5%.

Table 7: Comparing the impact of interest rates on the cost of borrowing. Source: Present Study

Interest Rate of 17%					Interest Rate of 5%				
Year	Payment	Interest	Principle	Balance	Year	Payment	Interest	Principle	Balance
1	$ 1,563	$ 850	$ 713	$ 4,287	1	$ 1,155	$ 250	$ 905	$ 4,095
2	$ 1,563	$ 729	$ 834	$ 3,453	2	$ 1,155	$ 205	$ 950	$ 3,145
3	$ 1,563	$ 587	$ 976	$ 2,477	3	$ 1,155	$ 157	$ 998	$ 2,147
4	$ 1,563	$ 421	$ 1,142	$ 1,336	4	$ 1,155	$ 107	$ 1,048	$ 1,100
5	$ 1,563	$ 227	$ 1,336	-	5	$ 1,155	$ 55	$ 1,100	-
Total	$ 7,814	$ 2,814	$ 5,000		Total	$ 5,774	$ 774	$ 5,000	

[70] Note that information related to Ethiopia and DRC was not readily available as at the time of this report and is therefore not included herein.

Actual cost of borrowing, or interest paid, at 17% is $2,814 while total interest paid when interest is set at 5% is $774. This is significant as the difference seen below is $2,040 more between these two prime lending rates.

Table 8: Variance analysis for cost of borrowing according to different interest rates. Source: Present Study

Variance Analysis:		
Cost of Borrowing at 17%	$ 2,814	(interest paid)
Cost of Borrowing at 5%	$ 774	(interest paid)
Savings to Borrower	$ 2,040	Difference

Thus, from the perspective of an ASM who may not fully appreciate implications of borrowing at a higher rate will pay an additional $408 per year ($1,563 - $1,155 = $408). This amount from the perspective of an ASM is significant given the annual salary of those working in this sector (averaging $221/p/a derived from ASM livelihoods and accounting for seasonality) is significantly less than this.

As an obvious divide exists for ASMs with regards to attaining finance for small mining projects and equipment purchases, the GoU might consider developing a micro finance facility, which would afford ASMs access to lower rates of interest for such purchases. This may in turn stimulate activity in the Development Minerals sector and enable ASMs to become more efficient, produce higher volumes or achieve other objectives (e.g. meeting national standards) which may unlock their access to civil works projects or new markets.

In summary, the recent decline in central bank rates has been significant and has been precipitated in part due to declining growth in the Ugandan economy. This can also be seen in the inflation rate which has declined to 3.5% which is believed to have also precipitated by this decline in GDP growth. Provided commercial banks operating in Uganda follow suit and lower prime lending rates for their respective clients the environment for lending is improving as the cost of debt is now cheaper. Should the application process be simplified and criteria for approving Development Mineral specific projects this could represent a significant opportunity for ASMs to participate more fully within the economy.

Sources of Financing for ASM and SME Operators

Financing can therefore be a key lever in driving both residential and non-residential construction, both of which drive demand for aggregate minerals. Important to note, however, that from an ASM perspective it is unlikely most would be able to attain financing as many lack a credit history and / or may be unable to navigate completion of banking documentation necessary as part of the normal loan process. However, the ACP-EU Development Minerals Programme is addressing this challenge through intentive training in entrepreneurialism and SME development, facilitating Artisanal and Small-Scale Miners to formalise their business, develop bankable business proposals and form association to improve their access to finance.

More sophisticated companies such as Hima Cement and Tororo Cement would, on the other hand, be able to take advantage of lower interest rates to drive capital acquisition of equipment and technology. If increasing ASM Development Minerals production, improving product quality, adding value or diversifying products through technological investments is one of the keys to unlocking the sector's potential, it would be necessary for them to upgrade, at least to some

extent, their equipment in order to do so (although the difficulties of this have been explored elsewhere in the report).

Currently, finance from commercial banks is generally available only to formal institutions, which generally exclude the 98% of ASM who operate outside of the framework provided under current mining legislation.[71] However, microfinance could be a viable solution to many Development Minerals stakeholders for whom access to commercial banks would be impossible. Uganda is regarded as having one of the most successful and vibrant microfinance industries in Africa, and has experienced strong growth in the sector, with some providers now reaching as many as 45,000 clients.[72] The microfinance is usually provided to small and medium sized enterprises (SMEs).

Findings from the accompanying *Baseline Assessment of Development Minerals in Uganda* show that there are several financing options from around Uganda that are best suited for consideration in the provision of support to the Development Minerals sector, including:

- **Savings and Cooperative Credit Organizations (SACCOs)**[73] SACCOs are community membership-based organisations that promote the economic interests of the members (who are also the owners), through savings. Although challenges exist in ensuring good management of SACCOs, they have significant potential for positive impact in that they can provide access to finance where formal financial institutions cannot.

- **Village Savings and Loan Association (VSLA)**[74] VSLAs, a micro-finance model used by a number of NGOs across Uganda, focusing on forming savings groups at a community level. Similarly to SACCOs, VSLAs are self-managed and do not receive external funding, providing their members with a safe place to save their money, to access loans and to obtain emergency insurance.

- **Rural Savings Promotion and Enhancement of Enterprise Development SPEED (USAID)** Rural SPEED is a USAID programme that aims to increase the capacity of rural inhabitants of Uganda to access finance through a variety of different ways, from formal institutions to community-based savings organisations.

- **Opportunity Uganda** Opportunity Uganda works to provide financial services to those living in chronic poverty, a category into which many Development Minerals stakeholders currently fall. Specific initiatives focus on training as to the benefit of savings, access to finance for educational purposes, home improvement loans and solar panel loans.

[71] Volume 1: Baseline Assessment of Development Minerals in Uganda (2017)

[72] A. Carlton, H Manndorff, A. Obara, W. Reiter, E. Rhyne. Microfinance in Uganda (2001) Austrian Ministry of Foreign Affairs, Department for Development Cooperation. http://www.oecd.org/countries/uganda/35481055.pdf

[73] Uganda Co-Operative Savings and Credit Union Ltd. FAQs. Accessed 23rd November 2017. https://ucscu.coop/index.php/faqss; Senyoni, Taddewo (2013). The CEO Magazine. Are SACCOs really transforming poor Ugandans? Accessed 23rd November 2017. http://www.theceomagazine-ug.com/blog/2013/08/20/are-saccos-really-transforming-poor-ugandans/

[74] Care Uganda "Village Savings and Loan Association" Accessed October 12, 2017. https://www.care.org.au/wp-content/uploads/2014/12/CARE-VSLA-Report-Uganda-Eco-Devel.pdf

- **Mobile Money-Based Financing Services** Telecom companies in Uganda are currently giving out micro loans to their subscribers, including MTN (via MoKash) and Airtel Uganda (via WeWole). Brief key points about these services are listed below:

  MTN Mobile Money Saving And Loans Service – MoKash[75]: MoKash is available to MTN subscribers and offers a savings platform as well as short-term (30 day) loans of up to UGX 1,000,000. Interest rates are set at 9% per loan, plus 2-5% depending on the size of the loan. Customers are able to improve their credit ratings using this service.

  AIRTEL UGANDA –WEWOLE Service[76]. Launched in partnership with JUMO, Wewole is a micro-credit solution that allows customers and Airtel Money agents to borrow up to UGX 500,000 and 1,000,000 respectively. Unlike other products on the market, Wewole does not require customers and Airtel Money agents to save or provide Collateral to be able to borrow.

Given the development potential of increasing access to finance for SMEs and micro-enterprises (including ASM actors), micro-finance financial institutions themselves can also receive support in order to ensure efficient and impactful disbursement and spending of funds. One notable example of support provided for a range of financial institutions across Africa is the African Guarantee Fund for Small and Medium-sized Enterprises Ltd (AGF). More details can be found in Box 3.

BOX 3: AFRICAN GUARANTEE FUND FOR SMALL AND MEDIUM-SIZED ENTERPRISES LTD (AGF)[77]

The African Guarantee Fund for Small and Medium-sized Enterprises Ltd (AGF) is a Pan-African non-bank financial institution founded by the government of Denmark, working in cooperation with the government of Spain, the African Development Bank (AfDB), the Agence Française de Développement (AFD) and the Nordic Development Fund (NDF). AGF aims to promote economic development, increase employment and reduce poverty in Africa by providing financial institutions with guarantees and other similar financial products specifically intended to support SMEs in Africa. Since its launch in 2012, AGF has partnered with financial institutions in 38 African countries. More than 4,000 SMEs have benefited from its loan guarantee facilities.

Given the importance of access to finance for the growth and development of SMEs, AGF enables them to access finance by sharing potential risk with financial institutions, as well as by providing required training.

In June 2017, a partnership was launched between the AGF and the ACP-EU Development Minerals programme, which expects to boost the livelihoods of approximately 25,000 people and their dependents across some of Africa's most impoverished communities by making available US$12 million in credit guarantee facilities to financial institutions in Cameroon, Guinea (Conakry), Nigeria, Uganda and Zambia. This will result in up to US$24 million in finance as guarantees underpin 50% of each loan. These loans will be made by financial institutions to SMEs working in the Development Minerals sector.

AGF and the ACP-EU Development Minerals Programme will also invest US$200,000 in training financial institutions and SMEs to ensure funds are disbursed and spent effectively. Together, they will run trainings on credit and risk assessment for credit directors, risk managers and risk analysts in the participating countries. At the same time, the ACP-EU Development Minerals Programme will work with Development Minerals SMEs to improve their entrepreneurship skills, including accounting, marketing, sales promotion and purchasing.

[75] MTN. Mokash: Overview. Accessed 8th December 2017. https://www.mtn.co.ug/en/mobile-money/banking/Pages/mokash.aspx

[76] Airtel. Accessed 8th December 2017. http://www.africa.airtel.com/wps/wcm/connect/africarevamp/uganda/home/personal/about-us/media-room/press-release/march-16-2017

[77] African, Caribbean, and Pacific Group of States (2017). US$12 million in loans to support thousands of small businesses quarrying 'Development Minerals' in Africa. Accessed 8th December 2017. http://acp.int/content/us12-million-loans-support-thousands-small-businesses-quarrying-development-minerals-africa

Competition Policy

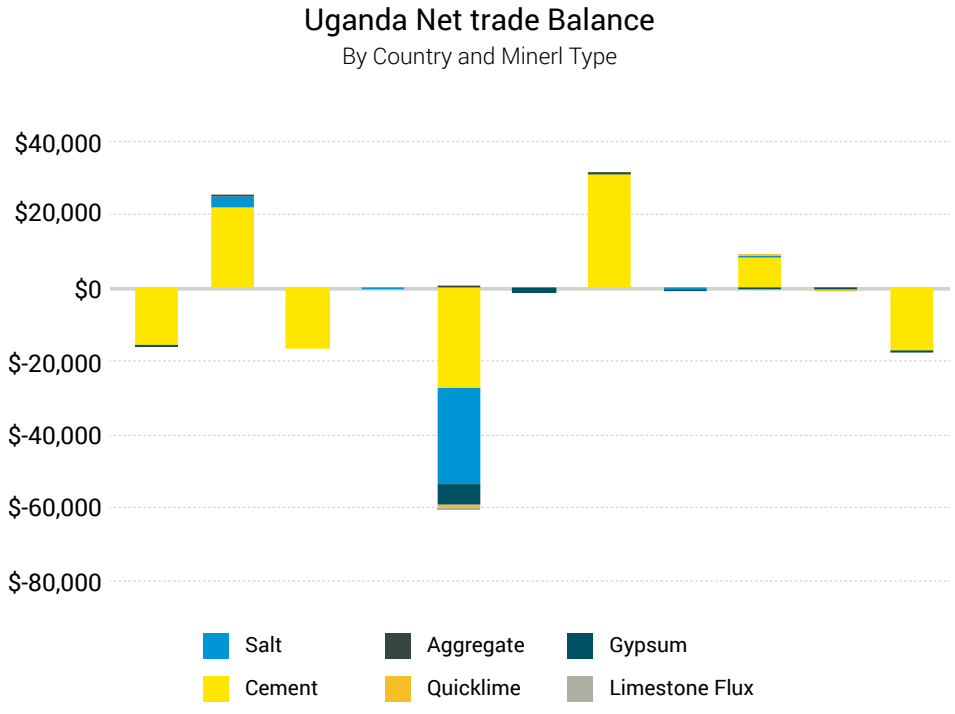
The main aims of a competition policy are to enhance the competitiveness of Ugandan businesses, including with respect to countries with which it trades, mainly through measures to support market development and improve market efficiency. While export markets may be out of reach for many working along ASM Development Minerals value chains, given the current size and growth in demand of the domestic market, developing such links may not be a priority in the short term. Nevertheless, ASM Development Minerals already play some role in reducing reliance on imports and, through strategic support, could play a greater role in the future.

Opportunities for ASM Development Minerals Value Chains

Considerable opportunities exist to increase production and diversify Development Minerals commodities within Uganda's domestic market. This is most readily illustrated by goods imported into the country. This includes some of the most significant contributors, amongst Development Minerals and their products, such as iodized salt, lime and limestone related products (Figure 17). Other key opportunities relate to dimension stones, glass products, ceramics and specialty clay products (Annex 3). Competing in these markets would require increasing current production for some commodities (e.g. kaolin) and greater attention to and support for beneficiation, particularly by ASM producers.

Export opportunities also exist for Uganda if production volumes and specification requirements were improved upon. Net Exports viewed by mineral type evidences that Uganda already exports considerable cement to the Democratic Republic of Congo (DRC), Rwanda and Sudan. Alternatively, Uganda has a net deficit as it imports considerable amounts of cement from areas such as China, Japan, Kenya and United Arab Emirates (UAE). Assuming volume and specification requirements were improved upon this might represent a considerable opportunity to not only fill the country's domestic need for cement but also export.

Figure 17: Ugandan Net Trade Balance comparison with neighbouring countries. Source: ITC Trademap



This data also illustrates how neighbouring Rwanda and DRC provide the main source of export market for multiple Ugandan Development Minerals products (including salt) while Uganda's main source of imports is Kenya. Understanding macroeconomic conditions and other non-economic factors in these jurisdictions, in particular, provides insights into how to increase Uganda's competitiveness with respect to other countries, as described in previous sections.

Competition Policies in Uganda

The Buy Uganda Build Uganda (BUBU) initiative represents policy reforms aimed at poverty eradication and improving the income levels of Ugandan citizens. This initiative is regarded as one of the contributors to reducing poverty levels from 31% in 2008 to 19.7% in 2013.

This trade policy charges Government with the responsibility to create an enabling environment for the private sector to nurture and grow. The Buy Uganda Build Uganda (BUBU) policy is premised on existing Government policies that support and encourage the consumption of locally produced goods and services. The policy will give guidance to policy makers to ensure that promotion is carried out[78].

Coupled with zero trade duties for import of mining equipment into the country, it is believed that this policy instrument could be used to specifically target and assist in the Development Minerals sector. If this policy were to be fully leveraged by focussing specifically at needs of Development Minerals, an immediate impact in the short to medium term could be experienced by directing the usage of local development minerals in commercial building and civil works projects. One example, which has clearly been guided by this policy and is likely to result in just this, is the September 2016 local procurement strategy by the Ministry of Works & Transport for the SGR project (detailed above).

Despite these opportunities, given the unique characteristics of Development Minerals, and ASM therein, sector specific laws, regulations and strategies to increase the competitiveness of the sector are warranted. Such efforts should extend beyond sector promotion (as outlined in BUBU) to address multi-faceted needs. Main entry points are presented in the draft National Minerals and Mining Policy in relation to mineral revenues and related fiscal provisions (Objective 3), promotion of mineral value addition (Objective 7), efforts concerning mineral marketing (Objective 8), the empowerment of women and protection of human rights (Objective 13 and 14), formalization of ASM (Objective 15) and sectoral local content strategies (Objective 18).

Though the Ugandan government has taken legal measures to drive domestic purchase of minerals in the country there have been considerable challenges including issues related to quality, producing sufficient volumes as well as complex bidding and tendering processes. In the context of ASM Development Minerals, in light of current minerals policy and legal reform processes, and given the magnitude of current and potential contributions of the sector to national development aims, a specific National Strategy for ASM Development Minerals Value Chains is warranted and could draw from and be integrated within the current BUBU policy to ensure appropriate mechanisms for sector development are introduced.

[78] Buy Uganda Build Uganda Policy, September 2014

Exogenous Factors

As highlighted throughout this section, national macro-economic stability and growth is one of the main factors that can significantly affect the Development Minerals sector's growth trajectory, including through impacts on domestic demand and purchasing power and the ease (and profitability) of investing in the sector, including through access to suitable financing mechanisms and appropriate technologies. Analyses of Uganda's economic outlook recognize that Uganda has generally adopted sensible measures to support strong rates of economic growth but the recovery from the recent downturn shall depend on a number of factors, among others including the capacity of the country attracting foreign direct investment and external factors related to regional stablity and the weather[79].

Regional Stability

Since July 2016, 1 million refugees from South Sudan have fled civil strife in their homeland and settled in Northern Uganda[80]. Uganda's current policy with respect to refugees has been internationally praised for its progressiveness[81]; refugees and asylum seekers are entitled to work; have freedom of movement; and can access Ugandan social services, such as health and education. The policy also entitles each refugee family to a piece of land for their own agricultural use[82] Given resulting demands for infrastructure (e.g. homes, schools, clinics) combined with limited income-generating opportunities, it is expected that a number of refugees will enter into production of clay bricks, stone aggregate, sand and other materials. This can provide an important basis to provide employment and reduce economic vulnerability of those directly and indirectly benefiting from this work, while reducing rural-urban migration and stimulating local economic development.

Importantly, there may be a conflict between the Government of Uganda's progressive policy on refugees, which grants them a right to work and receive education, and the recent draft Minerals and Mining Policy. Specifically, under Objective 13 of the latter, the Government's intent is to "*ensure that artisanal mining is a preserve for Ugandan citizens".* While this is a common and widely accepted requirement of ASM law in most countries, in the context of ASM Development Minerals in Uganda, such a provision may be impracticable in the case of large refugee populations, such as that found in Northern Uganda. Within this context, relegating these ASM miners to "illegal" status would put those involved at great risk of exploitation, extortion, various forms of Sex and Gender Based Violence (SGBV) and other human rights abuses by formal and informal authorities, thereby directly contradicting the human rights based approach to managing refugees and for which Uganda has been widely heralded.

[79] See: Deloitte (2017)

[80] UNHCR (2017). South Sudanese refugees in Uganda now exceed 1 million. Accessed 8th December 2017. http://www.unhcr.org/uk/news/stories/2017/8/59915f604/south-sudanese-refugees-uganda-exceed-1-million.html

[81] World Bank (2016). Uganda's Progressive Approach to Refugee Management. Accessed 8th December 2017. http://www.worldbank.org/en/topic/fragilityconflictviolence/brief/ugandas-progressive-approach-refugee-management

[82] Ibid.

Climate Change

Drought and resulting impacts on agricultural productivity were one of the factors that resulted in declines in economic growth of the Ugandan economy in 2016[83]. In the short- to long-term, it is important to understand the linkages between climate change, economic development and resulting impacts on (and impacts on climate change by) ASM Development Minerals.

Key findings of a Ugandan Climate Change Vulnerablity Assessment highlight that an increase of temperatures (approximately 0.5-1.2 °C for minimum and 0.6-0.9 °C for maximum temperatures) was found and some models predict warming of up to 2 °C by 2030[84]. This, combined with projected increases in heavier rains and greater frequence of extreme weather events are expected to strongly impact on agriculture and livestock. More vulnerable households (in terms of education, financial status, access to financing etc) are least equipped to adapt to the effects of climate change, particularly for those households that are heavily reliant on crops that are most likely to be impacted.

Resulting implications of climate change on macro- and micro-economic development are likely to have some affect on demand for Development Minerals, mainly vis-a-vis the affects on the purchasing power capacity of the rural poor. However, linkages between climate change and ASM Development Minerals production and markets extend beyond this. Specifically, low incomes of ASM mineworkers (and therefore their reduced capacity to invest in appropriate technologies) are directly tied to reduced production in the rainy season, thus increased annual precipitation rates and frequency of heavy storms may reduce incomes further.

In addition, ASM Development Minerals can further exacerbate climate change and its effects. This is mainly through consumption of an estimated 2.9 million tonnes of wood per annum from clay brick production alone, impacting roughly 450 km^2 of forests annually, and degradation of approximately 220 km2 of wetlands in the country, impacting their capacity to buffer water fluctuations (floods, droughts), among other functions[85].

While emphasis on building climate resilience and reducing impacts on climate change through appropriate technology and more environmentally friendly methods are an obvious priority, additional priorities exist, including with respect to positive contributions of ASM Development Minerals.

Specifically, strategies identified in the Climate Change Vulnerability Assessment include: (i) Strengthening capacity of vulnerable farmers to adapt tackled via strategies for "adaptive agriculture", wherein increased emphasis on agro-minerals may become increasingly relevant; and (ii) diversification of livelihoods, whereby entry into ASM Development Minerals may increasingly become attractive. Understanding ASM Development Minerals Value Chains in greater details provides more specific guidance for the way forward.

[83] World Bank, 2017b, The World Bank in Uganda, Overview of the Economy. http://www.worldbank.org/en/country/uganda/overview

[84] USAID (2013) Uganda Climate Change Vulnerability Assessment Report. Accessed 7th December 2017. http://pdf.usaid.gov/pdf_docs/pnaec771.pdf

[85] Baseline Assessment of Development Minerals in Uganda (2017).

Analysis of Selected Value Chains

This section provides a deeper analysis of markets and value chains for selected Development Minerals and products: clay bricks, sand, stone aggregate and dimension stones. This, combined with commodity-specific analysis of factors affecting market development and competitiveness, underpin targeted recommendations for these commodities.

Clay Bricks

A diversity of clay products is produced in Uganda. This includes a range of bricks (solid, aeration, half and facing (decorative), high temperature resistant refractory bricks) as well as roofing tiles, pots, charcoal stoves and storage containers, among others. This value chain analysis (VCA) focuses on clay extraction and production of burnt, solid clay bricks by ASM operators, which, by far, constitutes the largest source of direct employment and production value of all commodities produced in Uganda's Development Minerals sector[86].

These bricks are derived mainly from what are classified as "ball clays", which are very plastic and have low wet-to-dry shrinkage, making them well suited for moulding and burning. Throughout Uganda, ASM extraction of ball clays takes place in and adjacent to rivers and wetlands, particularly near to urban centres.

Market Overview

Uganda's burnt, solid clay brick market is expanding, as the country – home to one of the World's fastest growing populations – increases its calls for housing and non-residential buildings (Section 3.1.3). Key aspects of the solid, burnt clay brick market are summarized as follows:

Production & Sales

Production was estimated at 5.4 billion bricks in 2015/16. [ASM 5.1 billion; MSM: 0.27 billion][87]
Production, particularly in the case of ASM operators, responds directly to demand. Many ASM operators are capable of increasing rates of production in response to orders from consumers. These estimates are believed to be conservative because, in the case of non-residential structures, it draws only from permit applications for 9 municipalities and 60 town councils in the country for which there was data[88].

Sales are valued at $289.2 million USD in 2015/16 [ASM: $266 million; MSM: $23.2 million USD
Sales priced were based on the average "ground price" (sold from site) of a burnt brick price of 175 UGX/brick from ASM bricks and a 290 UGX/brick for MSM bricks as derived from the UBOS consumer price index.

[86] LevinSources, 2017, Baseline Assessment Report.
[87] The methodology used for the estimation of ASM production and sales are detailed in Box 2 in the companion "*Baseline Assessment of Development Minerals in Uganda*".
[88] In the case of non-residential structures, in addition to the limited number of urban areas for which data was available, it was assumed that only 10% of non-residential construction is not permitted, although rates are likely to be much higher.

Imports & Exports

Imports **12,735 tonnes valued at 1.2 million USD in 2016[89]**

The type of bricks imported is assumed to be limited to "specialty bricks" (e.g. decorative or facing clay tiles). This is attributed to the fact that, on review of import data and given an average solid burnt brick weight, quantities and values would equate to 3.98 million bricks valued at over 1,000 UGX/unit (roughly 3-4 times the current sales prices). Import (and export) quantities are therefore excluded from discussions of market shares, below.

Exports: **51 tonnes valued at 5,000 USD in 2016[90]**

The type of bricks is also assumed to be "specialty bricks" given that (based on average solid burnt brick weights) these bricks would yield almost 16,000 bricks at over 10,000 UGX/unit. This is consistent with an increased focus on specialty products by MSM-LSM producers, as described below.

Trade Deficit: **-1.198 million USD in 2016[91]**

The trade deficit related to these products is indicative of growing demand for specialty bricks and seems to further strengthen the justification for shifting priorities of MSM-LSM producers, below.

Market Share

It is estimated that 95% of production is attributed to ASM and 5% is attributed to MSM.
The estimated market share attributed to ASM has increased by 5% since 2008 estimates of the market[92]. This is largely attributed to the relatively recent shifts in target markets of larger producers. Specifically, according to their financial reports (Uganda Clays Ltd) and interviews (Lweza Clays Ltd.) have foregone solid, burnt clay bricks in lieu of specialty items (roofing tiles, facing bricks, interlocking bricks, decorative tiles and bricks) which yield higher returns. Losses of solid bricks (e.g. due to over- or under-firing) coupled with high demand for cheaper ASM bricks were cited as factors (although competition with concrete blocks also likely plays a role for higher end consumers). A few small- to medium-scale semi-industrial producers, such as Butende Brickworks and Nkozi Clays, continue to produce solid bricks but are relatively small operations given the magnitude and geographic distribution of the Ugandan market.

Burnt clay ASM bricks is expected to continue to dominate housing construction.
In terms of materials used for housing construction, burnt/stabilized clay bricks were used to construct walls in 36.4% of houses in 2015[93]. Remaining home builders relied on mainly mud-and-pole (33.6%; 20.3% rural, 14.2% urban) and unburnt bricks/mud (20.3% total 20.3% rural,

89 ITC Trademap, 2016, http://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1|800|||25|||4|1|1|2|2|1|1|3|1
90 ITC Trademap, 2016, http://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1|800|||25|||4|1|1|2|2|1|1|3|1
91 ITC Trademap, 2016, http://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1|800|||25|||4|1|1|2|2|1|1|3|1
92 MEMD, 2009, National Strategy for the Advancement of Artisanal and Small Scale Mining in Uganda.
93 UBOS, 2016, Statistical Abstract, 2015.

7.6% urban) followed by concrete blocks, stones and other materials. Concrete blocks appear to be gaining in popularity, particularly in urban areas, where 11.2% of houses were built using these in 2015, an increase from 5.5% in 2007. Although demand for more costly but durable concrete blocks is expected to increase in the coming years, this growth is more closely tied to that of the middle to upper class segment of the population.

Figure 18: Bricks continue to dominate local residential and non-residential construction (left) while the emergence of concrete blocks and a variety of other concrete products are becoming more common (right). (Photo: J. Hinton, 2017)

ASM Clay Brick Value Chain

The different employment, economic, technical, environmental, occupational and social dimensions of the ASM value chain for burnt, solid clay bricks are presented in Table 9. This has been indexed to production by 1,000 clay brick mineworkers in a one-year period and draws from estimates derived from ASM site field assessments and interviews with traders, SMEs and construction companies, with corresponding assumptions detailed in Box 1.

Main Steps in the Value Chain

Main steps in the ASM value chain for burnt clay bricks are summarized as follows:

- Primary production level (Mine site): The production process has the following steps: digging, moulding, stacking to dry, kiln construction, firing, loading into trucks (the latter of which is paid by the trader). From the most formal to the most informal sites, all actors typically perform all jobs in the production process, the exception being kiln construction, firing and loading, from which women miners were almost totally excluded but which were generally the highest paid tasks on site.

- On-site Selling: Most ASM sites are also points of sale (POS). Transporters are often also traders, many of whom rent (daily or weekly) their lorries although some work for others (e.g. construction companies). Traders sell mainly on order (e.g. on order from individual consumers, points of sale / SMEs or construction companies). The profit margins earned by these traders varies mainly depending on distance to market and ground sale prices, with price increases coinciding with reduced production in the rainy season.

- Points of Sale/SMEs: According to SMEs, selling clay bricks via trading center or town

based shops – mainly multi-commodity hardware shops – is not as lucrative as other commodities, such as cement or iron sheets. According to shop owners and traders, direct consumption from sites (mainly on order) by downstream builders (individuals or construction companies) rather than from off-site SMEs has become more common over the past 5 years.

- *Construction SMEs:* These include the micro-enterprises (e.g. clay brick layers) and construction companies that use clay bricks in construction. Although several teams (micro-enterprises) may be sub-contracted depending on project size, micro-enterprises are typically comprised of teams of 3 workers (1 skilled brick layer and 2 unskilled assistants), who lay approximately 1,000 bricks per day. Profits are typically earned by charging a margin on labour and materials, typically on the order of 20-30%; however, smallest SMEs (e.g. teams of 1 skilled and 2 unskilled workers) often earn revenues from wages alone.

Figure 19: Sun-drying of bricks (top right), loading a kiln with wood (bottom left) and burnt bricks awaiting sale (bottom right). Photo: Levin Sources (2017)

Table 9: Value Chain Analysis of ASM Solid, Burnt Clay Bricks (based on production by 1,000 clay brick mineworkers over the period of 1 year). Source: Present Study

ASM CLAY BRICK VALUE CHAIN	Clay Extraction and Curing	Moulding	Stacking and Drying	Kiln Construction	Kiln Firing	Transport/ Traders	+/- Point of Sale	Consumer/ End User
BUSINESS UNIT	**MNE SITE**					**TRADER/ TRANSPORT[2]**	**SME[3]**	**CONSTRUCTION SME[3]**
EMPLOYMENT	**1,000 (80% men; 20% women)**					**28**	**85**	**266**
Men (%)	95%	70%	70%	100%	100%	100%	54%	100%
Women (%)	5%	30%	30%	0%	0%	0%	46%	0%
ECONOMIC CRITERIA								
Revenues (USD/yr)	**1,358,690**					**582,296**	**62,112**	**19,952**
Sales	To Mine or Site Owners					To Traders[4]	To SME Owners[4]	To SME Owners[4]
Input Costs						46,584 Loading		136,210 Salaries
Labour	7,764 Paid per unit	35,714 Paid per unit	23,292 Paid per unit	64,441 Paid per klin	56,677 Paid per klin	174,348 Lorry Hire	2,665 5% Salaries	2,986 Trowels, etc[1]
Tools, equipment	5,669 Spades[1], hoes[1]	8,876 Wooden moulds[1]	19,410 Grasses[1]		388,197 Fuelwood	153,726 Fuel		3,402,515 Mortar, bricks
Other						19,614 Mainte-nance	3,106 5% Overhead	585,933 10% Over-head
Taxes, Royalties, Rent	**23,292**					**22,049**	**3,236**	**34,170**
Description	Rent to landowner ranges from 1 to 3 UGX/brick					Est. 5% pay VAT, Income tax	Est. 10% pay VAT, Income tax	Est. 10% pay VAT, Income tax
Net Profits (USD/yr)	**725,359**					**319,701**	**56,211**	**3,146,919**
TECHNICAL Main Quality, Quantity and Efficiency Factors	High degrees of variability in curing process (during, pile height).	Manual process. Variability in brick compression.	Rainwater infiltration during drying.	Variabiity in kiln dimensions, shape, location and size of burn holes, coating	Variability in burn time, fuelwood consumption. Over- or un-der-firing rates (22-45%)	Fairly efficient. Some carelessness can result in additional brick losses.	Fairly efficient. Some carelessness can result in additional brick losses.	Expect some carelessness can result in additional brick losses.

ENVIRONMENTAL Main risks and issues	Severe wetland disturbance, no reclamation activities.	Negligible	Consumption of grasses to prevent rainwater infiltration	Negligible	Wood con-sumption. Est. at 2.9 million tpa. Additional CO2, other gases emitted.	Fossil fuel consumption. CO2 emissions.	Negligible	Negligible
OCCUPATIONAL Main risks and issues	Heat stress. Overexertion. Water immersion	Heat stress. Repetitive motion injuries/ illness.	Heat stress. Repetitive motion injuries and	Heat stress. Overexertion.	Smoke inhalation. Security risks (night shift)	Excessive dust exposure (load/unload truck).	Excessive dust exposure (load/unload truck).	Dust exposure (unload, use), potential heat stress
SOCIAL Main risks and issues	Disturbance to other land users. Exclusion of women.	Negligible	Negligible	Exclusion of women from highest paying task.	Exclusion of women from highest paying task. Security risks	Exclusion of women from highest paying tasks (trade, load, unload)		Exclusion of women from highest paying task.

Notes:
[1] Paid by workers. Excluded from "operators" margins
[2] Assumes only 20% of bricks are sold from a point of sale other than the site (or sourced by consumers from traders). Labour estimates assumes that POS (other than site based) sell one 5 tonne lorry per week. Ave. POS employs for clay bricks found to employ 4 people.. Salaries est. based on GNI per capita but aalocates only 5% due to multi-product of most POS.
[3] Estimates for labour force, tax contributions, salaries and inputs excludes management and overheads. Data pertains to bricklayers (typically in teams of 1 skilled and 2 unskilled workers can jointly lay 1,000 bricks per day. Estimate reduces standard practice for margins on labour, inputs 20-30% to 10% to account for micro-SMEs.
[4] Revenues for traders and Points of Sale based on margin on sales. Construction SMEs typically earn profits via margins of 20-30% on salaries and materials. Many construction SMEs are assumed to be "micro" scale (i.e. hired but skilled labourers) thus margins estimated at 10% of salaries and materials.

Key Economic Findings

Based on assumptions and estimates developed in the clay brick VCA, main economic findings are summarized:

- **The ASM clay brick value chain may constitute as much as 4.5% of GDP**: If it were officially integrated within national statistics, the entire clay brick value chain would constitute 4.5% of the GDP in 2016[94]. As much of the downstream (construction) is reportedly already captured in official GDP statistics, excluding this final step, other steps in the value chain (from the mine site to the point of sale) would represent a 1.5% increase to the GDP.

- **Over 3% of the population may directly and indirectly rely on the ASM clay brick value chain.** Based on the VCA, every job in ASM clay bricks production amounts to almost 0.4 additional jobs downstream, with direct employment in the value chain roughly totaling 266,500 Ugandans[95]. Considering average household sizes (4.7) this would equate to almost 1.3 million Ugandans (roughly 3.4% of the population)[96] directly and indirectly relying on ASM clay brick value chains.

- **Economic multipliers extend far beyond employment**. Based on the VCA, every US dollar of ASM brick sales generates an additional $3.4 dollars in the downstream economy, suggesting a direct economic multiplier effect of 3.4[97]. Those providing inputs to the value chain are also significant, with fuel wood suppliers earning estimated gross revenues on the order of $76 million USD per annum and those supplying simple tools used in production grossing roughly $3.4 million USD per annum. Indirect multiplier effects (e.g. for non-mining related small enterprises) are likely to also be significant, particularly when wages and salaries of the workforce alone are considered (i.e. excluding mine site and SME owners). This constitutes $73 million USD per annum injected into local small businesses and used to meet family health, educational, food and other needs.

[94] Uganda's GDP in 2016 was $25.53 billion USD (see data portal at: https://data.worldbank.org/country/uganda). The percentage attributed to the ASM Clay Brick Value Chain is based on the total estimated gross revenue (sales) from each step (mine site, traders, POS, construction SMEs), which amounts to $1.16 billion USD when accounting for estimated production of 5.1 billion clay bricks produced by 195, 700 clay mineworkers.

[95] Estimated based on value chain analysis and extrapolated from the over 195,000 directly employed in ASM burnt, clay brick production.

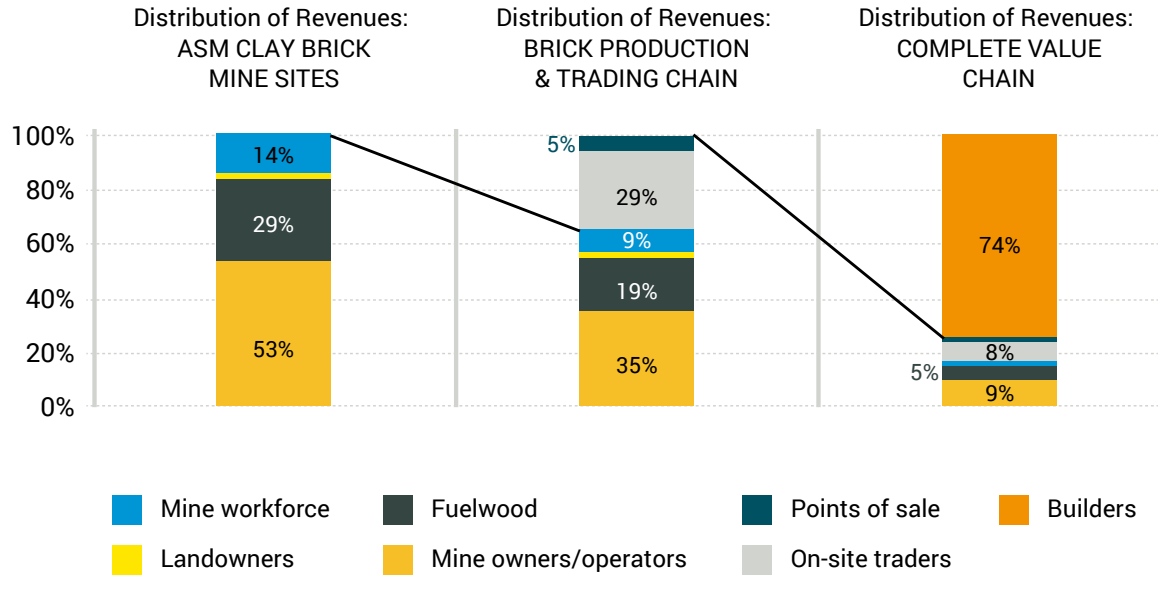
[96] Based on estimated population projected of 36,860,700 persons (projected from the 2014 census as provided in the UBOS 2015 Statistical Abstract) and 4.7 persons per 266,539 Ugandans estimated to work across the clay brick value chain. Although this estimate does not account for immediately family members working together (e.g. at ASM sites or in SMEs), it likely underestimates the number of partial and full dependents per employed persons (i.e. this could easily exceed 4.7 if support to extended family is considered)

[97] Based on estimated gross revenues at various steps in the value chain.

Figure 20: Upstream in the value chain, wood is one of the main and most costly inputs into the production process (left). In the downstream, a resort on Lake Bunyonyi sources local bricks and stone for construction (right). Photo: Levin Sources (2017)

Distribution of revenues is consistent with lower incomes of mineworkers in the upstream: As shown in the figures below, the greater share of estimated net profits accrue to those engaged in construction (74%) (Fig. 21, far right bar graph). When this is excluded, mine owners (35%) and those involved in trading (29%) earn the lion's share and mine workers – who constitute about 73% of the value chain workforce overall and 90% of the workforce when construction is excluded – remain with only 9% of revenues (Fig. 21, center).

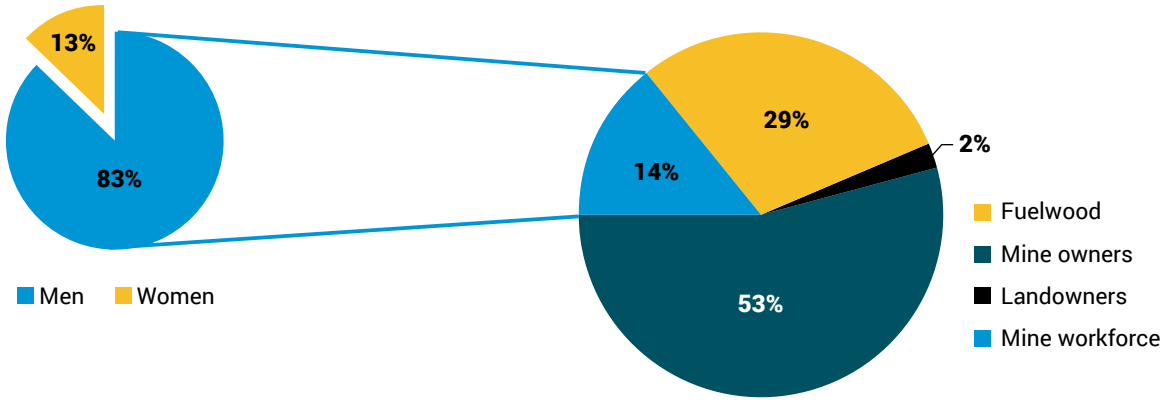
Figure 21: Distribution of revenues between economic actors



Incomes of the majority workforce in brick production average approximately $275 per annum. However, due mainly to the gender divisions of labour and exclusion of women from higher paying tasks (e.g. in loading and kiln construction), women are estimated to earn, on average, 39% less than men and obtain only ca. 13% of revenues accruing to the workforce, despite

constituting ca. 20% of the workforce. These findings are more acute when gender participation and wages across the entire value chain are considered. Based on estimates presented in Table 9, women constitute roughly 17% of the value chain workforce but earn only an 8% share of the wage bill. These results are particularly significant with respect to aims concerning the transformation of Development Minerals into a sector that more effectively facilitates wealth creation that is inclusive, which presumably also must include women.

Figure 22: Distribution of revenues at ASM mine site level for solid, burnt clay bricks.



Commodity-Specific Priorities for Value Chain Development

Cross-cutting entry points for enhancing market access, strengthening competitiveness and increasing – and supporting more equitable distribution of – development benefits are presented for a range of Development Minerals in the final section of this report. Many of these entry points apply directly to multiple Development Minerals value chains (including that for clay bricks). However, some critical issues are commodity-specific, as highlighted below:

1. **The incomes of ASM brick producers are reduced largely due to their heavy reliance on mine owners for financing of the production process.** In many cases, mine owners are not mine workers but economic agents who mainly finance the cost of fuelwood, which constitutes ca. 29% of all brick production costs. In some cases, these actors also play an essential role in providing a daily stipend and sometimes lunch to those producing bricks until the process is complete, at which point such pre-financing is deducted. On average, the production of 10,000 bricks takes 51 days[98] and, simply put, most mineworkers involved in brick production are living day to day. Occasionally, but rarely, ASM groups of workers or individual miners are able to save and finance fuelwood and sustain themselves throughout the process.

2. **Financing schemes should be piloted that are suited to production time frames and wood and non-wood related costs associated with the clay brick production cycle.** Although mine owners/operators play a key role and such entrepreneurialism itself represents development in action, mechanisms to increase the revenue share

[98] Based on field research, the production cycle from digging through to conclusion of burning was found to range from 14.8 to 86 days for 10,000 bricks. Although local geological, climate and other conditions may play some role, this heterogeneity attests to the need for production process optimization, including that related to reducing fuelwood consumption.

accruing to the ASM workforce are clearly critical to supporting more inclusive wealth creation. At a number of sites, mine owners are also landowners and the introduction of measures that undermine their profitability may pose a challenge. Related program design should therefore include targeted training to build skills needed to manage these funds and those skills needed to navigate and negotiate with landowners, authorities and each other. Ensuring that women mineworkers directly benefit from these efforts, together with efforts needed to break the stigma and exclusion of women working in higher paying tasks (e.g. loading bricks), would additionally help to rectify gender gaps in incomes.

3. **The market for low-cost burnt bricks is growing, however access to new markets (e..g upwardly mobile Ugandans) and diversification of clay products could provide additional opportunities.** In addition to clay burnt bricks, a number of ASM sites across the country are additionally (or solely) producing a range of other clay brick products, including ceramic pots, containers and specialty tiles. Demands from less affluent consumers for clay-lined charcoal or wood burning stoves, in particular, are likely to see similar growth trajectories as for bricks. The progressive shift from firewood to charcoal and corresponding growth in use of charcoal stoves is illustrated in Figure 22.

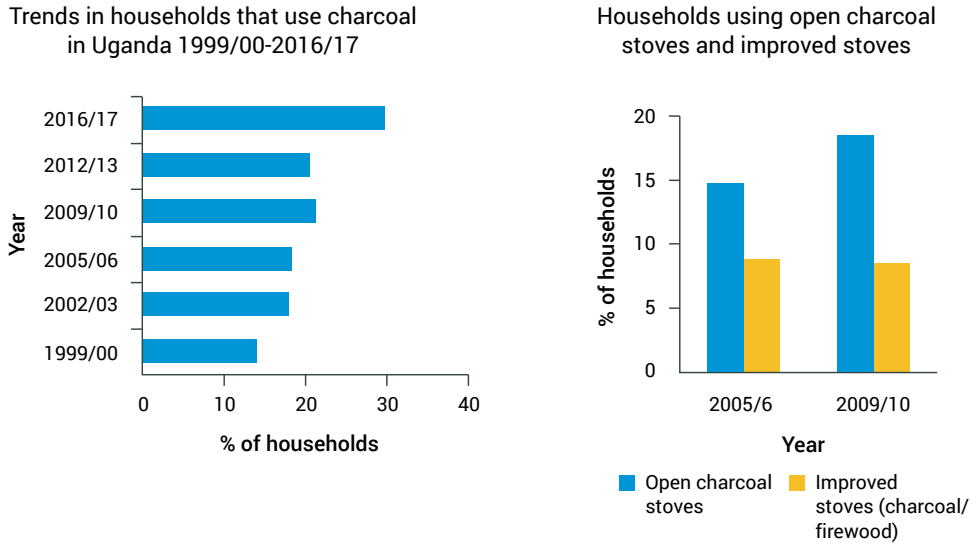
Figure 23: A number of local SMEs are trying to diversify but most of this is limited to lower value products.

Importantly, much work has been done in Uganda to introduce energy saving stoves to the population, most of which require clay in various forms. Any training, sensitization or information campaigns that seek to diversify clay products should similarly encourage market development in this area. Specifications, costs and benefits of improved stoves utilizing clay in various forms in Uganda are provided in Annex 5.

Similarly, as the middle class continues to expand, so too will demand for higher quality and specialty clay products. Some ASM sites already practice selectivity during extraction in terms of the quality of clay used to make and sell kaolin-rich "white clay bricks" at a higher price than brown or orange burnt bricks. Particularly for those deposits (or zones within deposits) that are rich in kaolin, an opportunity exists to mitigate some of the "ceramics deficit" found in the national balance of trade. In both cases, however, considerable assistance shall be needed to build capacity of miners to identify and selectively extract clay based on suitability for different uses, upgrade the quality of products, including in accordance with national standards for burnt bricks and other clay products99, and establish links with available markets.

[99] The companion "*Baseline Assessment of Development Minerals in Uganda*" provides details concerning the range of national standards available, including for burnt, clay bricks and related products.

Figure 24: Household usage of charcoal (left) and charcoal and improved stoves (Source: UNHS 2016; UNHS 2010)



4. **Technical assistance and training to optimize production processes and reduce word consumption can simultaneously help address multiple economic, environmental, occupational and social issues.** In addition to the main economic challenges and opportunities associated with clay brick value chains, the sector is also characterized by a number of environmental, occupational and social risks, as summarized in Table 9 and detailed in the companion "Baseline Assessment" report. The overlap between economic, technical, environmental, occupational and social dimensions is clear when considering main entry points for process standardization and optimization100:

- *Selective mining*: Identification of different quality clays for specific products and markets. Training in extraction should be integrated with basic site planning and reclamation (progressive backfill, re-contouring, creation of wetland corridors and water management).

- *Standardized raw brick production*: Curing times, brick (mould) size, brick compression (using a manual metal press), and drying times should be optimized within acceptable ranges.

- *Kiln construction*: Much literature exists on optimal ranges of design specifications in Uganda, including with consideration of the need to reduce fuel wood consumption. Training should introduce and pilot standardized dimensions, shapes, different insulating materials (mud, refractory bricks), and locations and sizes of burn holes in order to optimize heat distribution as well as in fixed kiln construction and use of refractory bricks (enabling continuous burning to reduce wood consumption).

[100] Considerable research has been done in Uganda in order to develop technical criteria and specifications as needed to improve productivity and quality of brick products. Annex 10 of the companion "*Baseline Assessment*" report outlines a number of extremely specific reports and published research on this topic. Uganda's *Small Scale Mining Handbook* additionally provides less technically complex but specific guidance on means through which quantity and quality improvements can be met while addressing related environmental and occupational risks and impacts.

BOX 4: CERAMICS PRODUCTION FROM DIFFERENT TYPES OF CLAYS

This study shows that currently, the vast majority of ASM clay production in Uganda is from ball clays for bricks used in the construction of residential and non-residential buildings, with a small portion being used to make simple pots, water containers, tiles and charcoal stoves. Many of these deposits are kaolin-rich and have potential to be used in higher value ceramics production. Kaolin is largely under-produced in Uganda (given demands from the cement industry), but some grades of kaolin are poorly suited for cement but could be used for higher quality ceramics.

Given this, and the variety of different clays in the country, supporting diversification of clay value chains to include a greater range of (typically higher value) ceramics would enhance value chain performance and help mitigate the large trade deficit attributed to ceramics. Below are some of the potential uses and characteristics of various clays[101]:

Ceramic clays	Properties	Products
LIGHT-FIRING CLAYS (LFC)		
High-grade Kaolins (HK)	• Easily dispersable in water, but difficult to press. • Highly refractory, enhancing the formation of mullite and whiter shades during firing. • HK are typically used in low amounts.	• Glazes and engobes(to thicken and stabilize suspensions). • Unglazed porcelain stoneware and white birapida (not > 10–15% porous and vitrified bodies) • Porcelain Stoneware
Low-grade kaolins (LK)	• Lower plasticity and confirming difficulties in pressing and sintering.	• Ceramic tiles. • Glazed white stoneware. • Porcelain Stoneware
Raw kaolins (RK)	• Poor plasticity (cannot fulfill ordinary requirements for ceramic clays).	• Ceramic tiles(it's a mix) • Glazed White Stoneware
Kaolinitic loams (KL)	• coarse grain size and relatively high plasticity.	• Ceramic tiles • Glazed white stoneware.
Ball clays (BC)	• Fine-grained and highly plastic. • Its higher grades can fire to a white or near white colour.	• Porcelain stoneware • White Monoporosa
Pyrophyllitic clays (PC)	• Lower loss on ignition, easier compaction, and lower refractoriness with respect to kaolins. • Contain quartz, feldspars and often kaolinite and/or illite or sericite.	• Ceramic tiles
White bentonite	• High smectites (frequently over 50%) and a relatively low iron content (Fe2O3 at max 6%, but preferably below 2%) are used in tilemaking as additives to enhance plasticity of too lean bodies.	• Ceramic tiles
DARK-FIRING CLAYS (DFC)		
Marly Clays (MC) and Carbonatic Clays (CC)	• Have the most complex mineralogical composition among ceramic clays, where different types of phyllosilicates (commonly illite, chlorite, smectite plus minor kaolinite and interstratified terms), carbonates and quartz are all present in significant amounts.	• Wall tiles. • Red Birapida • Red Monoporosa
Red Clays (RC)	• Contain very iron-rich clay material with Fe2O3 >3%, carbonates < 10% and a coarse-grained fraction <25%. • complex mixtures	• Glazed Red Stoneware • Red Birapida • Red Monoporosa
Red Loams (RL)	• Abundant coarse-grained fraction (over 25% N63 µm).	• Rustic tiles.

[101] Dondi, M., et al. (2014). Clays and bodies for ceramic tiles: Reappraisal and technological classification, Appl. Clay Sci. Accessed 8th December 2017. http://dx.doi.org/10.1016/j.clay.2014.01.013

- *Brick firing*: Main areas of emphasis should include wood storage and drying, optimization/minimization of quantities, wood alternatives (e.g. coffee husks) and optimization of mix ratios.
- *Loading Bricks*: Dust inhalation and suitable PPE in kiln de-construction and truck loading poses a serious OSH risk and should receive heavy emphasis, including within related business skills development training (e.g. costs of PPE versus health costs of no PPE).
- *Marketing and Selling*: Skills are needed to assess local market potential, making links with downstream markets and building skills in negotiation. Integration with organizational strengthening activities would reinforce the benefits of increased bargaining power.

Throughout training in each area – within which hands-on piloting of techniques should overwhelmingly comprise much of the curriculum - the de-stigmatization of women's work in various, higher paying jobs (e.g. kiln construction, loading) could be supported through advocacy, integration of gender dimensions in related training (e.g. human rights, women's right to work, etc) and through preferential emphasis on women mine workers in hands-on and classroom training. A focus of women's and youth empowerment in organizational strengthening efforts is needed to help mitigate unequal revenue distributions, including via group savings to reduce reliance on third party financing.

Sand

Sand occurs similarly and often adjacent to clay deposits in and on the margins of wetlands throughout the country as well as on lake shores, with extraction most intensive along Lake Victoria south and east of Kampala. A total of 346 active and abandoned sand extraction sites can be found within a 150km of the capital city, with intensive sand production found in Masaka, Wakiso, Buikwe, Mayuge and Jinja Districts.

Most Ugandan sand is used as fine aggregate[102], mixed with cement and stone aggregate for the production of concrete or mixed with cement for production of mortar (e.g. used in laying bricks or tiles). Despite this, deposits of glass quality silica sand are found along the shores of and on islands within Lake Victoria at Bukakata, Dimu, Nyimu, Nyabu, Nakimuli, Kome Island, Kabugoga and Entebbe.

Market Overview

Demand for sand is expected to increase alongside escalating demands for concrete and mortar used in construction although specialized uses (e.g glass production) may figure more prominently in the future. No in-country glass manufacturing is taking place although the potential is reportedly now being explored by a few domestic and foreign investors. The emergence of other cement products (e.g. concrete blocks and concrete tiles), which provide alternatives to clay products, is also likely to influence sand demand in the future, particularly as the middle to upper class segment of the population grows.

[102] Dondi, M., et al. (2014). Clays and bodies for ceramic tiles: Reappraisal and technological classification, Appl. Clay Sci. Accessed 8th December 2017. http://dx.doi.org/10.1016/j.clay.

Production & Sales

Production was estimated at 3.5 million tonnes in 2015/16. [ASM $3.1 million; MSM: $0.349 million].

Production of sand is directly in response to demand and correlates closely with cement consumption and demand, mainly in response to construction of civil works and residential and non-residential structures.

Sales are valued at $9.9 million USD in 2015/16 [ASM: $8.9 million; MSM: $0.99 million USD]

Sand is produced and sold in various "grades" (quality) in response to construction needs (e.g. high structural strength vs. mortar or textured paint), consumer capacity to negotiate and pay certain prices, sale quantity (tonnage), proximity to markets and geologic characteristics of sand deposits in different localities (i.e. affecting available grades). "Ground" sale prices therefore vary widely. At sites assessed, sale prices ranged from 6,000 to 16,700 UGX/tonne, averaging 9,600 UGX/tonne[103].

Imports & Exports

Imports **821 tonnes valued at $187,000 USD in 2016[104]**

This value equates to $227 USD per tonne (roughly 820,000 UGX/tonne or 85 times the average ASM "ground price"). The target use of this sand is unknown but presumably must be for highly specialized applications.

Exports: **20 tonnes valued at $3,000 USD in 2016[105]**

This equates to $150 USD per tonne (roughly 540,000 UGX/tonne or 56 times the average ASM "ground price") so is therefore assumed to be associated with exports of glass quality sand to China and Saudi Arabia for the purpose of glass production. The price difference between "glass" sand and "construction" sand provides an indication of a potential entry point to increase incomes of the ASM workforce.

Trade Deficit: **$-184,000 USD in 2016[106]**

[103] Prices do not equate to end-user purchase price, the latter of which includes margins charged by traders/ transporters and points of sale/SMEs as described in the VCA.

[104] ITC Trademap, 2016, http://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1|800|||25|||4|1|1|2|2|1|1|3|1

[105] ITC Trademap, 2016, http://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1|800|||25|||4|1|1|2|2|1|1|3|1

[106] ITC Trademap, 2016, http://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1|800|||25|||4|1|1|2|2|1|1|3|1

Market Share

It is estimated that 90% of production is attributed to ASM and 10% is attributed to MSM[107]. Although excavators are in use at some sites, the majority of sand is believed to be purchased from ASM producers. This seems like a practical assumption given that individual production per miner is high (average 3.5 tpd and up to 6.3 tpd) and both labour costs and sale prices are cheap. Given the nature of sand deposits and based on ASM site assessments, any lorry that shows up will be readily filled as needed, the exception being flooding and access issues in the rainy season (which is also an impediment for mechanized producers). Given this, most mine site owners/ operators seem to have little incentive to hire or acquire financing to purchase an excavator[108].

ASM Sand Value Chain

The different employment, economic, technical, environmental, occupational and social dimensions of the ASM value chain for ASM sand are presented in Table 10. This has been indexed to production by 1,000 sand mineworkers in a one-year period and draws from estimates derived from ASM site field assessments and interviews with traders, SMEs and construction companies, with corresponding assumptions detailed in Box 1.

Main Steps in the value chain

Main steps in the ASM value chain for sand are summarized as follows:

- Primary production level (Mine site): The production process involves manual overburden removal and excavation using shovels and spades. Sand is typically stockpiled according to "grade", which is a rough visual and textural interpretation by the digger and/or team leaders, for different uses (e.g. plaster, cement, mortar, concrete floors). Rarely, some manual sieving is undertaken and no other beneficiation (e.g. flotation, magnetic separation, other sizing) is done. Loading of lorries is paid by the truck driver or trader and thus, for the purpose of the VCA, related costs have been included therein (Table 10)
- On-site Selling: Most ASM sites are also points of sale (POS). Transporters are often also traders, many of whom rent (daily or weekly) their lorries although some work for others (e.g. construction companies). Traders sell mainly on order (e.g. on order from individual consumers, points of sale / SMEs or construction companies). The profit margins earned by these traders varies mainly depending on distance to market and ground sale prices, with price increases coinciding with reduced production in the rainy season.
- Points of Sale/SMEs: According to SMEs, selling sand via trading center or town based shops – mainly multi-commodity hardware shops – is not as lucrative as other commodities, such as cement or iron sheets, and because of the unit area requirements, is even less so for sand than bricks. According to shop owners and

[107] Production estimates exclude those individual cases where extraction was for the sole purpose of glass sand. Total production estimates were derived from consumption needs tied to cement consumption statistics. One case of a foreign company undertaking industrial dredging of sand deposits for the purpose of export for glass sand production are excluded from these estimates and the VCA.

[108] Given the low production costs and relatively high production capacity, a substantial proportion larger construction projects are expected to source from ASM producers. For example, if Hima is supplying 6,000 tonnes per month of cement to the Karuma Dam project, this equates to roughly 10,200 tonnes of sand, monthly. Based on ASM production levels, roughly 100 ASM miners could meet this demand.

traders, direct consumption from sites (mainly on order) by downstream builders (individuals or construction companies) rather than from off-site SMEs has become more common over the past 5 years although a number of road-side, nearer to market SMEs selling sand can be found around urban centers.

- Construction SMEs: These include the micro-enterprises and construction companies that use sand for the production of concrete. Although several teams (micro-enterprises) may be sub-contracted depending on project size, micro-enterprises involved in concrete production are typically comprised of teams of 6-7 workers (1 skilled operator of the small cement mixer, 2 assistants ad 3-4 labourers sieving sand, hauling water and mix), who can mix and pour approximately 25 m3 of concrete per day. Profits are typically earned by the sub-contractor "owner" by charging a margin on labour and materials, typically on the order of 20-30%; however, smallest SMEs often earn revenues from wages alone (e.g. for smaller projects).

Key Economic Findings

Based on estimates developed in the sand VCA, main economic findings are summarized as follows:

- **The ASM sand value chain may constitute almost 0.8% of GDP**: If it were officially integrated within national statistics, the entire sand value chain would constitute 0.8% of the GDP in 2016[109]. As much of the downstream (construction) is reportedly already captured in official GDP statistics, excluding this final step, other steps in the value chain (from the mine site to the point of sale) would represent a 0.1% increase to the GDP. Although much lower than for clay bricks and stone aggregate, it still makes an important contribution to the cumulative contributions of the Development Minerals sector.
- **The direct and indirect population relying on the ASM sand value chain is much lower than for other target commodities but employment multipliers are high.** Based on the VCA, every job in ASM sand production amounts to almost 5.7 additional jobs downstream, with direct employment in the value chain roughly totaling 17,000 Ugandans[110]. Considering average household sizes (4.7) this would equate to roughly 80,000 Ugandans (roughly 0.2% of the population)[111] directly and indirectly relying on ASM sand value chains. Such high employment multipliers but relatively low overall contributions (compared to other value chains studied) are mainly attributed to high per miner productivity.

[109] Uganda's GDP in 2016 was $25.53 billion USD (see data portal at: https://data.worldbank.org/country/uganda). The percentage attributed to the ASM Sand Value Chain is based on the total estimated gross revenue (sales) from each step (mine site, traders, POS, construction SMEs), which amounts to $193 million USD when accounting for estimated production of 3.1 million tonnes of sand produced by 2.550 sand mineworkers.

[110] Estimated based on value chain analysis and extrapolated from the over 2,550 directly employed in ASM sand production.

[111] Based on estimated population projected of 36,860,700 persons (projected from the 2014 census as provided in the UBOS 2015 Statistical Abstract) and 4.7 persons per 17,192 Ugandans estimated to work across the sand value chain. Although this estimate does not account for immediately family members working together (e.g. at ASM sites or in SMEs), it likely underestimates the number of partial and full dependents per employed persons (i.e. this could easily exceed 4.7 if support to extended family is considered)

Table 10: Value Chain Analysis of ASM Sand (based on production by 1,000 sand mineworkers over the period of 1 year)

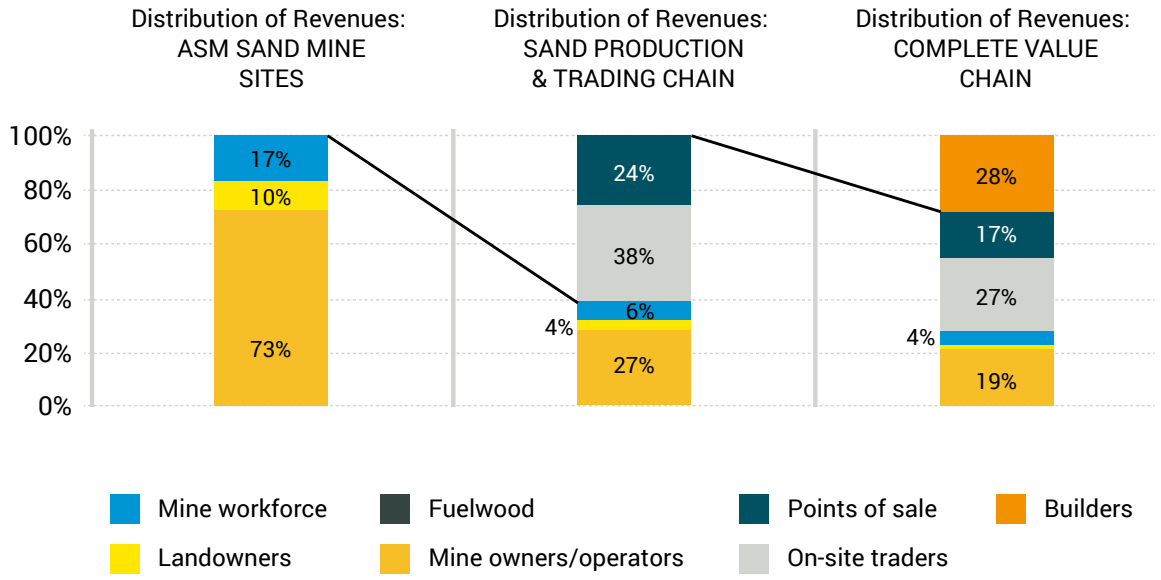
ASM SAND VALUE CHAIN	Digging	+/- Sieving	Transport/ Traders	+/- Point of Sale	Consumer/ End User
BUSINESS UNIT	MNE SITE		TRADER/TRANSPORT[2]	SME[3]	CONSTRUCTION SME[3]
EMPLOYMENT	**1000 (88% men; 12% women)**		**494**	**790**	**4,459**
Men (%)	88%		95%	54%	100%
Women (%)	12%		5%	46%	0%
ECONOMIC CRITERIA					
Revenues (USD/yr)	**3,502,653**		**8,216,049**	**2,384,378**	**61,657,286**
Sales	To Mine or Site Owners		To Traders[4]	To SME Owners[4]	To SME Owners[4]
Input Costs	585,300 Production sharing		911,095 Loading	26,057 5% Salaries	3,858,754 Salaries
Labour			3,036,982 Lorry Hire		78,700 Cement mixer, fuel
Tools, equipment	18,676 Spades[1], hoes[1]	10,355 Sieves[1]	5,345,089 Fuel	119,219 5% Overhead	47,443,618 Sand, Aggr, cement
Other			607,396 Maintenance		6,165,729 10% Overhead
Taxes, Royalties, Rent	**364,438**		**76,401**	**64,237**	**467,568**
Description	Only 50% of sites surveyed paid landowners (or landowners are site owners)		Est. 5% of traders pay VAT, Income tax	Est. 10% of SMEs pay VAT, Income tax	Est. 10% of SMEs pay VAT, Income tax
Net Profits (USD/yr)	**2,552,915**		**3,584,175**	**2,294,084**	**3,642,918**
TECHNICAL Main Quality, Quantity and Efficiency Factors	Visual Selectivity in products (affect price by usage) at only some sites.	Few sites sieve resulting in size variation. No other beneficiation.	Fairly efficient. Lack of covers can result in minor losses.	Fairly efficient. Some carelessness can result in minor losses. No beneficiation.	Crude sieving pre-addition to concrete mixer can lead to grade variations affecting concrete quality.

ENVIRONMENTAL Main risks and issues	Severe wetland or lake bed disturbance, no reclamation activities.	Dust dispersion affecting wetland vegetation.	Fossil fuel consumption. CO2 emissions.	Negligible	Some dust dispersion during sieving.
OCCUPATIONAL Main risks and issues	Heat stress. Overexertion. Water immersion illnesses.	Excessive dust exposure	Excessive dust exposure (loading/ unloading truck)	Excessive dust exposure (loading/ unloading truck).	Dust exposure, potential heat stress.
SOCIAL Main risks and issues	Disturbance to other land users. Exclusion of women.	Disturbance to other land users. Exclusion of women.	Exclusion of women from highest paying tasks (loading, trading).	Exclusion of women from highest paying task.	Exclusion of women from highest paying task.

Notes:
[1] Paid by workers. Excluded from "operators" margins
[2] Assumes only 20% of bricks are sold from a point of sale other than the site (or sourced by consumers from traders). Labour estimates assumes that POS (other than site based) sell one 5 tonne lorry per week. Ave. POS employs for clay bricks found to employ 4 people.. Salaries est. based on GNI per capita but aalocates only 5% due to multi-product of most POS.
[3] Estimates for labour force, tax contributions, salaries and inputs excludes management and overheads. Data pertains to bricklayers (typically in teams of 1 skilled and 2 unskilled workers can jointly lay 1,000 bricks per day. Estimate reduces standard practice for margins on labour, inputs 20-30% to 10% to account for micro-SMEs.
[4] Revenues for traders and Points of Sale based on margin on sales. Construction SMEs typically earn profits via margins of 20-30% on salaries and materials. Many construction SMEs are assumed to be "micro" scale (i.e. hired but skilled labourers) thus margins estimated at 10% of salaries and materials.

- **Economic multipliers are extremely high.** Owing to the low ground sales price of sand and margins earned at subsequent steps in the value chain, every US dollar of ASM sand sales generates an additional $20 dollars in the downstream economy[112]. Indirect multiplier effects (e.g. for non-mining related small enterprises) are likely to also be significant, particularly when wages and salaries of the workforce alone are considered, on the order of $12 million USD per annum injected into local small businesses and used to meet family health, educational, food and other needs.
- **Mine owners, landowners and traders retain a much larger proportion of overall sand value than for clay, stone aggregate and dimension stones.** As shown in the figures above, the greater share of estimated net profits accrues to those engaged in construction (28%) and trade and transport (27%) (Fig. 25, far right bar graph). When construction is excluded, mine owners (27%) and those involved in trading (38%) earn the lion's share and mine workers – who constitute of the 44% of the workforce when construction is excluded – remain with only 6% of the revenue share (Fig. 25, center).

Figure 25 Distribution of revenues between economic actors

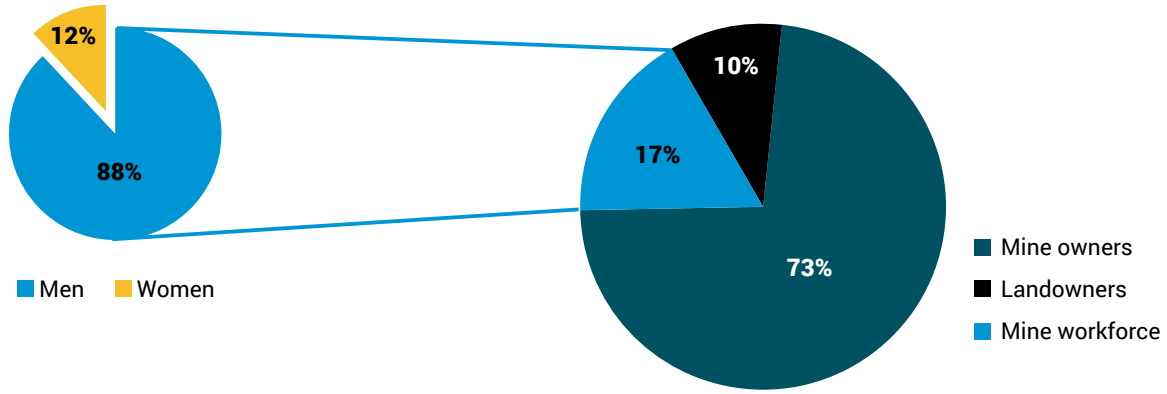


Incomes of the majority workforce in sand are much higher than for stone aggregate and clay bricks, averaging approximately $585 per annum. Individual daily incomes can be as high as $5.5 USD per day but interruptions due to rainy season flooding and exhaustion (requiring many miners to work for 5-6 days on and 5-7 days off) skew annual contributions of ASM sand production to their incomes streams. Mine site owners/operators can actually be comprised of a number of individuals, depending on local organizational structure. These may include an individual who owns the land or has an arrangement with a landowner who oversees pits (which typically have a pit owner or leader) who in turn oversees teams (who also often have a team leader who often garners a greater share). Within this hierarchy, the revenue share paid to the majority workforce is much lower than other commodities as each economic actor takes their cut.

[112] Based on estimated gross revenues at various steps in the value chain.

Based on ASM sand sites assessed, women are estimated to constitute 12% of the workforce. Due to the limited number of tasks at these sites (e.g. dig or load) and limited number of women encountered as needed to determine differences in incomes, it was assumed that the pay scales were similar (Fig. 26, below). In reality, due to women's systematic exclusion from loading, it is expected the average woman may also earn less than the average man.

Figure 26. Distribution of Revenues at an Average ASM Sand Mine.



Commodity-Specific Priorities for Value Chain Development

Cross-cutting entry points for enhancing market access, strengthening competitiveness and increasing – and supporting more equitable distribution of – development benefits are presented for a range of Development Minerals in the final section of this report. Many of these entry points apply directly to multiple Development Minerals value chains (including that for sand). However, some critical issues are commodity-specific, as highlighted below:

1. **Although higher than for other ASM commodities studies, ASM sand mineworkers incomes are still relatively low, in large part due to margins paid to economic actors at the site level as well as seasonality and exhaustion**. Average annual incomes are roughly 89% of the GNI per capita and one the highest of the 4 focus commodities. Nevertheless, unlike for clay bricks, where pre-financing of the production process is an essential role of mine owners, economic agents at ASM sand sites seem to play roles in navigating landowners and, given high levels of scrutiny concerning sand production in wetlands, authorities. Given the abundance of disenfranchised, often low-skilled young men that characterize sand production and the multiple channels that presumably must be navigated in order to work at ASM sand sites, competition for jobs is likely high, undermining further the bargaining power of these informal workers.

   The impact of seasonality and exhaustion cannot be underplayed, however. If no workdays were lost and mineworkers were able to produce at their maximum levels (assuming six days per week year round), annual incomes would be on the order of $1700 per annum, or 2.6 times the GNI per capita. This is an important consideration for the ways in which the evolution of the sector may be supported, i.e. with an emphasis on employment creation or with greater focus on increasing individual miners productivity (and therefore incomes) in response to growing demand. Importantly, consideration of mechanized approaches (e.g. use of excavators) must be balanced with impacts in terms of job losses and a greater consolidation of revenues in the hands of owners.

BOX 5. ARTISANAL GLASS PRODUCTION

Glass has been produced in some form since around 4000BC, and it was not until the last two centuries that it began to be produced on an industrial scale. Before this, glass-making was a labour-intensive process, with most glass containers blown by hand. It is clear, therefore, that artisanal glass-production is possible. Whether glass-making could enhance the sand value chain in Uganda depends on technical capacity-building, the availability of appropriate materials and a market demand for glass products.
Materials: The basic materials for making glass are silica sand (over 98% pure), sodium carbonate and limestone (calcium carbonate). Other materials include: decolorisers (e.g. manganese dioxide), materials for coloring (e.g. metal oxides) and materials for creating an opaque glass texture (e.g. titanium and zirconium oxides) maybe added.

Procedure:

- Silica sand of over 98% purity is mixed with sodium carbonate and calcium carbonate in a good heat resistant crucible. Sodium carbonate lowers the melting point of silica sand from about 23000C to 15000C but results into glass that permits water to pass through it. To counteract this effect, calcium carbonate is added to the mixture to increase structural reliability and chemical resistance of the formed glass.
- Depending on the intended purpose of the glass, other additives that or add or remove color to the glass maybe added.
- The crucible containing the mixture is carefully placed in a furnace or kiln to melt the mixture into a liquid.
- Once the liquid is formed, glass fining is carried out by homogenizing through stirring and removal of bubbles. Fining agents such as sodium sulphate, sodium chloride can also added at this stage.
- The molten glass is then shaped into the desired end product. This can be done by either casting the molten glass into pre-made moulds, or poured on top of a big vat of molten tin metal to make flat sheets of glass (e.g. windows) or by blowing (molten glass is wrapped around an open pipe which is slowly rotated. Air is carefully blown thrown the pipe thereby inflating the attached molten glass which is further shaped using other tools. The glass formed is then slowly cooled in a kiln through a process called annealing. The glass can then be coated, laminated or treated to improve its strength and durability.

Modern-day artisanal glass production case study: The Glassmakers of Herat[113]
In Western Afghanistan, a one-room artisanal glass factory was run by a local family, discovered by a researcher from the Corning Museum of Glass in the early 1970s. Using a wood-burning furnace built from stone and mud, they crushed pebbles from the bed of a nearby river and mixed the powder with plant ash, making 70-200 objects each day. The working environment was challenging due to high levels of smoke inhalation, which had negative effects on the health of the glassmakers. They produced specialty Afghan artefacts that supplied mostly tourist markets. Given the security situation in Herat and the sharp fall in tourism in Afghanistan, it is not known whether the glassmakers of Herat are still operating.

Kitengela Glass, Kenya[114]
Artisanal glass production also takes place in Kitengela, Kenya, where glass-blowing workshops have been held to increase the technical capacity of artisanal glass-producers. These workshops use recycled glass as their raw material, a method which could also be employed in Uganda.

[113] R. H. Brill (1979), "A Small Glass Factory in Afghanistan," Glass Art Society Journal, 1979, pp. 26–27. Rakow Research Library, The Corning Museum of Glass. Accessed 8th December 2017. https://www.cmog.org/sites/default/files/collections/DB/DB71CD47-0EFF-497A-9E78-D5F653AD9DE7.pdf

[114] Kitengela Glass. Accessed 8th December 2017. http://kitengelaglass.co.ke/_kiten-workshops.htm

2. **Traders play a key role, margins charged are high but individual net profits are far from excessive**. Beyond the mine site, margins charged by traders/transporters and points of sale typically ranging between 2.4 and 3.2 times the ground sale price. However, costs of transport are high and, particularly given the high volume, low value of sand compared to other Development Minerals. Many transporters/traders must hire lorries at relatively high costs (often over $100 per week) and, when fuel, loading and maintenance costs are considered, monthly profits can be high (est. at ca. $600 per month) but extremely variable, depending upon the season and increasingly, competition with other lorry drivers (reportedly affecting the number of trips taken per day). Off-site points of sale exist nearer to markets but, in particular for those paying rent for their space, are more likely to prefer products that yield higher margins but consume smaller areas. If groups of mineworkers were supported to acquire their own lorries, their incomes would increase appreciably.

3. **It is uncertain if focus on quality and achievement of certification requirements at ASM site level would drastically increase incomes in the short- to mid- term while potential for product diversification requires even more creative thinking.** The market for sand seems relentless, growing and largely indifferent to levels of beneficiation at the ASM site level. Although different sand grades yield different prices, markets for all grades seem to be increasing. Although "mega-projects" such as the Karuma Dam and larger buildings are certainly under scrutiny with respect to adherence to specifications, when required the testing and verification procedures are largely undertaken by downstream actors (e.g. construction companies). Simple, intermediate technologies (e.g. semi-mechanized screens) could be introduced to improve production of higher value, fine (and size controlled) sand products, particularly in the case of local tenders, however, demand for "visually selected", cheap sand is likely to nevertheless continue in the short- to mid-term.

   The main "leap forward" in terms of beneficiation within the ASM sand value chain may depend on the viability of ASM glass production. Box 3 outlines the main inputs needed for such ventures. Importantly, as found for a multitude of other mineral value chains (e.g. gemstones, jewellery production from gold), feasibility of such ventures often is based on its physical location farther from primary production sites and nearer to markets and other amenities (e.g. electricity). ASM glass production is likely to not differ in this respect. While examination of whether development of these SMEs (at least initially at a pilot project level) is worthwhile, those working at the mine site level should also benefit vis-à-vis much higher sale prices for glass quality sand (Box 5).

4. **Technical assistance and training to optimize production processes should simultaneously aim to mitigate environmental, occupational and social risks.** In addition to main economic challenges and opportunities associated with ASM sand value chains, the sector is also characterized by a number of environmental, occupational and social risks, as summarized in Table 10 and detailed in the companion "*Baseline Assessment"* report. The overlap between economic, technical,

environmental, occupational and social dimensions is clear when considering main entry points for process standardization and optimization[115]:

Similar to approaches proposed for the other 3 focus commodities, Throughout training in each area – within which hands-on piloting of techniques should overwhelmingly comprise much of the curriculum - the de-stigmatization of women's work in sand mining jobs (e.g. digging, loading) could be supported through advocacy, integration of gender dimensions in related training (e.g. human rights, women's right to work, etc) and through preferential emphasis on women mine workers in hands-on and classroom training. A focus of women's and youth empowerment in organizational strengthening efforts is needed to help mitigate unequal revenue distributions, including via group savings to reduce reliance on third party financing.

Specific entry points for technical training and sensitization include:

- *Selective mining:* Identification and grading of different quality sand for specific products and markets. Training in selective extraction should be integrated with basic site planning and reclamation (progressive backfill, re-contouring, creation of wetland corridors and water management). Safe extraction methods (e.g. eliminating the practice of undercutting, dust exposure) require significant emphasis. A cost-benefit analysis of water pumps would be useful.

- *Beneficiation methods for selected products:* Demand for different sand grades differs depending on applications. Pre-sieving to yield finer grained or a narrower size range of sand (and remove organics and larger stones) should introduce manual and semi-manual methods (e.g. manual shaking screens). Those sites with low sand quality overall (e.g. due to high clay or iron oxide contents) could additionally assess viability of other types of dry gravity concentration methods although economic feasibility (and time requirements compared to benefits with respect to sale prices) should be integrated in any related training.

- *Loading Sand:* Risks of dust inhalation and silicosis is extremely high. Training should involve introduction of suitable PPE and considerable emphasis on development of on-site "by-laws" to ensure its use.

- *Marketing and Selling:* The current workforce seems to lack bargaining power and negotiation skills. Business skills training should map out pathways to acquisition of key assets that would markedly increase miners incomes (e.g. small lorries).

Stone Aggregate

Stone aggregates are stones that are crushed within specified size ranges in order to meet requirements of the construction sector, mainly for its use with cement in the production of

[115] Considerable work has been done in Uganda in order to develop technical criteria and specifications as needed to improve productivity and quality of brick products. Annex 10 of the companion "Baseline Assessment" report outlines a number of extremely specific reports and published research on this topic. Uganda's Small Scale Mining Handbook additionally provides less technically complex but specific guidance on means through which quantity and quality improvements can be met while addressing related environmental and occupational risks and impacts.

concrete. Stone aggregate is also used as ballast in road and railways and, in the case of much larger stones (e.g. 0.2-0.5 m diameter), is used as foundation stones, flooring and wall materials.

A variety of rock types are exploited throughout Uganda, with some variation depending on the scale of producers. ASM extraction is primarily of quartzite, slaty quartzite, sandstone, phyllite, pozzolanic ash and, to a lesser extent, much harder granite, granodiorite and gneiss. The majority of ASM production is from slightly to extensively fractured and/or relatively soft (e.g. phyllites) or weathered rocks better suited to manual exploitation. Large scale extraction – typically using explosives, blasting and mechanized means - is more commonly of much harder and often massive granitoids (syenitic granites, granodiorites) and, to some extent, quartzite, which are generally more likely to meet market specifications (e.g. hardness, compressive strength).

Figure 27: Hardcore produced from quartzite just off of the Entebbe-Kampala is hauled to this roadside point of sale and manually crushed prior to sale

Stone aggregate quarries are dispersed throughout the country, yet exploitation is most intensive around densely populated urban centers. At least 316 stone quarries can be found in a 150km radius of Kampala, where both industrial and ASM production takes place.

A number of other large, industrial quarries are also found throughout the country, many of which are temporarily developed to meet requirements of large road works or other infrastructure projects (e.g. hydropower dams).

Market Overview

As stone aggregate is a major constituent of concrete, market demand is steadily increasing (Section 3.1 and 3.2). In addition, stone aggregate also comprises road base and shall underlie the standard gauge railway as the government seeks to provide to access to safe, affordable, accessible and sustainable transport systems by 2030.

Production & Sales

Production was estimated at $6.77 million tonnes in 2015/16. [ASM $6.09 million; MSM: $0.677 million].

Estimates of total production were tied to official statistics on cement consumption and could consequently be an underestimate of production. Of greater significance to ASM, use in other applications mainly for residential and non-residential construction (as in foundation stones, walling materials) are excluded. With respect to MSM-LSM, use as road ballast and in the standard gauge railway are excluded.

Sales are valued at $64.7 million USD in 2015/16 [ASM: $58.2 million; MSM: $6.5 million USD]

The value of sales have been estimated based on, for MSM-LSM, officially reported production values (UGX per tonne) reported to DGSM and, for ASM, average ground sale prices for medium to coarse aggregate, which is most commonly used in cement

Imports & Exports

Imports **4,632 tonnes valued at $130,000 USD in 2016**[116]

Despite high production levels in country, Uganda imports some broken or crushed stone, mainly from Kenya and China. Given that the price per tonne of these commodities is roughly 3 times that of ASM ground prices, these could potentially be specialty stones (e.g. for use in epoxy countertops or tiles), however, this is uncertain.

Exports: **1,026 tonnes valued at $248,000 USD in 2016**[117]

Uganda exported some stone aggregates to its immediate neighbouring countries like Rwanda, Kenya etc. The value per tonne of these exports equates to more than 25 times that of the ASM ground price, again implying a specialty but unclear use of the product.

Trade Deficit: **$118,000 USD in 2016**[118]

Market Share

It is estimated that 90% of production is attributed to ASM and 10% is attributed to MSM[119].

Although a number of industrial stone quarries can be found, in particular on the outskirts of Kampala (e.g. Kireka, Mukono) and large quarries are commonly established in association with large civil works projects (e.g. roads), production estimates (and ASM's estimated share therein) are nevertheless tied to cement production, as described above.

ASM Stone Aggregate Value Chain

The different employment, economic, technical, environmental, occupational and social dimensions of the ASM value chain stone aggregate is presented in Table 11. This has been indexed to production by 1,000 stone quarry mineworkers in a one-year period and draws from estimates derived from ASM site field assessments and interviews with traders, SMEs and construction companies, with corresponding assumptions detailed in Box 1.

[116] ITC Trademap, 2016, http://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1|800|||25|||4|1|1|2|2|1|1|3|1

[117] ITC Trademap, 2016, http://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1|800|||25|||4|1|1|2|2|1|1|3|1

[118] ITC Trademap, 2016, http://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1|800|||25|||4|1|1|2|2|1|1|3|1

[119] Production estimates exclude those individual cases where extraction was for the sole purpose of glass sand. Total production estimates were derived from consumption needs tied to cement consumption statistics. One case of a foreign company undertaking industrial dredging of sand deposits for the purpose of export for glass sand production are excluded from these estimates and the VCA.

Main Steps in the Value Chain

Main steps in the ASM value chain for stone aggregate are summarized as follows:

- *Primary production level (Mine site):* Stone aggregate production involves generation of multiple products at various stages. During extraction, pickaxes, sledgehammers and other hand tools are used to break rock into large boulders (hardcore) or – if geologic conditions permit – slabs used as rough dimension stones (See Section 4.4). This is almost exclusively undertaken by men. Hardcore may be sold as foundation or wall material (at a lower price per weight) or value is added on-site via manual crushing. In many cases, those engaged in crushing purchase the boulders from those in extraction. Rock is crushed to various sizes (e.g. 2", ¾", ½", ¼") and sieved in the process (stone dust) resulting in several products from the site, that are piled according to size as buyers are awaited.

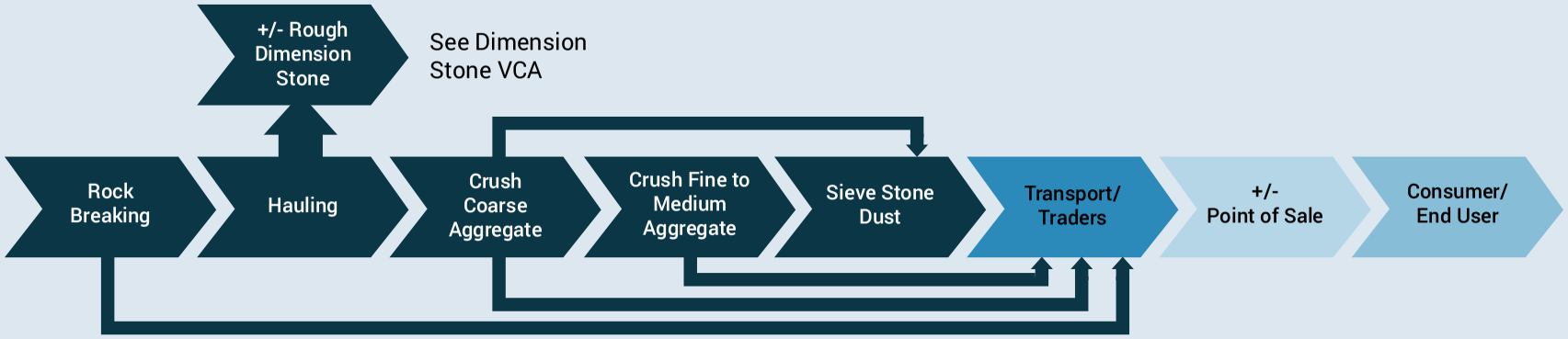
- *On-site Selling:* Most ASM sites are also points of sale (POS). Transporters are often also traders, many of whom rent (daily or weekly) their lorries although some work for others (e.g. construction companies). Traders sell mainly on order (e.g. on order from individual consumers, points of sale / SMEs or construction companies). The profit margins earned by these traders varies mainly depending on distance to market and ground sale prices, with price increases coinciding with reduced production in the rainy season.

- *Points of Sale/SMEs:* According to SMEs, selling stone aggregate via trading center or town based shops – mainly multi-commodity hardware shops – is not as lucrative as other commodities, such as cement or iron sheets. According to shop owners and traders, direct consumption from sites (mainly on order) by downstream builders (individuals or construction companies) rather than from off-site SMEs has become more common over the past 5 years. A number of roadside SMEs nevertheless sell stone aggregate but these are more likely to focus almost solely on Development Minerals products.

- *Construction SMEs:* These include the micro-enterprises and construction companies that use stone aggregate (together with sand and cement mix) for the production of concrete. Although several teams (micro-enterprises) may be sub-contracted depending on project size, micro-enterprises involved in concrete production are typically comprised of teams of 6-7 workers (1 skilled operator of the small cement mixer, 2 assistants ad 3-4 labourers sieving sand, hauling water and mix), who can mix and pour approximately 25 m3 of concrete per day. Profits are typically earned by the sub-contractor "owner" by charging a margin on labour and materials, typically on the order of 20-30%; however, smallest SMEs often earn revenues from wages alone (e.g. for smaller projects).

Table 11: Value Chain Analysis of ASM Stone Aggregate (based on production by 1,000 stone aggregate mineworkers over the period of 1 year)

ASM STONE AGGREGATE VALUE CHAIN



BUSINESS UNIT	MNE SITE			TRADER/ TRANSPORT[2]	SME[3]	CONSTRUCTION SME[3]
EMPLOYMENT	**1,000 (30% men; 70% women)**			**15**	**19**	**67**
Men (%)	95%	50%	21%	100%	54%	100%
Women (%)	5%	50%	79%	0%	46%	0%
ECONOMIC CRITERIA						
Revenues (USD/yr)	**344,898**			**193,569**	**10,464**	**931,710**
Sales	To Mine or Site Owners			To Traders[5]	To SME Owners[5]	To SME Owners[5]
Input Costs						
Labour	204,742 By production	tbd. Often but not always, unpaid. Done by rock breakers (selling) or crushers (buying) hardcore	135,007 Paid by production	44,542 Loading 91,369 Lorry Hire	611 5% Salaries	9,839,822 Salaries 200,684 Cement mixer, fuel
Tools, equipment	14,485 Hand Tools[1]		6,658 Hand Tools (hammers, basins)[1]	39,197 Fuel	523 5% Overhead	120,981,225 Sand, Aggr, Cement
Other	13,037 +/- Wood[1]		4,592 +/- Sieves[1]	4,751 Mainte-nance		15,772,608 10% Over-head
Taxes, Royalties, Rent	**13,363**			**1,866**	**277**	**7,065**
Description	Arrangements with landowners vary widely[4]			Est. 5% pay VAT, Income tax	Est. 10% pay VAT, Income tax	Est. 10% pay VAT, Income tax
Net Profits (USD/yr)	**30,558**			**51,040**	**9,576**	**55,049**

TECHNICAL Main Quality, Quantity and Efficiency Factors	No mine planning (benching, backfill), some selective mining, manual	Manual process.	Some selectivity (stone quality) but inadequate sizing (lack of standardization). Highly manual process.	Fairly efficient. Some carelessness can result in aggregate losses	Fairly efficient. Some carelessness can result in aggregate losses	Fairly efficient. Some carelessness can result in aggregate losses
ENVIRONMENTAL Main risks and issues	Land degradtion, no reclamation, some wood consumption (if burning rock during breaking). Potential siltation of rivers from run-off, dust dispersion.			Fossil fuel consumption. CO2 emissions.	Negligible	Negligible
OCCUPATIONAL Main risks and issues	Rock falls, dust, flying rock fragments, accidents with tools, heat stress	Heat stress. Exhaustion, spinal compression, muscle hardening.	Heat stress. Repetitive motion injuries and illness. Flying rock fragments. Accidents with tools. Exhaustion. Excess dust exposure. Lack of sanitation and hygiene)	Excessive dust exposure (load/unload)	Dust exposure during loading/unloading	Dust exposure, potential heat stress during constructoin.
SOCIAL Main risks and issues	Disturbance to other land users. Sigmataization of women's work.	Low paid, undervalued but back-breaking job	Under-payment, lack of bargaining capacity, low pay (esp. after deduction for purchase of hardcore), potential conflicts withother miners and landowners.	Exclusion of women from highest paying task (loading, unloading).		Exclusion of women from highest paying task.

Notes:
[1] Hand tools (pickaxes, sledgehammers, hammers etc) are paid by workers and so excluded from "operators" margins. At least 20% of sites also burn wood to expedite rock breaking (also paid by miner at a cost of roughly 30-35,000/p/mo)).
[2] 2. Assumes only 10% of bricks sold from a point of sale other than the site (or sourced by consumers from traders). Labour estimates assume that POS (other than site based) sells 15 tonnes of aggregate per week. Ave. POS employs employs 4 people.. Salaries est. based on GNI per capita but allocates only 5% due to multi-product of most POS (i.e. most are hardware stores and sell other products).
[3] Estimates for construction sector labour force, tax contributions, salaries and inputs excludes management and overheads based on interviews with small, medium and large building "contractors". Data pertains to those engaged in small concrete mixing and related construction. Ave. team ca. 6 per crew can produce 25m3 of concrete per day, ave. mix cement:sand:stone = 1:1.7:3.3 by weight. Assume only 10% of construction uses concrete mixers.
[4] Rent to landowner varies widely. At 25% of stone aggregate sites (where such data was openly provided) the average payment to landowners was roughly 5,000 per tonne.
[5] Revenues for traders and Points of Sale based on margin on sales. Construction SMEs typically earn profits via margins of 20-30% on salaries and materials. Many construction SMEs are assumed to be "micro" scale (i.e. hired but skilled labourers) thus margins estimated at 10% of salaries and materials.

Key Economic Findings

Based on assumptions and estimated developed in the stone aggregate VCA, main economic findings are summarized as follows:

- **The ASM stone aggregate value chain may constitute about 1% of GDP***:* If it were officially integrated within national statistics, estimated revenues generated at each step across the value chain amount to approximately 1% of the GDP in 2016[120]. As much of the downstream (construction) is reportedly already captured in official GDP statistics, excluding this final step, other steps in the value chain (from the mine site to the point of sale) would represent only a 0.1% increase to the GDP. Although lower than for clay bricks, when combined with clay, sand and dimensions stones, cumulative contributions are substantial.

The direct and indirect population relying on the ASM is much higher than for sand but employment multipliers are considerably lower. Based on the VCA, every job in ASM stone aggregate production amounts to only 0.1 additional jobs downstream, mainly due to the high labour intensity per production volumes required. Overall, however, given the size of the stone aggregate workforce and considering average household sizes (4.7) this would equate to roughly 1 million Ugandans (roughly 2.7% of the population[121]) may directly and indirectly rely on ASM stone aggregate value chains.

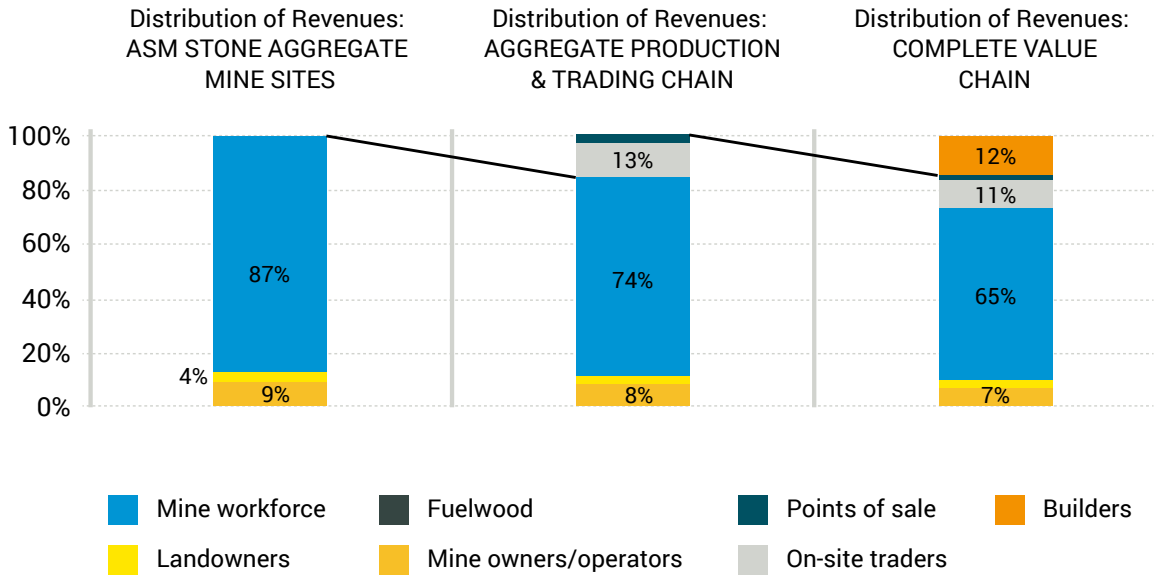
- **Cumulative economic contributions are high**. Every US dollar of ASM stone aggregate sales generates roughly an additional $3.2 dollars in the downstream economy[122]. Indirect multiplier effects (e.g. for non-mining related small enterprises) are likely to also be significant, particularly when wages and salaries of the workforce alone are considered. Excluding owners of mine sites, landowners and SME owners, workers salaries and wages are estimated on the order of $74 million USD per annum injected into local small businesses and used to meet family health, educational, food and other needs.

[120] Uganda's GDP in 2016 was $25.53 billion USD (see data portal at: https://data.worldbank.org/country/uganda). The percentage attributed to the ASM Stone Aggregate Value Chain is based on the total estimated gross revenue (sales) from each step (mine site, traders, POS, construction SMEs), which amounts to $249.9 million USD when accounting for estimated production of 6.1 million tonnes of aggregate produced by almost 170,000 stone quarry mineworkers.

[121] Based on estimated population projected of 36,860,700 persons (projected from the 2014 census as provided in the UBOS 2015 Statistical Abstract) and 4.7 persons per 212,885 Ugandans estimated to work across the stone aggregate value chain. Although this estimate does not account for immediately family members working together (e.g. at ASM sites or in SMEs), it likely underestimates the number of partial and full dependents per employed persons (i.e. this could easily exceed 4.7 if support to extended family is considered)

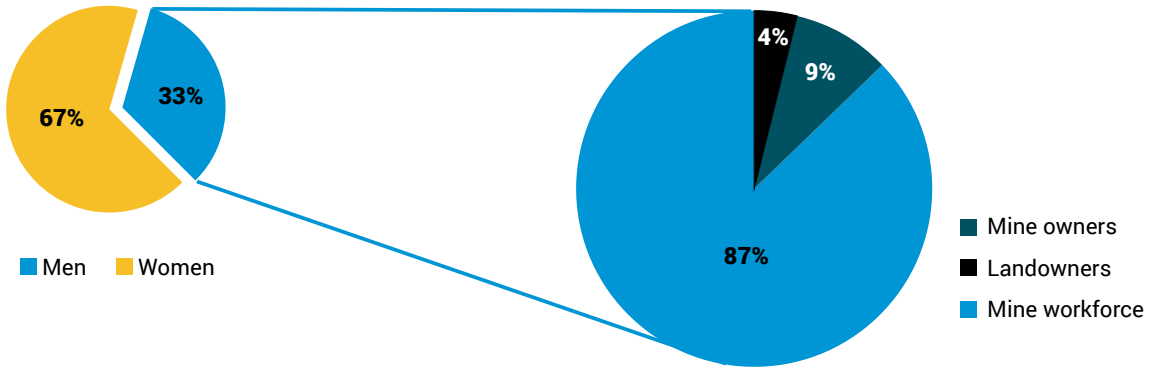
[122] Based on estimated gross revenues at various steps in the value chain.

Figure 28: Distribution of revenues between economic actors



Incomes of the majority workforce in stone aggregate production average approximately $350 per annum. However, due mainly to the gender divisions of labour and exclusion of women from higher paying tasks (e.g. in loading and kiln construction), women are estimated to earn, on average, 14% less than men, despite constituting ca. 70% of the workforce. These findings are more acute when gender participation and wages across the entire value chain are considered, particularly given women's low to negligible participation in concrete production and trade/transport. These results are particularly significant with respect to aims concerning the transformation of Development Minerals into a sector that more effectively facilitates wealth creation that is inclusive, which presumably also must include women.

Figure 29:: Distribution of revenues at an average ASM stone aggregate mine site.



Commodity-Specific Priorities for Value Chain Development

Many entry points apply to multiple Development Minerals value chains (including that for stone aggregate) and are highlighted the final section of the report. However, some critical issues are commodity-specific, as follows:

1. **Although the revenue shares accruing to mine owners/operators appears to be low, the share accruing to the ASM workforce is distributed across a large number of mineworkers**. Manual breaking, crushing and hauling of rock is an extremely labour intensive activity, with comparatively low productivity per mineworker (by tonnage) compared to sand. Although seemingly subject to less scrutiny by authorities, the organization of labour and need for agreements with landowners is similar to that observed for sand. Similar to sand, seasonality plays a key role in lost workdays per annum, and therefore low salaries when averaged across the dry and rainy seasons, while the risks (and costs) of occupational illness and injury also seem to be high.

2. **Traders play a key role, margins charged are high but individual net profits are far from excessive**. Beyond the mine site, margins charged by traders/transporters and points of sale typically ranging between 1-2.3 times the ground sale price, depending on the product. However, costs of transport are high and many any transporters/ traders must hire lorries at relatively high costs (often over $100 per week). When fuel, loading and maintenance costs are considered, monthly profits are typically much lower than for sand (averaging approximately $275/p/mo compared to about $600/p/ mo for sand). Traders incomes, however, are extremely variable, depending upon the season and increasingly, competition with other lorry drivers (reportedly affecting the number of trips taken per day). Off-site points of sale exist nearer to markets but, in particular for those paying rent for their space, are more likely to prefer products that yield higher margins but consume smaller areas. If groups of mineworkers were supported to acquire their own lorries, their incomes would increase appreciably.

3. **Many sites seem to wait long periods to sell products, suggesting over-production and lack of alternative market access**. Oversupply may be consistent with much lower rates of cost increases for aggregate (based on consumer price indices shown in previous sections). Linkages with local (e.g. district level) civil works projects may provide a means to increase access to a larger market but attention will be needed to standardization of products. Considerably variability was observed between different sites in terms of sizing, size homogeneity (e.g. within piles) and rock hardness.

4. **Access to finance for appropriate, intermediate technologies and technical assistance to optimize production, meet standards for local contracts, reduce labour intensity and, in particular, address dire occupational risks is needed.** As described in previous sections, the ACP-EU Development Minerals Programme in Uganda is doing extensive training of the ASM workforce, including in environmental, occupational and community health issues as well as in building business skills and supporting access to financing. Integrated approaches to training, including via collaboration with local and central government officials whose mandates involve such service delivery, would be useful in institutionalizing these training models for sustained progress in the future.

   With respect to technical, economic, environmental and occupational dimensions, training should address access to appropriate, intermediate technologies and methods, including:

   - *Basic geology, mine planning and extraction*: Safe extraction methods (e.g. eliminating the practice of undercutting, introduction of benching methods)

requires greatest emphasis given high fatality rates in stone quarries. Basic geology should also consider site planning based on different grades of rock and their differing product values (e.g. based on hardness). Use of rock breaking equipment (e.g. jackhammers) should be co-evaluated using a simple cost-benefit analysis approach that sufficiently accounts for related inputs (e.g. compressors, spares) and maintenance costs.

- *Beneficiation methods for selected products*: Simple semi-manual or small jaw crushers should be piloted and tested on-site during hands-on training. Emphasis in particular will be needed on who owns any equipment (and benefits derived from it) as introduction of crushers pose risks of virtually eliminating women from the workforce. Sizing requirements for different applications (e.g. structural cement versus mortar) and standardization of sizing through improved sieving methods would aid in achieving required size gradations as per national standards.

- *Environmental and Occupational Safety and Health Risks.* A comprehensive review of risks is provided in the companion Baseline Assessment Report. These issues should receive high levels of priority and should additional be reinforced through integration within business skills training (e.g. costs of reclamation, PPE) and organizational strengthening (e.g. development of on-site "by-laws" to ensure suitable measures are employed).

- *Marketing and Selling*: In addition to building awareness of value of products and strengthening negotiation skills, such training should also explore (or ideally pilot) skills needed to obtain local contracts for civil works and fulfillment of related requirements, including with respect to national standards and verification requirements. A strong collaboration with government partners, local mineworkers and project supporters (e.g. ACP-EU Development Minerals Programme) will be critical to success.

Figure 30: Although sieving is practiced at many sites, the size ranges within most products often do not adhere to national standards for different applications

Similar to approaches proposed for the other 3 focus commodities, training should heavily emphasize hands-on piloting of techniques, including those related to reclamation, use of PPE and maintenance of equipment and tools. Within this, the de-stigmatization of women's work in certain jobs (e.g. digging, loading) could be supported through advocacy, integration of gender

dimensions in related training (e.g. human rights, women's right to work, etc) and through preferential emphasis on women mine workers in hands-on and classroom training. In particular, any efforts to introduce mechanized methods should be scrutinized such that those persons likely to be impacted (e.g. through job losses) actually become beneficial owners of such equipment.

Dimension Stones

Dimension stones refer to slabs or blocks produced from natural stones that meet basic dimension requirements (length, width, thickness, shape) and suitable for use as rough or cut tiles, countertops, tabletops and similar applications. Uganda boasts a wide diversity of other rocks that are well suited for production of cut and polished dimension stones. These range from pink, grey, reddish, greenish and black granites to black, banded and foliated gneisses to pink and white marble, dolomite and limestones, among others[123]. Despite known occurrences of "specialty" types of rock, such as gypsum (alabaster) and massive talc (soapstone), it seems that these localities have not been assessed for the purpose of dimension stone production or are lacking adequate properties. Despite its high value as a dimension stone, travertine marble at Dura in Kamwenge District is currently being exploited for cement production.

A large number of ASM stone aggregate quarries in Uganda also produce dimension stones, particularly when rocks are strongly foliated and layered, allowing for production of fairly thin (2-10cm thick) slabs. Just under half (42%) of stone quarries assessed produced dimension stones alongside hardcore and aggregate of different sizes, with main rock types including slaty quartzite, phyllite, sandstone and, in one case, a banded gneiss. Only a fraction of ASM quarries seem to produce dimension stones. Most of these exploit extremely soft, fissile and comparatively less durable and lower value mudstone/siltstone type rocks that are completely unsuited to aggregate production (and questionable for dimension stone applications). These production sites appear to be quite small, such as that found along the Lyantonde-Mbarara Road in southwest Uganda.

Market Overview

The market for dimension stones is increasing at a remarkable rate as banks, shopping malls, hotels, homes, government buildings and other structures are using dimension stones for a range of uses. Dimension Stone materials can execute both structural and decorative architectural functions in building and construction as well as in internal decoration and landscaping projects. The growing popularity and commercial value of dimension stones is attributed to their characteristics such as durability, longevity, easy maintenance, permanence and artistic elegance. Despite growing demand for cut and polished stones, particularly in association with the growing middle to upper class, a major portion of the Ugandan market continues to be for rough, uncut and unpolished stones, most commonly used for construction of pathways, decorative facing of houses and border walls.

Production & Sales

Production was estimated at 1.5 million tonnes in 2015/16 (all attributed to ASM).

Proximity of deposits to markets, ease of obtaining blocks or slabs (i.e. due to natural foliation or layering) and to some extent durability and hardness (except for mudstones/siltstones) seem

[123] Kato, V. 2008.

to be more significant factors in selection of dimension stones for ASM extraction rather than properties such as colour, texture, surface finish and chemical resistance. Although the market is growing, only a small percentage of ASM dimension stones are cut into tiles, mainly in the Kampala area, while the remainder are "naturally sized", rough edged blocks and slabs used mainly for walkways, exteriors and compound walls. Although some MSM extraction is reported (see Market Share, below), this is not licenced under the current mining legislation and as such official production figures could not be obtained.

Sales are valued at $8.9 million USD in 2015/16.

The value of sales was derived from reported ground prices at ASM sites assessed.

Imports & Exports

Imports **284 tonnes valued at $49,000 USD in 2016**[124]

Since the dimension stone industry is still in its infancy stage, Uganda mainly depends on imported dimension stones from countries like South Africa

Exports: **58 tonnes valued at $39,000 USD in 2016**[125]

Low quantities of fairly shaped sandstone, granite and slates were the major dimension stones exported by Uganda in 2016.

Trade Deficit: **$-10,000 USD in 2016**[126]

Market Share

All rough dimension stones are attributed to ASM; all cut and polished stones are attributed to MSM.

Despite a growing number of cutting and polishing companies importing blocks of granite, marble and slate into the country, medium to large scale, semi-mechanized or mechanized production is limited to a few quarries cutting blocks of granite, sericite schist, amphibolites, sandstones

Figure 31: Rough, uncut slaty quartzite at a roadside point-of-sale along the Soroti-Mbale Road

[124] ITC Trademap, 2016, http://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1|800|||25|||4|1|1|2|2|1|1|3|1
ITC Trademap, 2016, http://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1|800|||25|||4|1|1|2|2|1|1|3|1

[126] ITC Trademap, 2016, http://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1|800|||25|||4|1|1|2|2|1|1|3|1

and meta-sandstones.[127] Marble deposits in Karamoja were briefly exploited until recently by a small- to medium-scale company prior to management issues halting operations.

Importantly, a number of MSM operators also produce and sell cut (but unpolished) stones as per consumer demands. Such demand is likely to grow in centers beyond Kampala where, in the case of ASM, the small number of SMEs engaged in cutting (but not polishing) are situated. As equipment is quite straightforward (Box 6), this alludes to an important opportunity for up-country producers.

ASM Dimension Stone Value Chain

The different employment, economic, technical, environmental, occupational and social dimensions of the ASM value chain for dimension stones are presented in Table 12. This has been indexed to production by 1,000 dimension stone quarry workers in a one-year period and draws from estimates derived from ASM site field assessments and interviews with traders, SMEs and construction companies, with corresponding assumptions detailed in Box 1.

Main Steps in the value chain

Main steps in the ASM value chain for dimension stones are summarized as follows:

- *Primary production level (Mine site):* ASM rough dimension stones production involves use of prybars, wedges and hammers to break slaty or foliated "layers" of rock into large slabs. In few cases (e.g. Laroo Stone Quarry in Gulu), manual line drilling and use of rock wedges are used to remove stone in larger blocks (Box 6), which are then manually broken into large tiles. Although few women do work in extraction, this is almost exclusively undertaken by men. When dimension stone is the primary product at a site, smaller fragments may also be sold as aggregate.

- *On-site Selling:* Most ASM sites are also points of sale (POS). Transporters are often also traders, many of whom rent (daily or weekly) their lorries although some work for others (e.g. construction companies). Traders sell mainly on order (e.g. on order from individual consumers, SMEs or construction companies). Profit margins earned by traders vary mainly depending on distance to market, ground sale prices and, to some extent, higher prices with lower rainy season production.

- *Points of Sale/SMEs:* Off-site selling of rough dimension stones seems to be more common than for stone aggregate and sand, likely as a consequence of its higher value-to-volume ratio. As for the other focus commodities, these are mainly found at road-side SMEs, in many cases with other Development Minerals products, while local multi-commodity hardware shops are increasingly focused on other commodities that yield higher returns per volume. As ASM producers venture into cut (and ideally) polished products, they may also expand into more "shop based" sales, as found for cut and polished MSM products.

[127] Granite block production by Building Majesty is the only extraction site licenced according to the Mining Act (2003). One major stone tile manufacturer reports also sourcing granite, marble, venturine, quartzite, amphibolites and sandstone from Mukono, however, marble and venturine are not known to be found in the area and these (as well as the other stones) may actually be sourced from elsewhere.

Table 12: Value Chain Analysis of ASM Dimension Stone (based on production of rough dimension stones by 1,000 stone aggregate mineworkers over the period of 1 year)

ASM ROUGH DIMENSION STONE VALUE CHAIN	Rock Breaking	Hauling Sizing & Piling	Transport/ Traders	+/- Point of Sale	Consumer/ End User
BUSINESS UNIT	MNE SITE		TRADER/TRANSPORT[2]	SME[3]	CONSTRUCTION SME[3]
EMPLOYMENT	**1,000 (90% men; 10% women)**		**52**	**62**	**19**
Men (%)	90%		95%	54%	90%
Women (%)	10%		5%	46%	10%
ECONOMIC CRITERIA					
Revenues (USD/yr)	**294,470**		**677,280**	**139,115**	**308,796**
Sales	To Mine or Site Owners		To Traders[5]	To SME Owners[5]	To SME Owners[5]
Input Costs			59,912 Loading		11,692 Salaries
Labour	169,547 By production		319,529 Lorry Hire	8,225 20% Salaries	245,638 Cement, sand
Tools, equipment			52,722 Fuel		
Other	94,899 Pickaxes, etc[1]		63,906 Maintenance	27,823 20% Overhead	30,880 10% Overhead
Taxes, Royalties, Rent	**3,654**		**6,472**	**3,472**	**2,342**
Description	Arrangements with landowners vary widely[4]		Est. 5% of traders pay VAT, Income tax	Est. 10% of SMEs pay VAT, Income tax	Est. 5% of SMEs pay VAT, Income tax
Net Profits (USD/yr)	**121,269**		**227,462**	**127,418**	**18,245**

TECHNICAL Main Quality, Quantity and Efficiency Factors	Inadequate consideration of hardness, colour, texture, durability.	Virtually no beneficiation, majority are rough stones.	Fairly efficient. Careless loading and unloading can result in breakage and value loss	Fairly efficient. Careless loading and unloading can result in breakage, losses	Skill in breaking to fit is variable.
ENVIRONMENTAL Main risks and issues	Land degradion, no reclamation, potential siltation of rivers, dust dispersion.		Fossil fuel consumption. CO2 emissions.	Negligible	Negligible
OCCUPATIONAL Main risks and issues	Rock falls, dust, flying rock fragments, accidents with tools,	Heat stress. Exhaustion, spinal compression, muscle	Dust exposure (loading/unloading truck).	Dust exposure (loading/unloading truck).	Dust exposure, potential heat stress.
SOCIAL Main risks and issues	Disturbance to other land users. Exclusion of women.	Disturbance to other land users. Exclusion of women.	Exclusion of women from highest paying tasks (loading, trading)		Marginal participation of women from highest paying task.

Notes:

[1] Hand tools (pickaxes, hammers etc) are paid by workers and so excluded from "operators" margins.

[2] Assumes 20% of dimension stones are sold from a point of sale other than the site (or sourced by consumers from traders). Labour estimates assume that POS (other than site based) sells three 6-tonne lorries of dimension stone per week. Ave. POS employs employs 4 people.. Salaries est. based on GNI per capita but allocates 20% due to multi-product of most POS (notably, most dimension stone POS are less likely to be hardware store-type SMEs, more commonly “specialized” road side POS.

[3] Estimates for construction sector labour force, tax contributions, salaries and inputs excludes management and overheads based on interviews with small, medium and large building "contractors". Estimates pertain to those engaged in sizing and laying (with mortar) rough dimension stones. Ave. team ca. 3 persons can install ca. 25m3 of dimension stones per day, requiring roughly 180 kg of cement and 1.7 tonnes of sand.. Assume only 10% of construction uses concrete mixers.

[4] Rent to landowner varies widely. Estimates derived from those found a stone aggregate sites (only 25% of stone aggregate sites where such data was openly provided, the average payment to landowners was roughly 5,000 per tonne.

[5] Revenues for traders and Points of Sale based on margin on sales. Construction SMEs typically earn profits via margins of 20-30% on salaries and materials. Many construction SMEs are assumed to be "micro" scale, margins est at 10% of salaries and materials.

- *Construction SMEs:* These include the micro-enterprises and construction companies that construct pathways, decorative facing stones and for other purposes, in many cases using mortar much like that used for bricklaying. Although several teams (micro-enterprises) may be sub-contracted depending on project size, those involved in rough stone laying are typically comprised of teams of 3 workers (1 skilled operator, 2 assistants), who can lay about 25 m3 of rough dimension stones per day. Profits are typically earned by the sub-contractor "owner" by charging a margin on labour and materials, typically around 20-30%; however, smallest SMEs often earn revenues from wages alone.

Key Economic Findings

Based on previously elaborated estimated developed for the rough, uncut dimension stone VCA, main economic findings are summarized as follows:

- **The ASM dimension stone value chain supplements GDP contributions of other Development Minerals.** If it were officially integrated within national statistics, estimated revenues generated at each step across the value chain amount to only about 0.2% of the GDP in 2016[128]. Unlike other focus commodities, contributions in the downstream are comparatively minor, accounting for only about 3% of the total gross revenues.

- **The direct and indirect population relying on the ASM is much higher than for sand but employment multipliers are considerably lower.** Based on the VCA, every job in ASM rough dimension stone production amounts to only 0.1 additional jobs downstream, mainly due to the high labour intensity per production volumes required. Overall, however, given the size of the workforce across the value chain (about 34,000 in total) and considering average household sizes (4.7) this would equate to roughly 160,000 Ugandans (roughly 0.4% of the population)[129] may directly and indirectly rely on ASM rough dimension stones value chains.

- **While not as massive an economic contributor as other focus commodities, the rough dimension stones value chain adds to the economic contributions of ASM Development Minerals**. Every US dollar of ASM rough dimension stones sales generates roughly an additional $3.8 dollars in the downstream economy[130]. Indirect multiplier effects (e.g. for non-mining related small enterprises) are likely to also be significant. Excluding owners of mine sites, landowners and SME owners, workers

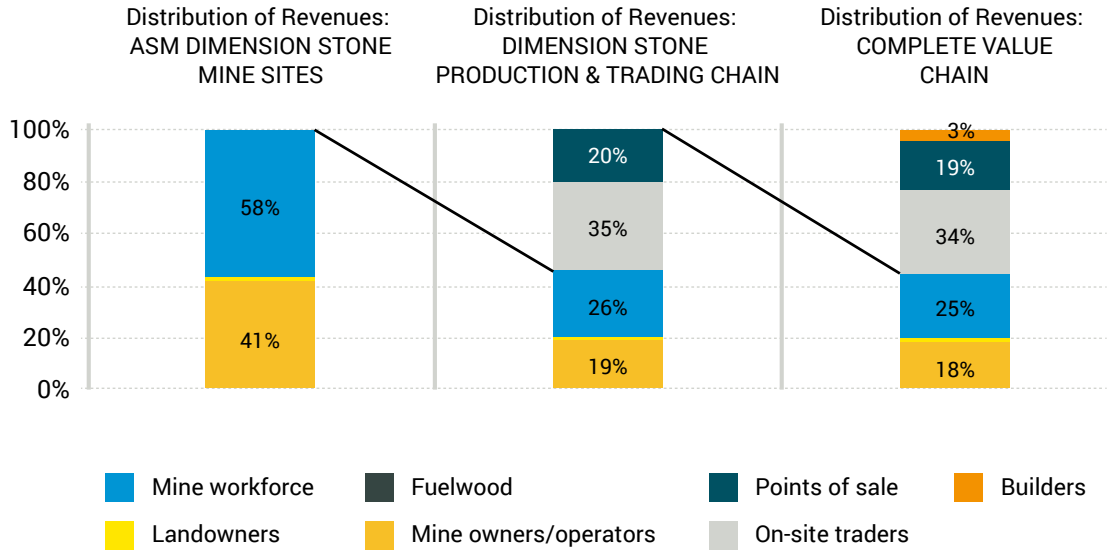
[128] Uganda's GDP in 2016 was $25.53 billion USD (*see data portal at:* https://data.worldbank.org/country/uganda). The percentage attributed to the ASM Rough Dimension Stones Value Chain is based on the total estimated gross revenue (sales) from each step (mine site, traders, POS, construction SMEs), which is estimated at $42.7 million USD when accounting for estimated production of 1.5 million tonnes of aggregate produced by about 30,000 stone quarry mineworkers.

[129] Based on estimated population projected of 36,860,700 persons (projected from the 2014 census as provided in the UBOS 2015 Statistical Abstract) and 4.7 persons per 34,000 Ugandans estimated to work across the rough dimension stone value chain. Although this estimate does not account for immediately family members working together (e.g. at ASM sites or in SMEs), it likely underestimates the number of partial and full dependents per employed persons (i.e. this could easily exceed 4.7 if support to extended family is considered)

[130] Based on estimated gross revenues at various steps in the value chain.

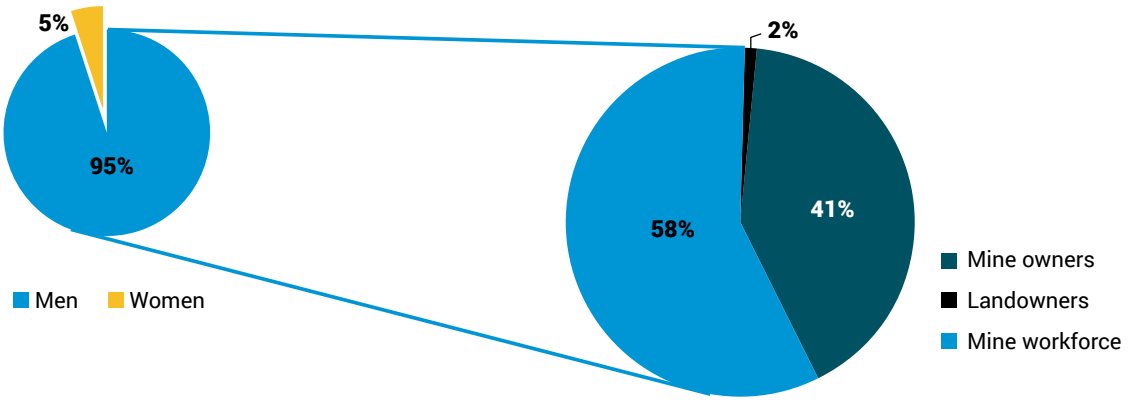
salaries and wages are estimated on the order of $7.5 million USD per annum injected into local small businesses and used to meet family health, educational, food and other needs.

Figure 32: Distribution of revenues between economic actors



Incomes of the majority workforce in stone aggregate production average approximately $170 per annum, however, this average accounts for sharp drop-offs in production in the rainy season and, importantly, co-production with stone aggregates, estimated to account for 90% of ASM rough dimension stone production (thus these incomes in effect supplement incomes of mainly men engaged in stone aggregate at about 40% of those production sites). As such, estimates of men's incomes in such scenarios account for time allocated to extraction of stone aggregate compared to rough dimension stones and consequently are slightly higher for 40% of the aggregate workforce than that presented in previous sections.

Figure 33: Distribution of revenues at an average ASM Dimension Stone Site.



This means that, because dimension stone production is dominated by men, then their incomes are actually considerably higher than those earned by women. Based on field estimates of incomes from dimension stone production *alone,* women are estimated to earn 5% of revenues

yet comprise an estimated 10% of the workforce. Similar disparities in trade and sales are found as for the other 4 focus commodities. However, women reportedly are more likely to engage in laying rough dimension stones (ca. 10% of the workforce), than for bricklaying and concrete mixing, which reportedly employs a negligible number of women.

Commodity-Specific Priorities for Value Chain Development

Many entry points apply to multiple Development Minerals value chains (including that for dimension stones) and are highlighted the final section of this report. However, some critical issues are commodity-specific, as highlighted below:

1. **Mine owners/operators appears to be earning a higher margin on dimension stones than for stone aggregate yet margins earned by traders are the highest of all focus commodities.** Although the primary production workforce is quite large (ca. 30,000 mineworkers) and productivity per mineworker (by tonnage) is relatively low, the value of rough dimension stones is surprisingly quite low at many production sites (averaging ca. $6 per tonne). Margins earned by traders can be extremely high, averaging 4.2 times the ground price. Some traders reported inconsistency of market and lack of demand, particularly compared to sand and stone aggregate, as a factor in charging such margins although their profits estimated to be about 25% higher when they do haul dimension stones. A factor may be longer loading times and difficulty obtaining orders sufficient to fill one lorry, thus consistent with idle stockpiles of dimension stones found at some quarry sites. Lack of awareness of downstream sales prices, the fact that dimension stones are often a "by-product" of aggregate (thus it is, in effect, a supplement to that income) may be additional factors in the low ground prices.

2. **Many sites seem to wait long periods to sell products, suggesting over-production and lack of alternative market access**. As for stone aggregate, linkages with local (e.g. district level) civil works projects may provide a means to increase access to a larger market but attention will be needed to obtaining fair prices for products.

3. **Access to finance for appropriate, intermediate technologies and technical assistance to optimize production, diversify products and understand market demands provides a critical entry point.** Capacity building is needed in multiple areas, with main environmental, occupational and organizational risks and issues being similar to those found for stone aggregate, as described in the previous section. The nature and specific market for dimension stones, however, presents unique opportunities that should be the focus of training and technical support, including those summarized below:

    - *Basic geology, mine planning and extraction*: In addition to safe extraction methods, systematic planning (benching, hauling, etc) and related environmental management needs, an increased focus on geologic parameters affecting product price is needed. Current ASM extraction is mainly determined by the presence of layered structures in rock. Skills to identify and other selection criteria (e.g. colour, hardness, acid resistance, etc) will be needed to penetrate other markets.

    - *Beneficiation methods for selected products*: Introduction of small cutting machines to shape rough stones (e.g. into squares and rectangular tiles) is an obvious point

of transition for current producers (Box 6). Given that women have largely been excluded from rough dimension stone value chains, preferential support and training should be given to them, and/or women-run mineworkers associations, in order to redress this imbalance.

- *Marketing and Selling*: In addition to building awareness of product value and strengthening negotiation skills, such training should also build skills needed to market different products at different prices. More direct links with local sellers or consumers (e.g. construction sites) could be sought and, potentially through small, repeat financing (e.g. via mobile money based loan services), short term loans could be obtained to hire lorries for transport rather than sell on-site. This would represent a major increase in the incomes of those engaged in these activities.

BOX 6: ASM CUTTING AND SHAPING OF DIMENSION STONES

This study found that the vast majority of dimension stones producers were not cutting or shaping the stones they produced, but selling them 'rough'. Only in some areas around Kampala was the cutting into rectangular and square tiles observed while cutting and polishing is solely done by MSM enterprises. Technical capacity building and the enabling of ASMs to purchase equipment is needed. Below, the process of dimension stone cutting is described:

Cutting blocks or slabs[131]

- A series of holes is drilled in line along natural layers to be split using a chisel.
- Wedges are put into all holes and then each is hit with a sledge hammer resulting into a crack along the line.
- Wedges are removed and a pry bar is inserted into the crack to split the rock open.

Cutting of tiles from natural stone:

- Mark the stone tile block with a lead or grease pencil.
- Set the stone tile against the fence on the sliding saw bed and line up the diamond blade with the cutting mark.
- Turn on the saw and wait for water to flow over the blade.
- Hold the tile on both sides of the cutting line and slowly feed it into the blade.
- As the cut nears completion, gently push the two halves of the tile together to prevent the tile from breaking before the cut is complete.
- When the cut is complete, carefully slide the bed and cut tile back toward you until the tile is clear of the blade.

Polishing and finishing dimension stones
A range of finishing applications exists, and each uses specific types of equipment to accomplish the resulting appearance. Polished, honed, thermal, diamond sawed, rough sawn, and brush hammered finishing are frequently used to add value to the tiles. However, all these methods are expensive requiring specialized machines and skilled labour which may not be afforded by many artisans. Further research is warranted.

[131] **MEMD**, (2008), "Small Scale Mining Handbook: A Guidebook for Improving the Performance of Artisanal and Small Scale Miners in Uganda", New Vision Commercial Printers publ., 196p.

Conclusions and Recommendations

This study sought to better understand the magnitude of the Uganda's Development Minerals sector and its potential to support the fulfilment of Uganda's short, medium and long-term development goals. With a focus on four commodities produced by ASM operators (clay bricks, sand, stone aggregate and dimension stone) and their value chains, this work sought to understand the numerous factors that drive the incentives, growth and competitiveness of the Ugandan Development Minerals sector in order to provide a basis for specific recommendations to enhance value chain performance. Main conclusions and recommendations are summarized below.

Conclusions

Development Minerals are, by no means, "Low Value Minerals", they are in fact "High Value" for Development Outcomes. When both the value of primary production and downstream macro-economic contributions are considered, the significance of the Development Minerals sector, and ASM production in particular, is remarkable. Based on estimates provided herein:

- ***When the full value chains are considered – from production of ASM clay bricks, sand, stone aggregate and rough dimension stones to their use in construction – the total value equates to almost 6.5% of the GDP.*** When gross margins earned in the downstream – by traders, local SMEs and small construction enterprises (e.g. bricklayers, concrete) are considered in addition to local sales prices, cumulative value amounts to an estimated 1.6 billion USD per annum. Economic multiplier effects of ASM production are substantial, ranging from $3.2 to $20.6 generated in the downstream for each dollar generated in upstream production. When construction is excluded, contributions from these commodities and their trade drop sharply, but nevertheless represents an increase to the current GDP on the order of 1.9%.

- ***Almost 6.8% of the population, approximately 2.5 million Ugandans, is estimated to rely on these ASM Development Minerals value chains.*** Downstream employment multipliers from focus commodities ranged between 0.1 jobs in the downstream created by 1 job in ASM production of stone aggregate and dimension stone to 0.4 for clay bricks and 5.7 for sand. Cumulatively, total employment from these value chains is estimated at just over 530,000 jobs. When considering an average household size (4.7), this amounts to almost 2.5 million Ugandans.

- ***ASM Development Minerals is undoubtedly an important catalyst for local economic development.*** Employment and economic multipliers associated with lateral inputs (e.g. wood, tools) and other micro- and small-enterprises undoubtedly expand economic contributions further. Incomes of the workforce alone (mineworkers, SME employees, bricklayer and those engaged in concrete mixing in pouring) are estimated at almost $170 million USD annually injected into local economies and used to send children to school, meet health needs, improve living conditions and invest in agriculture and other sectors.

Future demand of Development Minerals commodities is strongly tied to the strength of the national economy and growth (and the purchasing power) of the population. Although GDP growth continues to be strong and macro-economic stability is regarded as positive, recent declines in

GDP per capita seems to have translated to reduced purchasing power of the population, with the poorer segments of the economy, those most reliant on low-cost ASM Development Minerals for construction, appearing to be hardest hit. Although this seems to be somewhat counterbalanced by high population growth rates, and thus demand for low cost ASM products overall, should this trend continue, a slowdown in demand for construction goods, particularly within residential and non-residential construction, is considered highly probable.

This may be particularly relevant if greater numbers of the population enter the ASM workforce, potentially resulting in over-production and reduced prices and therefore incomes (as suggested for stone aggregate and dimension stone). Climate change may increase such risks further, although ASM Development Minerals are also positioned to help build the adaptive capacity of most vulnerable farmers to adapt, including through provision of agro-minerals and opportunities for livelihood diversification.

Entry into new markets, such as that provided by government civil works investments or products demanded by the growing middle-to upper class, will depend on whether ASM operators and other SMEs understand and have adequate capacity to meet the needs of and compete within these markets. Access to financing and equipment alongside targeted training and mechanisms for sustained support will be critical.

- Substantive devaluation of the Ugandan shilling relative to the US dollar (over 60% since 2010) means that imported equipment is likely to be prohibitively expensive for most artisanal producers. Thus an emphasis on locally fabricated, low-cost intermediate and appropriate ASM technologies is warranted and support to local fabricators increase spin-off benefits from the sector even further.

- With respect to financing models, bank interest rates are extremely high but a number of initiatives are well suited to the needs of ASM and SME entities. Needs vary from small machines expected to cost between $3000 to $8000 USD to funds needed to finance certain facets of production, thus enabling mineworkers to substantially increase their low incomes.

- With respect to large capital inputs, the African Guarantee Fund For Small And Medium-Sized Enterprises (Box 3) can play a critical role in negotiating reduced lending rates, among other benefits, through existing institutions. Savings and loans schemes implemented by telecom companies using mobile phone networks provide amounts and time frames that may, for instance, help brick producers finance wood purchases and sustain production until sales or provide a basis for stone quarry operators to hire their own lorries and thereby obtain the large margins on sales currently earned by on-site traders.

- Contracts to supply civil works projects, in particular, is extremely competitive and bureaucratically demanding and therefore typically the domain of large foreign and domestic entities. ASM operators may, however, gain a foothold particularly in local government tenders, particularly if mechanisms to help facilitate this process and fill capacity gaps are undertaken. Fulfillment of national standards and specifications for quality and quantity shall be critical, requiring both intensive strengthening of technical and business/management capacity as well as a linkage with the National Bureau of Standards for verification purposes.

- The ACP-EU Development Minerals Programme in Uganda provides an excellent model involving capacity building of ASM stakeholders and downstream SMEs throughout the country. Topics have ranged from enterprise skills and market analysis to investment promotion and value addition to environment and occupational health and safety, among others. As found throughout the value chain analysis of the 4 focus commodities, the evolution of the sector will also hinge on specific, targeted training on critical technical topics from production level to value added opportunities and the needs of the sector shall likely extend beyond project timelines, calling for greater emphasis on institutionalization of support to the sector, as described below.

Frameworks and institutions governing ASM Development Minerals are positioned to substantial support realization of the sector's full potential. Models provided by the national Competition Policy and Local Content Policy for the Standard Gauge Railway hold promise but more targeted, ASM appropriate strategies can be integrated within the currently reviews of the minerals sector framework. Entry points range from licencing and mineral promotion to planned ASM-specific regulations on environmental and occupational safety and health to downstream value addition. Given statistics touted above, an imbalanced emphasis on tax collection poses risks of increasing vulnerability of mainly poor mineworkers further, particularly if mechanisms for long-term support to the sector are not mandated in law. The massive refugee population in Northern Uganda, as an example, highlights a specific gap in the current policy, particularly given that many are likely into ASM Development Minerals production but may be characterized as "illegal".

Many of the constraints and opportunities associated with ASM Development Minerals relate to current organizational structures on sites and across value chains. ASM is often viewed to be best suited to operate in the form of a "cooperative" In the case of ASM production of clay bricks, sand, stone aggregate and dimension stones, the current organization of labour and distribution of revenues therein can be better likened to: (i) an SME or small company (in the case of small sites with a single financier or owner) or (ii) an umbrella organization that oversees and exerts some controls over a large number of individually or group owned micro- and small enterprises and individuals (in the case of large sites). This is clearly evidenced by the distribution of revenues at mine sites and low incomes of the majority workforce found in analysis of the four target value chains.

As found for other commodities where similar labour arrangements have been observed (e.g. gold or tin, tantalum and tungsten), requirements to form cooperatives often entrench power inequalities further by legitimizing the current structure. Specifically, cooperatives are often at risk of "elite capture" wherein those holding positions of influence (e.g. landowners, pit owners, site supervisors or financiers) become cooperative leaders and members and the broader workforce, although they may be de facto members, do not necessarily exert any greater influence or yield greater benefits than before. In the case of gender inequalities, such scenarios may actually entrench inequalities further, particularly if cooperative leadership is primarily comprised of men who are position to operationalize their own biases about acceptable roles for women in the ASM workforce and power structure. In such a scenario, efforts to mechanize and thereby "improve operations" often consolidate financial benefits further in beneficial owners, in many cases resulting in job losses for the most vulnerable workers on site, often women, the elderly and disenfranchised youth.

The approach to ASM organization formation and strengthening is therefore critical. Where an operation is more suited to an association-type of structure, intensive efforts must be made to ensure institution of democratic processes, including for election of leaders, transparent decision-making and fair models for the distribution of benefits. Targeted efforts are typically needed to ensure voice, representation and meaningful participation of women and other vulnerable mineworkers. Where an ASM operation is better suited to an SME or small company model (which is the case in some scenarios), as increased benefits accrue to "leadership" or beneficial owners of an operation, much like a small company, so should increased responsibilities, including for environmental, occupational and labour conditions.

Indeed, the outcomes of these processes shall ultimately determine whether Development Minerals achieve their full potential as an engine for inclusive and gender-responsive development, wealth creation and Uganda's aim to become an upper middle-income country by 2032.

Recommendations

A number of specific recommendations have been integrated throughout the market study and value chain analysis. The following are summarized key recommendations. These are suggested to be taken together with those put forward in the companion *Baseline Assessment of Development Minerals in Uganda* report as, together, they provide more cohesive strategic guidance for the sectors evolution.

- **A National ASM Development Minerals Strategy**, ideally harmonized with the Buy Uganda Build Uganda competition policy and introduction of necessary measures within minerals sector reforms. This should outline commodity specific strategies for Development Minerals value addition by ASM operators and downstream SMEs, many specific components of which have been highlighted herein. Other components are incorporate recommendations provided below and thereby provide a more comprehensive framework for action.

- **Focus technical interventions in critical and commodity-specific areas that will increase the quality and quantity of products and therefore profitability of ASM operations.** Technical training topics have been identified in a number of areas throughout the VCAs, including with a heavy emphasis on de-stigmatization of women's work in higher paying jobs. Targeted intervention on specific areas is also warranted. In the case of clay bricks, an emphasis on optimizing brick production methods and reduced reliance on firewood is needed. Stone aggregate requires greater scrutiny to sizing while dimension stones training should emphasis source material selection and, as an easy "step up", introduction of cutting machines. Pilot technologies, such as artisanal glass production and diversification of ceramics (including in order to help redress the trade deficit) should be explored through collaborations with DGSM and technical institutes in academia. In all cases, closer coordination with NBS and bridging gaps between labs conducting standards verification and testing is needed.

- **Bridge gaps between ASM producers, downstream users and consumers and intermediary support institutions.** The ACP-EU Development Minerals Programme in Uganda has already made great strides in this direction, including in building capacity of ASM operators to understand the market. Further engagement with organizations involved in promotion of domestic and/or foreign markets and other forms of support to SMEs (as outlined in the Baseline Assessment report), is needed. Sponsorship for participation in trade fairs, networking events and evolution towards regional and perhaps national ASM organizations or federations should be explored.

- **Develop mechanisms to increase sourcing from ASM suppliers.** Commitments for local content and institutional to build requisite capacity of and support procurement from ASM operators in particular. The Local Content Strategy for the Standard Gauge Railway provides a good model but bridging gaps between the requirements of consumers (including in government) and producers and firmer commitments (e.g. minimum percentages supplied by ASM producers, women-led or women-owned SMEs) will also be needed to catalyze the sectors transformation and ensure that resulting development is truly inclusive.

- **Review of fiscal mechanisms to increase competitiveness.** This may range from deductions for those sourcing from ASM suppliers (labelled as "ASM Uganda approved" or some other means of verification) to zero-rated tax on imports of ASM machines to lower royalty rates for those producing under and ASM licence.

- **Pilot and evaluate a basket of strategies for low-cost financing.** In addition to the AGF, described above, a number of approaches could be piloted and introduced to ASM and SME operators. For example, savings and loans schemes using mobile phone networks can be tested with brick producers struggling to sustain production or stone quarry operators wishing to hire lorries and seek a higher revenue share. Establishment and building capacity of "Mining Desks" at willing local banks and MFIs could be set-up in areas of highly concentrated activities.

- **Ensure training further emphasizes formation and strengthening of more inclusive and gender-responsive organizations and the empowerment of women in particular.** The aims of the Government of Uganda and the ACP-EU Development Minerals Programme are first and foremost about empowerment. Ensuring that wealth creation and development is inclusive will ultimately depend on how and to whom different opportunities are extended. The Programme has already thoughtfully worked with this in mind and such a model should be integrated within approaches by Government through its sustained, long term support for advancement of ASM Development Minerals in the country.

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Annexes

Annex 1: Definitions of Mining by Scale

Definitions for artisanal and small-scale mining (ASM), medium scale (MSM) and large scale (LSM) mining differ widely by context, commodity and country, with no universally accepted distinctions between them. Although useful, these traditional labels can also be deceptive. For example, in terms of employment and overall production, for example, the ASM sector in most countries would certainly be classified as 'large-scale'.

Some of the distinguishing characteristics of the various scales of mining, and, where relevant, have been tailored to the Development Minerals sector. Boundaries between these categories are relatively blurred but the general "trend" in terms of differences provides some insight (Fig. 34). In general:

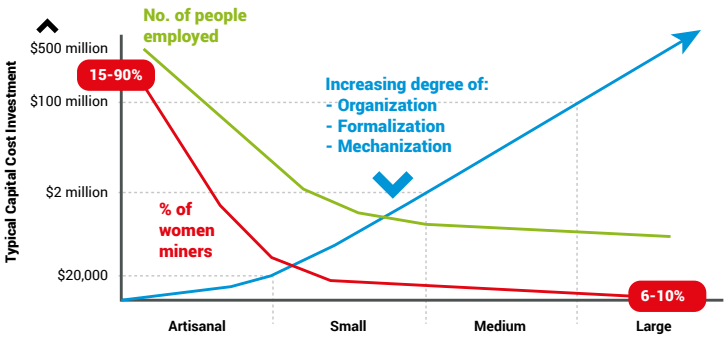


Figure 34: General Differences between Scales of Mining (Source: Hinton, J. 2017, Hinton, 2012)

Formality and Legal Status: The vast majority of artisanal mine sites operate outside of any legal framework. MSM operations are often partially or fully formalized, with some exceptions, whilst LSM are always formal and licensed.

Mechanization: ASM sites use rudimentary tools such as shovels or hammers. As the scale of the operation increases through MSM, mechanization increases with the use of diggers, crushers and others, with LSM often using the most sophisticated technologies

Technical, environmental and occupational standards of practice: ASM sites generally do not abide by any formal technical, environmental or OSH standards due in part to lack of knowledge as well as inadequate oversight by the mandated institutions. MSM through to LSM operate under increasingly structured standards driven by regulatory and consumer requirements.

Exploration Methods: Only very informal (and often unreliable) exploration is conducted on ASM sites, based on prior experience of miners, whereas MSM and LSM often use sophisticated exploration techniques to generate high-quality data.

Capital cost investment. An individual artisanal miner may own a shovel or may, in lieu of a hammer, use a rock to break other rocks. In comparison, capital investment for a large-scale operation can readily exceed $100 million USD.

Workforce Size and Incomes per capita: Whilst ASM workforce size for individual sites varies hugely, ranging from 2 people to over 1000, the workforce in the sector as a whole is in general much larger than the MSM or LSM sector, where increased mechanization means that fewer jobs are conducted by the manual workforce. In contrast, incomes per capita are far lower in the ASM sector than in MSM and LSM.

Seasonality: Due to lack of site management, mechanization and low levels of financial security, ASM sites are particularly vulnerable to seasonal aspects such as difficult weather and subsequent domestic market fluctuations. MSM and, to a greater extent, LSM, are able to better plan for and manage seasonality.

Vulnerability to External Shocks: Low incomes per capita and a lack of tangible assets mean that ASMs are vulnerable to external shocks such as fluctuations in price and demand in the domestic market. MSMs and LSMs are more able to plan for and manage similar external shocks.

Annex 2: Number and Locations of ASM Sites and POS Assessed During Fieldwork

Table 13: Number of Districts, Sites and SMEs or Points of Sale (POS) Assessed by Region and Commodity

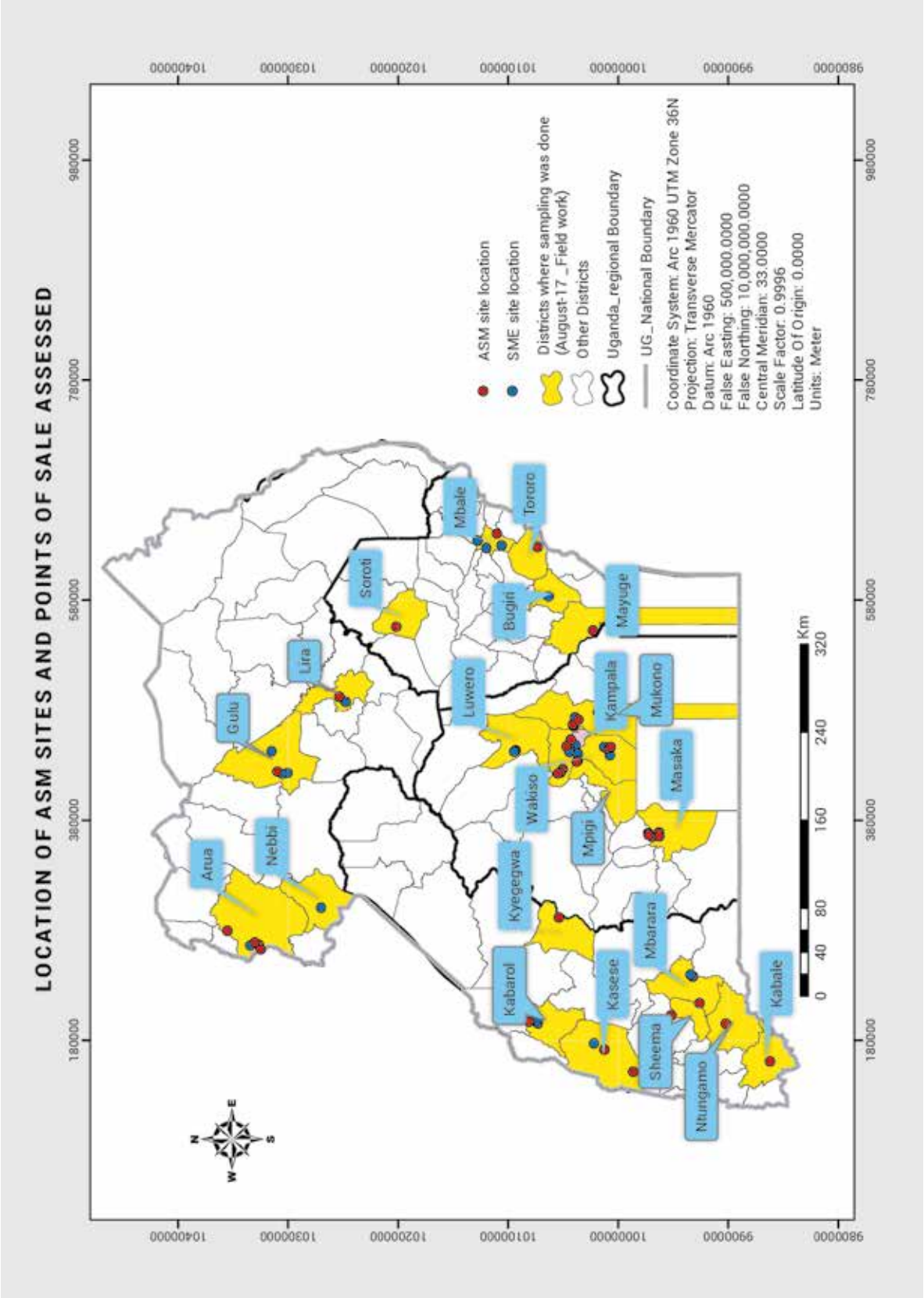
COMMODITY[1]	REGION															TOTAL		
	Central			Western			Southwest			Eastern			Northern					
	Districts	Sites	POS	Districts	Sites	POS	Districts	Sites	POS	Districts	Sites	POS	Districts	Sites	POS	Districts	Sites	POS
Clay & Clay Bricks	4	6	1	2	2	3	1	3	4	1	1	1	1	1	1	11	13	10
Stone Aggregate	2	5	8	1	0	4	2	2	9	2	1	1	4	3	4	12	11	26
Dimension Stone	2	3	4	1	1	1	0	0	0	1	0	1	2	2	1	7	6	7
Sand	2	4	10	1	0	5	2	2	9	1	1	1	2	2	3	9	9	28
Limestone/ Lime	0	0	0	1	1	1	0	0	0	1	1	0	0	0	0	2	2	1
Kaolin	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1	1
Salt	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1
Pozzolana[2]	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1
Total	4	20	19	3	4	17	4	9	27	5	4	3	4	6	8	22	42	73

Notes:

[1] Following consultations with DGSM and other sector stakeholders, it is evident that gypsum production in country (formerly undertaken in Bundibugyo District) has ceased. In lieu of this, field teams assessed pozzollanic ash production sites (a substitute for limestone in cement production) in order to obtain additional insight on implications for the limestone market.

[2] Although pozzolana was not one of the 8 minerals chosen as focus minerals for this project, a limited assessment of production in the west was undertaken during the fieldwork, and have been incorporated in the findings of this report as an additional mineral.

Figure 35: Districts and sites where field research was conducted



Annex 3: Development Minerals Production, Imports and Exports

Table 14: Officially Reported and Estimated Annual Development Minerals Production in Uganda (2015/16). Source: DGSM Annual Reports

COMMODITY	Medium and Large Scale[1]		Artisanal and Small Scale[1]		Total	
	Production (tonnes)	Value of Production (USD)	Production (tonnes)	Value of Production (USD)	Value of Production (USD)	Percent Attributed to ASM (%)
Clay Bricks[2]	270,407,259	23.2 million	5,137,737,929	266.0 million	289.2 million	95%
Sand	349,100	0.99 million	3,141,390	8.9 million	9.9 million	90%
Stone Aggregate	677,490	6.5 million	6.097,410	58.2 million	64.7 million	90%
Dimension Stones[3]	-	-	1,461,119	8.8 million	8.9 million	100%
Limestone	891,295	31.6 million	297,026	11.9 million	43.4 million	27%
Kaolin	-	-	40,774	0.06 million	0.06 million	100%
Salt	-	-	48,927	0.96 million	0.96 million	100%
Pozzolanic Ash	742,423	4,6 million	15,928	0.1 million	4,7 million	2%
Vermiculite	1,213	0.2 million	-	-	0.2 million	0%
Total	**-**	**67,124,001**	**-**	**354,913,309**	**422,037,310**	**88%**

Notes:

1 See Box 2 within the companion "Baseline Study" report for explanation of how estimates were derived.

2 Volume of bricks provided in number of burnt, solid clay bricks rather than tonnes and excludes other brick products (e.g. ventilators, half bricks etc).

3 Although some entities have been granted rights to exploitation of dimension stones in 2017 (Section 3.4.1), as of 2015 production had not been officially declared.

Table 15: Imports and Exports of Development Minerals and their Products (2016))[132,133]

Development Minerals Products		Official Imports		Official Exports		Trade Deficit (USD)
		Quantity (tonnes)	Value (USD)	Quantity (tonnes)	Value (USD)	
Clay	Bricks	12,735	1,203,000	51	5,000	-1,198,000
	Ceramics	150,258	36,701,000	1,413	2,524,000	-34,177,000
	Total	**162,993**	**37,904,000**	**1,464**	**2,529,000**	**-35,375,000**
Sand		821	187,000	20	3,000	-184,000
Stone Aggregate		4,632	130,000	1,026	248,000	118,000
Dimension Stones	Granite	158	13,000	32	37,000	24,000
	Slate	101	15,000	0	0	-15,000
	Marble	25	21,000	26	2,000	-19,000
	Total	**284**	**49,000**	**58**	**39,000**	**-10,000**
Limestone and Related Products	Cement	1,436,316	76,590,000	356,834	61,164,000	-15,426,000
	Lime	16,047	1,693,000	62	10,000	-1,683,000
	Flux	40,005	345,000	1	1,000	-344,000
	Total	**1,492,368**	**78,628,000**	**356,897**	**61,175,000**	**-17,453,000**
Kaolin		1,220	519,000	685	104,000	-415,000
Salt		195,315	26,626,000	16,930	3,700,000	-22,926,000
Gypsum		114,040	7,163,000	14	1,000	-7,162,000
Pozzolanic Ash		0	0	0	0	0
Agrominerals	Vermiculite	67	22,000	3,252	876,000	854,000
	Phosphate	392	84,000	0	0	-84,000
	Other	19	15,000	7	14,000	-1,000
	Total	**478**	**121000**	**3259**	**890,000**	**769,000**
Total		1,972,435	151,189,187	380,353	68,688,000	-82,638,000

[132] ITC Trademap, 2016, http://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1|800|||25|||4|1|1|2|2|1|1|3|1

[133] Global Edge. Global Insights. Uganda. Accessed 24th November 2017. https://globaledge.msu.edu › Global Insights › By Country › Uganda

Annex 4: Main Medium- to Large-Scale Producers

Table 16: Main Medium to Large Scale Development Minerals Product Producers

COMMODITY	Licensed companies listed on the Mining Cadastre	Companies operating under other licenses	Main Current Consumers[134]
Clay	-	Uganda Clays Ltd, Lweza clays Ltd, Nkozi clays Ltd and Herm Clays Ltd, Butende Brickworks.	**Buildings (bricks**, roof tiles, **ventilators**, face bricks), **ceramics, pottery**
Sand	-	Registered Trustees of Masaka Diocese; River Katonga Investments Ltd; Seroma Ltd; Parkson Hongkong Investments Ltd.[135]	**Buildings (mortar, plaster, concrete), Moulds used in foundries, Sandpaper industry**
Stone Aggregate	-	Jomayi Stones and Concrete Products Ltd	**Road construction, concrete production**.
Dimension Stone	**Mining Lease** Building Majesties Limited[136] **Location License** Samuel Sebabi, Flux enterprises, Tropical sky mineral Rock Limited, Mugume George)[137]	Building Majesties Limited, Jomayi stones and concrete products Ltd, Ms Uganda Marble and Granite Ltd, Granite Homes Ltd and Millennium Marble (2000) Ltd	Buildings/House designs (Counter tops, Tiles), stone monuments. **Exterior design**.
Marble and Limestone	**Mining Lease** Tororo Cement Ltd, Moroto Cement Industries (u) Ltd, Hima Cement Ltd[138] **Location License** Peter Lokwang, Bithaba Foundation investment Ltd, Mathimu Enterprises Ltd, Ndiwa Property consultants Ltd, Sikander Meghani[139]	Tororo Cement Ltd;Hima Cement Ltd ; Kampala Cement Ltd.	**Cement industries**, **Agriculture industry in form of agricultural lime**, Road industry in form of aggregate, Glass making industry, Blast furnaces, and sculpture industry.

[134] Consumers in **bold underlined** are also common consumers for the ASM sector.
[135] Parliament of the Republic of Uganda (2016). These are the companies that have legal permits for their operations. Other companies were named whose legal status is unclear or illegal, but they have not been included in this list.
[136] Companies with a mining lease. Uganda Mining Cadastre Portal" Accessed October 11, 2017. http://portals.flexicadastre.com/uganda/.
[137] Location licence
[138] Companies with a mining lease. Uganda Mining Cadastre Portal" Accessed October 11, 2017. http://portals.flexicadastre.com/uganda/.
[139] Location licence

COMMODITY	Licensed companies listed on the Mining Cadastre	Companies operating under other licenses	Main Current Consumers[134]
Kaolin	**Location License** Optima Mines and Minerals Ltd, Nawata Mines Ltd, Masereka Joachim[139]		**Paper industry, Paint and porcelain industry**.
Salt			Humans and cattle
Gypsum	No production	No production	Used in manufacture of wallboards, plaster and in Portland cement as a hardening retarder.
Pozzolanic Ash	**Mining Lease** National Cement Co. Ltd, Kampala Cement Co. Ltd, Tororo Cement Ltd, Eastern Mining Ltd[138] **Location License** Industrial Minerals Ltd, Mystical Rose Ventures, Ryan Mining and construction company (U) Ltd[139]	Tororo cement Ltd, Hima Cement Ltd	**Portland Cement industries**
Phosphates	**Mining Lease** Guangzhou Dong Song Energy group Co. Ltd[138]	Guangzhou Dong Song Energy group Co. Ltd	Fertiliser industry/Agriculture
Vermiculite	**Mining Lease** Namekara Mining Company Ltd[138]	Namekara Mining Company Ltd	Horticulture, insulation, agriculture, and construction

Annex 5: Alternative Clay Products: Energy Saving Stoves

Table 17: Energy Saving Stoves using Clay Products

Type/Description	Materials/ Components	Sizes/Shapes	Availability/Production	Advantages	Source
Rocket stoves They include an insulated L-shaped combustion chamber that allows for partial combustion of the gases and smoke in a stove, and thus achieve important emission benefits compared to open fires or crude stoves.	-Clay mixed with glass, anthill soil or sawdust. -Clay bricks -metals	-Rocket stoves are available in different sizes ranging from household stoves to industrial stoves which are designed for pots with a volume of 300 litres. But also on the household level designs differ. -Single pots and double pots but of different sizes.	Clay and clay bricks are cheap and freely available. It was claimed that 700.000 rocket stoves have been built in Uganda GIC/GTZ 2010). The GTZ Energy Advisory Project (EAP) managed among other actions to build over 110 000 Rocket Lorena stoves in Western Uganda in twelve months.	Fuel input can be reduced from 39% to 70% depending on build and type. CO Emissions can be reduced up to 86%.	Oliver Adria 2014, Residential Cooking Stoves and Ovens, Good Practice Technology: Rocket Stove http://www.bigee.net/media/filer_public/2014/10/08/bigee_residential_cooking_stoves_good_practice_rocket_stoves.pdf
Improved Firewood Stoves **1.Rocket-lorena stove** -The saucepan cavity is deep enough to have the saucepans submerged into the stove's hot gases' passage. This increases the surface area of the saucepan being exposed to the fire (hot flue gases), resulting in increased heat transfer to the saucepan. **2.Shielded fire Rocket stove**	-Clay/anthill soil. -Sawdust/dry chopped banana leaves/dry chopped grass. -Mad bricks. -Water.	The size of the stove depends on the size of the saucepan to be used in cooking e.g saucepans of cooking capacity 3.5 litres with diameter 26 cm and 2.5 litres with a diameter of 23 cm.	Demand driven	-Saves money -Cooks faster - smoke -Easy to use -Safe to use -Affordable -Environmentally friendly i.e firewood savings of 50 – 60 % when compared to the traditional (open) 3-stone stove	MEMD,PREEEP 2008. Construction Manual For Household Rocket Stoves. https://energypedia.info/images/9/93/GTZ-HOUSEHOLD_Stoves_Construction_Manual_June_2008.pdf

Type/Description	Materials/ Components	Sizes/Shapes	Availability/Production	Advantages	Source
Improved Cookstoves. **1.Charcoal Stove**	-Cladding(made from sheet metal) -Liner (clay often mixed with sand, mica or sawdust),liner mould and fuel for firing the kiln. -Insulation(made from cement and Mica)	Basic charcoal stoves are of different sizes and their cost range is between 1-2.	-Most production is done around Kampala and the market for improved stoves comprises mainly urban and peri-urban households living above the poverty line. -561,000 households with an improved stove (UNHS 2009/10). -In the Shell Foundation research 6% of rural firewood users had bought an improved stove, 14% of peri-urban wood users had a stove (mostly supplied by others) and around 27% of charcoal users had a clay lined jiko. This equates to something like 200,000 improved woodstoves and 135,000 improved charcoal stoves. -600,000+ stoves in the past 10 years (Businesses and NGO's sales sector reports).	Reduced exposure to indoor air pollution(IAP) Prevent accidents from open fires	GVEP International 2012,Global Alliance For Clean Cook Stoves. http://cleancookstoves.org/resources_files/uganda-market-assessment-mapping.pdf
2.Rocket Stove	-Insulating mud(organic materials) -Stones/bricks (insulating mud alone or with stones and bricks held together by the mud) -Fire box shelf(ceramic tiles or metal)	Rocket mud stove are also of different sizes and their cost range is between $5-$20			

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