NIRDA

National Industrial
Research and Development
Agency

NATIONAL INDUSTRIAL RESEARCH AND DEVELOPMENT AGENCY

TECHNOLOGY AUDIT FOR STONE VALUE CHAIN REPORT

September 2020

Executive Summary

National Industrial Research and Development Agency (NIRDA) is entrusted with mandate of supporting and enabling a generation of industrial innovators that have the potential to become competitive through technology upgrade.

NIRDA's programme for **promoting technological upgrades across the priority Value Chains involves working with identified** private sector actors/companies through assessment of the their current levels of technology along their respective value chains with focus on identifying gaps in technology used in the production required technical skills, Distribution and marketing with a view to supporting them to upgrade technology required for improved production and productivity through "**the Open Call program**". This program involves selection of companies that have potential to produce competitive products on the local market with technological support which includes enhanced capacity and capabilities of these companies.

The construction industry is a fundamental economic sector, which transforms various resources into constructed economic and social physical infrastructure necessary for socio-economic development and transformation. It includes the process of planning, designing, procuring, constructing, maintaining and disposing physical infrastructures and facilities.

The objective of this study was to conduct technology audit of value chain of the natural stones used in construction sector in term of the level of access to technology, existing technological capabilities, and existing green technologies, and to identify possible opportunities for value chain upgrade, expansion and optimization.

The approach and methodology adopted involved a combination of both qualitative and quantitative methods. The study relied more on use of survey; Key Informant Interviews for targeted officials and technical staff drawn from stakeholder institutions; and Focus Group Discussions (FDGs) for primary extractors of natural stones.

Findings of the technology audit of Natural stone value chain relate to the various actors along the value chain including the Primary extractors; processors of natural stones and the end-users as indicated hereunder:

Primary extractors

Low levels of efficiency were observed among majority of actors involved in primary extraction of natural stones because of the rudimentary technological practices that dominate this node of the value chain, the following functional features characterize them as non efficient in almost all of their business activities:

- **Extended period of time required in the delivery of clients' orders**; it takes long time for primary extractors (Quarries) to deliver natural stones ordered by their customers. This carries an embedded impact on the cost of transport and period of construction activities as claimed by the end users;
- **Quality of the natural stones; because of use of traditional tools**, majority of the primary extractors produce asymmetrical natural stones (irregular shapes) which has an implication in terms of concrete used in construction activities and also an implication on wall durability of different structures;
- **Quantity of extracted stones;** in terms of profitability, primary extractors take long time and use high number of human resources to mine natural stones and this carries additional overhead costs on the side of the business;
- **High quantities of waste and limited capacity to do up cycling**; Given the use of rudimentary technology in primary extraction of natural stones, extractors incur a lot of wastage in terms of broken pieces of stones (Ibiparara).
- **Limited capacity** to do up cycling like some of the processing plants with modern technology, they are unable to transform waste into other natural stone products such as fine sand and/or aggregate of different sizes which can also add value to their businesses;
- **Poor road network in some mining areas**

  Poor infrastructures in terms of road networks that connect primary extractors to national and/or district paved roads tend to negatively affect their businesses. The situation of poor roads is aggravated by the unexpected occurrence of natural hazards such as landsides and floods that end up making unpaved roads impassable;

- **High costs involved in rehabilitation** of degraded sites after primary extraction of natural stones.

Processors of natural stones

The results of the Technology Audit on the side of processors of natural stones exhibited levels technology gaps and other associated challenges at exploration; extraction and processing stages production.

- **Limited efficiency levels;** The findings indicated that **existing technologies** are heavily dominated by partially and fully manually operated machines and traditional hand used tools. This implies that majority of the processors take long time to deliver production cycle.

- **Product quality and differentiation;** Findings show that the quality of Natural stone and Natural stone products is highly determined by technology, tools and the human resources skills used in extraction and production of natural stone products which still limited.

- **Under-utilization of the installed capacity** for majority of the processing plants (including granite and cobble stone processing plants) this was found to caused by the low demand of their products;

- **Limited relevant skills for improved production and productivity of processing plants;** With the available skills sets at the labor market, quality of products produced and/or extracted cannot be competitive on the local, regional and international markets.
- **Lack of natural stone database and absence of laboratories for testing composition of natural stones;**

- **High costs of production;** Processing of natural stones requires electricity and water utilities which are perceived expensive and irregular in their supply in most geographical areas across the country;

- **Limited levels of up cycling of the waste;** natural stone product range is still limited and this is partly because of limited technological capacity to conduct up cycling for the waste. Up cycling is one of the avenues that would increase the product range and diversify the products that would improve options of the products supplied on the local and regional markets.

<u>Proposed set of recommendations</u>

Recommended technology required in Exploration of natural stones

There is need to organize actors involved in processing of natural stones to secure technologies such as tomographic imaging, the use of geophysical sensors and GPS

as well as drilling technologies which more effective in exploration for sustainable extraction and processing and optimization.

Technology required in primary extraction of natural stones

The recommended technology that is most modern in primary extraction of natural stones includes the use **diamond wires, discs, blasting and wheel loaders as well as Excavators** for increased efficiency and effectiveness depending on the targeted stone products to be produced.

Technology required in processing of natural stones

Regarding processing technology, upgrading of should include securing of **Multi-wire machines; Block cutters machines; Polishing Machines; Maema Machines**(for rough surfaces)**; Bridge saw machines; Welding machines** (used in customization of different sizes)**; Edge polishing Machine (**used in maintenance services**); Grooving machines; Crushers; and Splitting machines.**

Organizing study tours for experience sharing and inspiring innovations; Supporting benchmarking visits of Rwandan Natural stone processors to other countries to inspire innovation and increased capacity of the personnel working with these plants.

Inclusive development and upgrade of primary extractors; There is need to mobilize and sensitize primary extractors of natural stones who still use traditional hand used tools in extraction to gradually work on securing small and affordable stone crushers and other required but affordable machines. The in-built plan should be leading them to graduating to processors of natural stones.

The need to build/ upgrade human resource skills; Given the inadequate level of specialized skills in natural stone exploration, extraction and processing, special attention should be paid on developing an inclusive capacity development program for sustainability of the required skills at Rwanda labour market.

The need to sustainably increase local market share; through appropriate marketing of products using internet marketing, participating in locally and regionally and as well as international organized exhibitions.

The need to reduce environmental protection costs; abandoned Quarry sites in should be rehabilitated to become high-value ecological areas.;

Promote the culture of upcycling as a process of transforming by-products, waste materials, useless or unwanted stone products into new products perceived to be of greater quality.

- **Incentives to local natural stone producers to give them** comparative advantage in order to encourage implementation of import substitution strategies which include promotion and support of the young processing plants involved in natural stone extraction and processing;
- **Awareness creation about the value of natural stone products** in Rwanda and in the region. There is need for the Government to support local processing plants to market their products within and outside country through organizing public exhibitions and use of other media outlets that can effectively do marketing;
- **As part of supporting the processing plants at nascent stage of development**, there is need to introduce subsidies and/tax holidays for investors in natural stone extraction and processing such as exemption of imported consumables used natural stones processing and spare parts used repair and maintenance of the installed machines in different production lines;
- **Develop standards for key natural stone products** Made in Rwanda. In order to have competitive edge in both local and regional as well as international markets.

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List of Abbreviations and Acronyms

COVID 19- Corona Virus 2019
EIA –Environmental Impact Assessment

FGD – Focus Group Discussions

GDP – Gross Domestic Product

GHG – Green House Gas

GPS – Global Positioning System

Ha – Hectare

IER- Institute of Engineers of Rwanda

KII- Key Informant Interviewees

m^3 - Cubic Meter

MICE – Meeting Incentives Conferencing, Exhibition

MINICOM- Ministry of Trade and Industry

MiR – Made in Rwanda

MoE- Ministry of Environment

NIRDA- National Industrial Research and Development Agency

NISR- National Institute of Statistics of Rwanda

NST 1- National Strategy for Transformation One

R&D- Research and Development

RCA- Rwanda Cooperative Agency

RMB-Rwanda Mines, Petroleum and Gas Board

RSB -Rwanda Standards Board

RWF- Rwandan Francs

SME – Small Micro Enterprises

STI- Science, Technology and Innovation

USD- United States Dollars

VC- Value Chain

1.0 Introduction

1.1 Background and Context

The Government of Rwanda embarked on an ambitious development agenda as articulated in its retiring long term development framework (**Vision 2020**) which focused on transforming the country from a shattered, predominantly agrarian economy to a middle income status by the year 2020[1]. The high level development targets articulated in Vision 2020 document included among others; a raised per capita income of USD 1,240 by 2020, up from US Dollars 220 in 2000; an average GDP growth rate of 11.5% and an increase in life expectancy from an average of 49 years in 2000 to 66 years by 2020[2].

Given that initial long term development framework (Vision 2020) for Rwanda is in its last year (2020) of implementation, the Government adopted its second generation of the long term development framework (Vision 2050) which envisages attaining feasible percentage of urban and rural population; register not more than 10% of total land area reserved for human settlement and infrastructure with a view to preserving nature and agricultural land; achieve planned modest percentage of urban population living in informal settlements or inadequate housing entities; elevate the number of households which are in need of housing that have access to decent housing in the formal sector; achieve the limited total number of buildings contributing to total GHG emission over their life time to not exceed 20%; and total CO_2 emission/ capita/ year to never exceed 2 tons despite the massive planned development[3].

National Strategy for Transformation (NST 1) and related Sector Strategies envisage a transformation of Rwanda's economy by facilitating urbanization and supporting the development of secondary cities as one of the major pillars contributing to realization of the overarching country development goals and more specifically contributing to the attainment of the aforementioned development indicators planned in the Blue Print of the Vision 2050.

[1]Vision 2020
[2]Blue Print of Vision 2050

One of the key interventions envisioned to contribute to the realization of the priority area 2 of the Economic transformation pillar of the NST 1, is to promote and develop local construction materials in collaboration with the private sector which is in consonance with the 'Made in Rwanda' policy which seek to support the growth of the construction sector through provision of affordable and low cost housing materials[4].

The NST 1 further highlights the need to promote industrialization and attainment of a structural shift in the export base to high-value goods and services with the aim of growing exports by 17% annually. In order to deliver on the aforementioned development target, there is need to identify and develop priority value chains (especially in productive sectors of the economy) through targeting pro-active investors to attract the right anchor firms with market linkages for each priority economic value chain including but not limited to agro processing, construction materials, light manufacturing, meat and dairy, leather, textiles and garments, horticulture, tourism (including MICE tourism), knowledge based services, transport and logistics.[5]

According to the National Science, Technology and Innovation (STI) Policy and NIRDA's technology upgrade and support programme, the two documents echo the need to promote technological upgrades across the priority Value Chains as a key intervention in contributing to the delivery of the planned economic development targets[6].

NIRDA's programme for **promoting technological upgrades across the priority Value Chains involves working with identified** private sector actors/companies through assessment of the their current levels of technology, identification of gaps along their value chains with focus on technology used in the production processes, required technical skills, Distribution and marketing with a view to supporting them to upgrade technology required for improved production and productivity through the popular Open Call program[7].

[4] National Strategy for Transformation One (NST 1)

[5] National Strategy for Transformation one (NST1)

[6] Private sector Development and Youth Employment Strategy

[7] Private sector Development and Youth Employment Strategy

Following thorough selection of companies that meet the established guidelines and set criteria of the Open Call Program, the leadership of NIRDA facilitates the selected companies/firms to identify and outsource efficient technology, support them in enhancing their technical capacities required in the use of the outsourced skills through provision of technical assistance services (TAs) and finally extend support for improving the distribution and marketing of the produced products in both local and regional as well as international markets. **However, having appropriate technology and skills is one thing and producing products and services that comply with established local and international quality standards is another.** With quite substantially expanded catalogue of standards and major improvements to their laboratories and services offered, Rwanda Standards Board (RSB) is currently heavily involved in regional harmonization of its standards. They are therefore now able to offer a wider range of standards with wide geographical recognition, at a subsidized rate. With its improved capacity, RSB envisions supporting local companies to comply with established standards.

The construction industry is a fundamental economic sector, which transforms various resources into constructed economic and social physical infrastructure necessary for socio-economic development and transformation. It includes the process of planning, designing, procuring, constructing, maintaining and disposing physical infrastructures and facilities.

In order to achieve the required efficiency and quality standards for improved competitiveness in local and regional markets for construction materials, supply chain needs to be strengthened to allow easy accessibility to the inputs used in the construction sector. One of the major objectives for empowering the construction industry shall be the enhanced stability, performance and support of green growth, enabling non-farm employment, competitiveness and regional outreach.

According to the Strategic Plan for Urbanization and Human Settlement sector, there is need for technology upgrade in the construction sector which should be done in parallel with technical skills upgrade that is regulated and whose outcomes monitored. A diverse and skilled pool of professionals is key to growth of this sector. Currently, a total of 987 architects, engineers, land valuers and surveyors are registered in professional bodies. Urban planners have not yet successfully established an organizational body[8]. In addition, the strategic plan for the Urban and

[8]Strategic Plan for Urban and Human settlement, 2018

Human Settlement proposes that not only the professionalism of individuals and firms in the industry shall be constituted, but also the resulting efficiency, cost-effectiveness in the supply chain of the construction industry as well as increase of sustainable investment and increase of volumes in local production of base and finishing materials required by this sector/industry. The increase of demand for commodities relative to the growing demand should be addressed by domestic production and increase of domestic economic actors in the industry, with a proven impact on employment and economic growth. Lastly, the strategic plan for the Urbanization and Human settlement envisions that the enhancement of the Rwandan construction industry will be important in the context of enhanced regional integration where private actors involved shall explore partnership arrangements with East African Community member states to further promote green settlement.

Competitiveness is a dynamic goal and one that requires continuous investment in industrial research and development (R&D). NIRDA was established to spearhead the process of facilitating firms to become more competitive through the use of applied research, technological advancement and innovation[9].

The "Made in Rwanda" policy articulates that with the meagre raw materials and limited access to working capital for most processing entities, it is important that production processes are efficient in terms of raw material and utilities utilization. Resource efficiency contributes to lower overall production costs, freeing up working capital and lowering prices, while also fetching significant environmental benefits. Many companies waste insurmountable amounts of their inputs through inefficient technologies and inadequate technical skills. Reducing resource wastage is therefore a critical component to improve competitiveness in Rwanda.

Domestic Market Recapturing strategy recognizes the need to increase domestic production for local consumption while tremendously contributing to structural transformation of productive sector and increasing international competitiveness[10].

Findings from the study on Mapping and Market Analysis of Made in Rwanda Construction Materials commissioned by Enable Rwanda to inform the process of elaboration of its new country Assistance development program specifically on establishing clear understanding of the Made in Rwanda (MiR) construction materials (current status), the challenges faced in the sector, existing opportunities

[9]Made in Rwanda Policy, 2017

[10]Domestic Market Recapturing Strategy, 2015

that can be explored by local companies[11].***The stakeholder mapping found 110 enterprises (of which 24 are cooperatives) producing 'Made in Rwanda' construction materials, be it at the extraction, transformation or on-site stages of the construction value chain. Many of these enterprises are considered to be micro- and small enterprises.***

According to the findings from mapping and marketing analysis conducted by BNS Consortium, 2019, the Made in Rwanda materials were found to be at the **primary level (extraction), intermediate and secondary processing stages**. Raw materials made in Rwanda include clay, stone, sand, lime, granite, wood, used metals (scraps) and bio-waste.
The **intermediary products** produced included cement, timber, gravel (various sizes) and plastics.

At the **final processed level** are a plethora of products whose production heavily relies on imported raw materials. Those that can be made from Rwanda raw materials are Bricks, blocks, earth floors, tiles, mortar, concrete, doors and frames and straw walls, although they are not necessarily being produced with Rwandan raw materials at present. Made in Rwanda products that are reliant on imported raw materials included metal roofing products, windows, structural steel, tools and machinery, spare parts, PVC piping, plastic tanks and paints.

In light of the above, NIRDA in partnership with ENABEL engaged Capacity Development Consultants Ltd (CDC Ltd) to provide technical backstopping services in the process of conducting Technology Audit of the value chain of the natural stones used in construction sector with a view to identifying technological capabilities, existing green technological practices, potential opportunities for value chain upgrading, expansion and optimization.

1.2 Objectives of the assignment

1.2.1 General Objective

The main objective of the assignment was to conduct technology audit of value chain of the natural stones used in construction sector in term of the level of access to technology, existing technological capabilities, and existing green technologies, and

[11]Mapping and Market Analysis of Construction materials Made in Rwanda, BNS Consortium, 2019

to identify possible opportunities for value chain upgrade, expansion and optimization.

Specific Objectives of the assignment

Specifically the assignment sought to:

a) Assess value chain in terms of **efficiency**, **existing quality, product differentiation**, **social and environmental standards** and **business environment**:
b) Assess the **environmental impact** of the functional activities of different actors along the value chain;
c) **Analyze existing technology and technological capabilities** that are available in the value chain versus what is available outside the country in order to increase the efficiency of products developed in the value chain including indicating new products that could be developed if the relevant technology/technological capability would be available;
d) Conduct a **SWOT analysis** of the natural stone value chain and individual players and recommendations on which strengths and weaknesses to focus on;
e) Analyze the potential to **upgrade** (collaboration between different producers to move to a higher value added component of the chain), **expand** (actions to broaden existing value chain to increase its job creation and value impact potential) and **optimize** (actions to improve operation of certain links of the value chain to achieve greater value added) the value chain.

1.3 Rationale for conducting Technology audit for the Value Chain of natural stones

The National Industrial Research and Development Agency (NIRDA), has a mandate of enabling a generation of industrial innovators to become competitive through technology monitoring, acquisition, development, transfer and applied research. In order to deliver on this mission, NIRDA under commissions value chain technology audits with an objective of identifying technological and capacity gaps that constrain the competitiveness of Rwandan industries within a specific value chain. The findings of the value chain technology audit inform the capacity building agenda of any given specific enterprise/ industry that has been audited.

It is therefore upon this backdrop that NIRDA commissioned a Tech audit for the Value chain of natural stones used in construction sector.

2.0Approach and Methodology

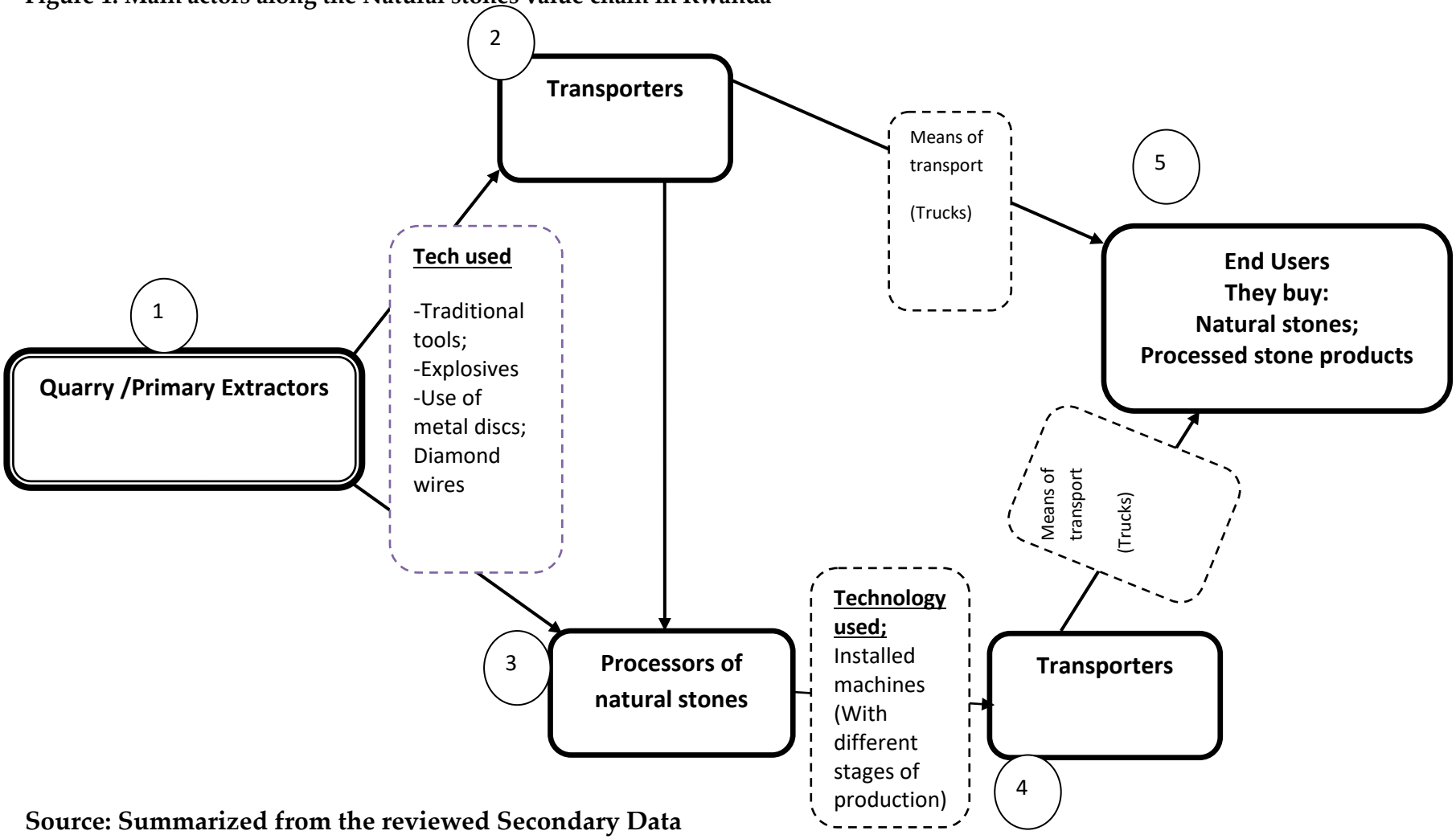
The approach and methodology adopted to deliver on this assignment was based on our overall understanding and appreciation of the client's requirements as it was articulated in the Terms of Reference. The approach and methodology adopted involved a combination of both qualitative and quantitative approaches. The qualitative approach was used to gain understanding of situation analysis of value chain of Natural Stones.

2.1 Target Population and scope of the Technology audit

In order to thoroughly conduct the technology audit of the value chain of natural stones used in construction sector and also given the nature of assessment of this value chain, there was need to map and categorize various actors along this chain.

The identified categories of actors along the chain value of natural stones used in construction sector included the primary extractors of the natural stones, processing plants of natural stones; and end-users of both processed and unprocessed stone products as well as transporters. The figure summaries the main VC actors involved natural extraction, processing and transportation.

Figure 1: Main actors along the Natural stones value chain in Rwanda



Source: Summarized from the reviewed Secondary Data

2.2 Sampling Techniques and Procedures

The combination of three different techniques of sampling was used for determining sample size of respondents representing the identified actors along the value chain of the natural stones. In terms of scope, the technology audit and assessment of the entire value was conducted in all the 30 Districts despite the limitations associated with measures instituted by the government in controlling the Covid-19 pandemic. However, determining the number of quarries in each District and number of respondents consulted in each of the selected Quarries required the use of **purposive/judgemental sampling and simple random sampling techniques** respectively. For the "End-Users" who are the last actors along the value chain of the natural stone and the related products, different construction sites were identified in each District visited with support of the Institute of Engineers of Rwanda (IER).

Association of Transporters was also consulted for them to share the views and opinions on experiences in delivering transport services to from one node of the value chain to the other. The representatives of the Association of Transporters were purposively sampled with the guidance of the leadership.

2.2.1 Purposive or judgemental sampling

Quarries across the country have less the same functional features in terms of the technology used in extraction of stones, human resources deployed in these quarries have almost the same skills sets, governance and management practices are more or less the same and therefore this qualifies them as homogenous population (artisanal mining of natural stones). Based on these described features, with the technical guidance of the officers in charge of Environment and Natural Resources and the statistician at the District level, 2 Quarries were purposively selected in each of the District depending on the regularity of their individual Quarry operations.

2.2.2 Simple random sampling

Following the selection of quarries, respondents of the questionnaire from each of the respondents were randomly selected in all the Quarries and approximately 6 to 11active extractors were consulted.

2.3 Data Collection Techniques and Tools

2.3.1 Desk Review of relevant literature

The consultants reviewed different development frameworks and reports from different sources (national and local level reports) on natural stones extraction, processing and usage. The consultant collected and reviewed all relevant documents in order to have a feel of the issues associated with entire Natural Stone Value Chain in the country.

2.3.2 Questionnaire for Survey

The consultant developed a structured Questionnaire with close and open ended questions which was shared and approved by the client. The questionnaire was dissected into 3 major parts based on the categories of respondents who included the **Primary extractors of natural stones, Processors and End-users** of both processed and unprocessed natural products used in the construction sector.

It should however be emphasized that design of the Questionnaire was based on standard technology audit parameters provided by the National Industrial Research and Development Agency (NIRDA).Some key parameters were broken down from and aligned to specific objectives of the assignment as follows:

- On **Primary Extraction**: technology (machines) used; knowledge and skills sets deployed, market trends and practices related technology in extraction of natural stones used in construction;
- **Processing of natural stones:** Establishing the level of efficiency and effectiveness of the technology used in processing of the extracted natural stones; the tools used; skills sets of technicians deployed at different stages of production (**Including Extraction stage; Splitting stage; Block and Wire cutting stage; and Customization stage)** of the processed products as may be required by the construction sector, Market trends and challenges encountered;
- **End-users**: Their appreciation of the quality of products supplied at the market, Market trends, and challenges encountered at production level as well as their views and opinions on recommendations to further improvement on the currently produced quality as well as accessibility and affordability of the natural stones and stones products

The questionnaire was formatted in electronic software of Cs-entry connected to Cloud Drop Box for online transmissions with off-line data collection (CTO-Survey). The use

of the CTO survey guaranteed the use of GPS in order to map how data was collected and distributed across all districts.

2.3.3 Key Informant Interviewees

The KIIs were also organized by the team of experts at the level of the Districts and central level. The interview guide was used to facilitate the process of conducting interviews with selected officials drawn from policy and coordination level institutions. This views and opinions collected from KIIs will strictly used for triangulation of the data collected using the structured questionnaire.

2.3.4 Focus Group Discussion

The FGDs mainly targeted employees of primary extracting companies and/or cooperatives of natural stones and staff for companies involved in processing. The few FGDs that were conducted enriched quantitative data that was collected using structured questionnaires for the various actors along the value chain especially in identification of technology gaps, development/ upgrading needs and competitiveness challenges along Natural Stone value chain.

2.3.5 Observation

Albeit the limitations associated with the measures put in place to curb the recently recorded sporadic occurrences of the Covid-19 in different provinces of the country, selected quarry sites were visited and observation used to have an overview of the technology used, deployed skills sets in terms of human resources and general practices in both natural stone extraction and processing at the level of the processing plants (Units).

2.3.6 Benchmarking on best practices

Benchmarking on best practices demonstrated by countries that have developed processing plants of natural stones used in construction sector was one of the methods used to establish concrete technology and skills gaps in the natural stones extraction and processing in Rwanda.

2.4 Data Analysis

Data analysis was systematically done using different statistical and narrative writing techniques, data collected was extracted from stored server to computer for processing using STATA and excel Spreadsheets; data coding, labeling, recode and other needs of STATA commands were applied in order to arrive at credible findings.

Qualitative analysis was comprised of transcribing the answers of the interviewees and the process of generating text files that were further examined to spot relationships using a thematic approach in order to ensure that quotes by Key Informants were effectively recorded and used in the analysis of the data.

2.5 Quality assurance

Quality assurance function was handled by the team leader who ensured time, scope and quality aspects are properly managed in accordance with client requirements as indicated in the Terms of reference.

2.6Limitations

The main limitations identified were mainly associated with the measures instituted by the government of Rwanda to control the currently experienced erratic spread of the Covid-19 pandemic in the country.

After the failure to secure a research VISA from the National Institute of Statistics of Rwanda (NISR) on account of curbing the spread of the Covid-19 pandemic through observing the directives put in place by the government which is a requirement for one to conduct research especially the one covering all Districts in the country, the only option left was to work closely with the local government authorities in order to have access to the targeted respondents especially those working in Quarries (Owners and/or employees). The following were the limitations in data collection:

Restricted access to 3 districts of Rusizi, Nyamasheke and Rubavu; at the time of data collection, the 2 districts (Rusizi and Rubavu) had been subjected to total lockdown and there were inaccessible and for Nyamasheke; it was not under lockdown but it could not be accessible at the time of data collection given that it borders Rusizi District both public and private transport vehicles were not allowed to enter the District. However, list of owners of quarries in the 3 districts was shared by Rwanda Mines, Petroleum and

Gas Board (RMPGB) which helped us consult with selected owners and/or employees of the identified Quarries in the 3 Districts. We were also able to audited 4 more processing plants.

Limited observation as one of the methods used in data collection from primary extractors in the 9 districts

In the 9 Districts of Ruhango; Nyanza; Huye; Gisagara; Nyaruguru; Gatsibo; Gakenke; Musanze and Gicumbi the targeted respondents were gathered in one designated and controlled rooms where interviews and Focus Group Discussions (for few individuals) were conducted in the spirit of observing the measures put in place by the government to control Covid-19 pandemic. In order to mitigate this gap in data collection and given the homogenous functional nature of the Quarries which are typically artisanal (where traditional hand used tools and informally trained human resources are predominant), a few selected Quarries were visited in those districts and pictures taken.

The table depicts below indicates the Quarries visited in each of the 9 Districts where conducting interviews in the Quarries was restricted.

Table indicating quarries visited in each of the Districts where conducting interviews in the Quarries was restricted

Province	District	Site Address		Primary Extractors Contacts		Enumerators collected the data	
		Sector	Cell	Name	Telephone	Name	Telephone
Eastern Province	Gatsibo	Kabarore	Karenge	Ndayizeye Kadafi	0788257432	Dancan Karemera	0783436647
		Gitoki	Nyamirama	Rushigajiki Evaliste	0788840911		
Northern Province	Musanze	Nkotsi	Bikara	ByazayireKitoko	0788494005	Marie Ange Uwingabire	0782389672
	Gakenke	Muhondo	Bwenda	Ahimana Eugene	0782756768		
	Gicumbi	Nyamiyaga	Kabuga	MukamukeshaProvidance	0788481306	Yvette Muhorakeye	0783392167
Southern Province	Ruhango	Bweramana	Rubona	Ndahayopierre	0788542542	Baziki Eugenie	0788403718
	Nyanza	Rwabicuma	Nyarusange	Ntakirutimana Isaac	0788877143		
		Mukingo	Kerezo	HakizimanaAimable	0788118628		
		Rwabicuma	Gishike	NyamwasaCyprien	0788421390		
	Huye	Mbazi	Mutunda	DISSI Chantal	0788740874		
	Gisagara	Gishubi	Gabiro	Ngarukiyintwali Theophile	0786390859		
	Nyaruguru	Munini Sector	Giheta	Niyindorera Japhet	0788640409		

3.0 Analysis and interpretation of Technology Audit Results

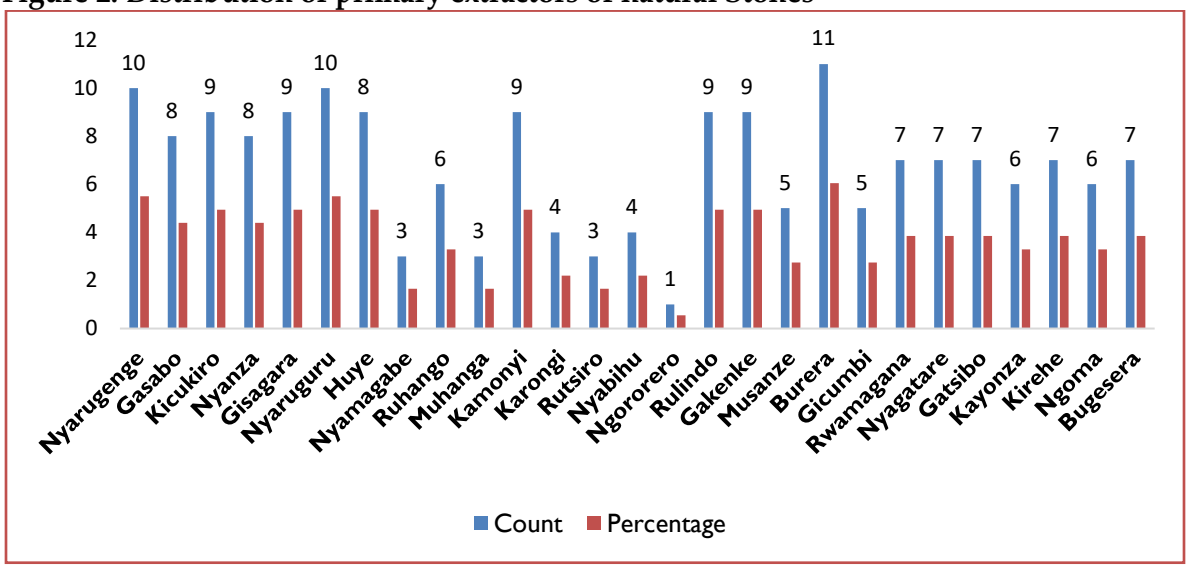
The presentation of the results was based on the objectives of the assignment as detailed in the terms of reference; emphasizing the key parameters of the typical Technology audit of any value chain. However, the sequencing of the sections and sub-sections under the chapter of findings was considerate of the succinct fact sheet for each of the identified actors along the Value chain of natural stones used in construction sector in Rwanda.

3.1 Analysis of Primary Extraction of Natural Stones

3.1.1 Distribution of primary extractors of natural stones

The Tech-Audit was conducted in 27 Districts of Rwanda; the most primary extractors were identified in Northern, Southern and City of Kigali more than the rest of the other two provinces in the country. The identification of the potential respondents in the Districts of the Western province was limited by the need to observe the measures put in place by the Government to control the spread of Covid-19 pandemic across the country. Access to the 3 districts of Nyamasheke, Rusizi and Rubavu was restricted because of the need to observe the measures associated with lockdown that was being enforced in the aforementioned districts during the time of data collection. However, Data in Western province was only collected in 5 districts of Karongi, Ngororero, Rutsiro, Nyabihu and later Rubavu after the lifting the total lockdown in this same District.

Figure 2: Distribution of primary extractors of natural Stones



Source: Results of the Tech Audit, 2020

3.1.2 General Information of Primary Extractors of Natural Stones

The results of tech – audit showed that most visited quarries were managed by quarry managers (63.4%) and individual extractor (31.1%). The visited quarries are in the category of small scale employing between 4 and 30 employees and micro scale quarries which represented 24%.

Over 70% of the Quarries are regular in their operations and 31.4% tend to be irregular in the operations. In terms of ownership of the quarries, 72% are owned by the individuals, 21.4% are owned by the cooperatives, and 6.6% are owned by the registered companies. On ownership of Quarries based on nationalities; over 97% of the Quarries are owned Rwandans, 2.2% are owned by foreigners and 0.5% of the Quarries are jointly owned by Rwandans and foreigners. A summary of the key general characteristics of Quarries in Rwanda are provided in the table 1 below:

Table 1: General features of primary extractors (Quarries)

Quarry category	**Count**	**Percent**
Micro scale (Firms employing 1 - 3 people)	44	24
Small scale (Firms employing 4 -30 people)	127	69.9
Medium scale (Firms employing 31 - 100 people and at least 5 million capital)	8	4.4
Large scale (Firms employing more than 100 people, at least 100 million capital)	3	1.6
Total	**182**	**100**
Working schedule status	**Count**	**Percent**
Regular Working	120	65.9
Temporarily working	62	34.1

Total	**182**	**100**
Quarrying status ownership	**Count**	**Percent**
Individual	131	72.0
Cooperative	39	21.4
Company	12	6.6
Total	**182**	**100**
Quarrying owners by nationality	**Count**	**Percent**
Rwandan	177	97.3
Foreign (Other rest of world)	4	2.2
Joint (Rwandan + Other rest of world)	1	0.5
Total	**182**	**100**

Source: Results of the Tech Audit, 2020

3.1.3 Natural stones and processed stone products in Rwanda

The Quarries visited included those owned by processors of natural stones and primary extractors who do not do processing (do not add value to what they extract). The results of Tech-Audit depicted 85.7% natural stone products supplied on the market are unprocessed stones which are mostly used construction activities such as raising foundations for different structures, construction of retaining walls, bridges among others. The results of technology audit revealed that, for processors owned quarries accounted only 14.3% of the extracted natural stones which are later processed into **aggregate of different sizes, Gravel, granite tiles, cobblestones, Road pavers, slates and stone claddings**. This implies that the level of natural stone processing is still at a nascent stage of development as it will later be explained in other sections of this report. Table 2 below provides the details.

Table 2: Natural stones and processed stone products

Natural stones and processed stone products	Count	Percent
Non processed stones for constructing foundations for different structures	156	85.7
Gravel used in concrete mixing	11	6.0
Cut natural stones used in finishing and decorations of buildings,	4	2.2
Cobblestones and sets	4	2.2
Road pavers	2	1.1
Granite tiles	1	0.5
Stone Claddings	2	1.1
Slates	1	0.5
Aggregates and powder	1	0.5
Total	**182**	**100.0**

Source: Results of the Tech Audit, 2020

3.1.4 The usages of the non processed natural stones

As indicated in the results of tech – Audit in table 3 below, over 94% of the non processed extracted natural stones are supplied and used for construction of both residential and commercial buildings (especially in raising foundations, retaining walls, among other construction activities); and 5.5% are used for Construction of bridges and retaining walls along highways, Decoration and fishing of structures. The table 3 below displays the results.

Table 3: Usages of non processed natural stones

The stones /stone Products you supply are mainly used for	Count	Percent
Construction of residential and commercial buildings (especially in raising foundations,);	172	94.5
Construction of bridges and retaining walls along highways;	5	2.7
Decoration and fishing of structures;	2	1.1
Others	3	1.6
Total	**182**	**100**

Source: Results of the Tech Audit, 2020

3.1.5 Knowledge and skills deployed in primary extraction of Natural Stones

The results of tech – Audit showed92.9% of primary extractors of natural stone do not use any academic acquired skills and knowledge to extract natural stones, the only 7.1% claim to have undergone formal education and trainings as depicted in the table 4 hereunder. The issues of relevant and formal qualifications among the employees of primary extractors was quite common among extractors because of the perceived tradition where extraction of natural stones used in construction of structures was an economic activity that was reserved for the uneducated people. The skills and knowledge used in extraction of these natural stones were acquired through informal on the job trainings where one gets to learn by doing. "Our employees know what they do in the quarries, we don't need highly educated people, we are only required to train them about safety procedures", underscored one of the participants of the Focus Group Discussions in Kamonyi District.

Table 4: Level of formal education qualifications used in natural stones extraction

Level of academic skills and knowledge to extract natural stones	Count	Percent
Yes	13	7.1
No	169	92.9
Total	**182**	**100**

Source: Results of the Tech Audit, 2020

Those who do not use academic skills in extracting natural stones (92.9%) were reported have undergone either informal apprenticeship training or conducted short term trainings organized by their respective Quarries as summarized in table 5 below.

As it is shown in table 5, 47.3% used personal talent and informally acquired technical capacities to extract natural stones in most of the Quarries; 33.1% used skills and knowledge acquired from organized informal apprenticeship training (trained on the job by experienced relatives and/or friends); and 18.9% used skills and knowledge from Short term training organized by the management of their respective Quarries and sponsored by either Non Governmental organizations or development partners who do not issue any recognized certificate of competence.

Table 5: Other sources of skills and knowledge acquired by natural stone extractors

Other source to acquire non-academic skills and knowledge required in natural stone extraction	Count	Percent
Informal apprenticeship training (trained on the job by experienced relative or friend);	57	33.7
Short term organized training organized by development partners or government with no certificate issued;	32	18.9
Used personal talent and informally acquired technical capacities	80	47.3
Total	**169**	**100**

Source: Results of the Tech Audit, 2020

3.1.6 Technology used in identification of quality natural stones

According to the results of the Tech Audit, majority of the primary extractors do not use any technology in identification of quality stones required at the market during the process of primary extraction as indicated in the table 6 below.

Table 6 depicts that 87.6% of the primary extractors have no known technology that is used in identification of quality stones as required by clients but rather use individual experience of observing stones and determine the ones perceived to be of good quality. The use of drillers and other forms of relevant technology accounted for only 7.8% of the visited primary extractors. The table below portrays the results:

Table 6: Technology used in identification and selection quality natural stones during primary extraction process

Do you have any adopted method for identifying the quality stones demanded by your clients	**Count**	**Percentage**
Yes	89	48.9
No	93	51.1
Total	**182**	**100**
If yes, please select among the following way to identify the quality of stones to be extracted	**Count**	**Percentage**
Natural selection using our experience in identification of quality stones required clients	78	87.6
We use installed machines which sieve and separate the wanted from unwanted extracted natural stones	5	5.6
Detectors or sensors of quality natural stones	2	2.2
Others	4	4.5
Total	**89**	**100**

Source: Results of the Tech Audit, 2020

3.1.7 Diagnosis of the technology used in primary extraction of natural stones

The results of the Tech- Audit showed that only 6.0% of the primary extractors of natural stones had technology for exploration and determination of the quantity of natural stones available in the area of extraction. It should be noted that only 6% of the primary extractors who were able to conduct exploration and determination of indicative quantities of natural stones in their Quarries. However, it is important to note that only 94% of the primary extractors had no technology as required to undertake exploration of the natural stones envisaged to be extracted and also indicatively determine the quantities (in terms of cubic meters) in the area of extraction (Quarry). The absence of technology used in exploration of natural stones was in consonance with the results of Focus Group Discussions where almost all the participants indicated that exploration of quality natural stones is done by experienced staff and owners of quarries. One of the participants of the FGDs in Nyaruguru District noted that "Exploring where quality natural stones, we do it ourselves by visiting several places rocky hills, it is easy for one to identify good natural stones that are suitable for raising foundations and even structures ".

In terms of the technology used in extraction of the natural stones from underground, up to 94.0% of the primary extractors declared that they used traditional hand used

tools which included Traditional tools (including heavy hummer (Kinubi); Metalic bar (Umutarimba); Spikes (ibihadiko), Axes, Spades, Hand hoes, among others and over 36% indicated that they used natural heating of rocks using firewood to facilitate easy breaking and/or crushing of huge and hidden rocks. However, for few Quarries which are also owned by developed natural stones processing plants used Stone crushing /cutting technology.

It was also revealed that close to 96% of the primary extractors were sourced locally (fabricated in Rwanda) only and slightly over 4% out sourced tools used in stone extraction from the region and the rest of the World. Asked whether technology used in primary extraction of natural stones is more efficient, one of the District officials in Rwamagana District highlighted that the technology of hand used tools was ineffective and non efficient since it involves a lot of waste. "The use of hand used tools is not efficient, for instance these tools when they are used in mining of natural stones mostly required in construction sector, the heavy hammers tend to undermine the quality and quantities being extracted; when they hit the big rocks, there cause a lot of damages and hence a lot of waste".

"There is a lot of waste caused by the commonly used technology in primary extraction; there is need for actors to consider upgrading the technology in primary extraction and also in processing in order to ensure that value is added," advised one of the officials at interviewed at Rwanda Mines, Petroleum and Gas Board.

The table 7 below depicts the findings:

Table 7: Diagnosis of the technology used in primary extraction of natural stones

On whether there is technology used in exploration and determination of the quantity of natural stones available in the area of extraction	**Count**	**Percent**
Yes	11	6
No	171	94
Total	**182**	**100**
Common tools usedin extraction of natural stones	**Count**	**Percent**
Traditional tools (including heavy hummer-Kinubi; Metalic bar (Umutarimba); Spikes (ibihadiko), Axes, Spades, Hand hoes, etc)	171	94.0
Modern stone extracting Machine with mounted engines(Pokers; caterpillars, etc);	3	1.6
Explosives (Intambi)	4	2.2
Use of metal Discs	1	0.5
Use of Diamond wires	1	0.5
Crusher machines	2	1.1

Total	**182**	**100.0**
The technology used to facilitate natural stone extraction (easy breaking or crushing of huge rocks hidden underground or on surface)	**Count**	**Percent**
Natural heating using Firewood	66	36.3
Explosives/Intambi)	9	4.9
Stone crushing / (including use of heavy hammers)	70	38.5
Cutting and breaking of stones using machines/wires	37	20.3
Total	**182**	**100**
The source of machines/tools that are used in Primary extraction	**Count**	**Percent**
Sourced locally (Fabricated in Rwanda)	174	95.6
Sourced in the Region and in the rest of the World	8	4.4

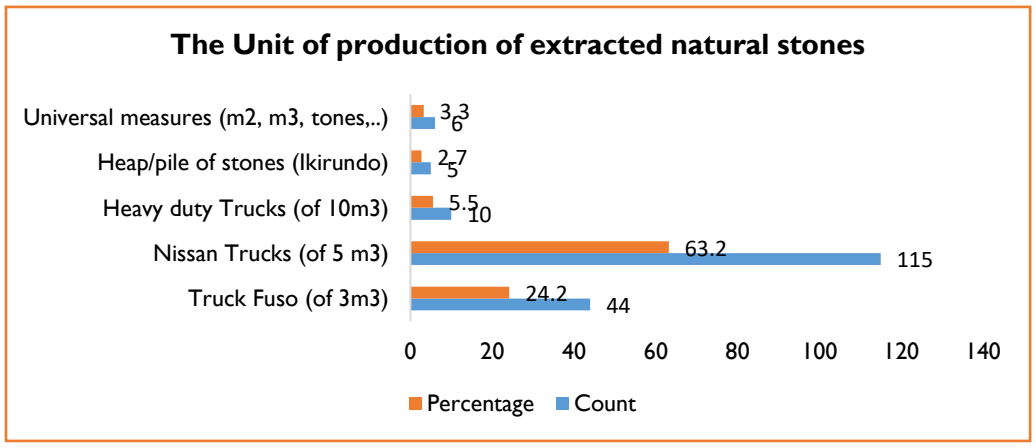
Source: Results of the Tech Audit, 2020

3.1.8 Production of natural stones extracted at primary level

The establishment of production capacity in terms of volume of cubic meters (unit used in production) produced by primary extractors was measured using transport trucks of different capacities (in cubic meters (m^3) loaded and sold per month. This finding was meant to have sense of the production efficiency among the primary extractors who predominantly employ artisanal natural stones mining practices.

However, given the rudimentary methods used in extraction of stones coupled with limited management skills and knowledge in business, some primary extractors (Quarries) use heaps (Ibirundo) as a unit of measurement in both production and sell. The figure 3 below indicates the units of measurements and volumes sold per month.

Figure 3: The common unit of measurement of production in quarries



Source: Results of the Tech Audit, 2020

The results of tech Audit indicate that the most primary extractors (63.2%) visited use Nissan Truck of 5m^3 and Truck Fuso of 3m^3 24.3% in their measurement of efficiency in their reproduction processes. The findings in the table below indicate that the average production per month for one primary extractor of natural stone was found to be218,482m^3/ per month.

Table 8: Average production of natural stones per month (Cubic meters-m^3)

The average production per month (m^3)	Sum (m^3)	Mean (m^3)
Production of extracted natural stone per month	39,763,715	218,482

Source: Results of the Tech Audit, 2020

3.1.8 Indicative expenses incurred by primary extractors of natural stones

The tech-audit assessed indicative expenses incurred by primary extractors in the production process, as revealed in the results, the most of the primary extractors (94%) use traditional tools to extract natural stones, in this table of expenses and revenues, the majority of primary extractors of natural stones use Firewood (Inkwi) as one the expenses averaging 11,863 RwF per Unit of production, and earn between 25,956 RwF and 30,582 RwF per truck sold depending on the capacity of the truck. The production cost per unit (in terms of trucks used in transportation) was also found to be influenced by the distance from the area of extraction to the demand destination and the quality of stones as well as the most used truck in the supply of non processed natural stones.

Table 9 : Indicative expenses incurred by primary extractors of natural stones

The Expenses incurred for producing one unit of truck (choose among these options: 3m³, 5m³, 10m³ or Pile (Ikirundo) of stones)	**Amount spent in RwF/ truck/Pile**
	Average
Firewood/Inkwi	11,863
Gasoline/Mazut	13,666
Value of explosives/ Urutambi	22,382
Wages for work/ per truck	98,265
Rental charges (In case the Quarry is rented/leased)	60,342
Cost of depreciation of tools used	11,119
Costs of consumables (such as food and Drinks and others) used at the extraction site	6,642
Earning/ Total Revenue (RwF/ Truck) How does truck of Natural stones extracted is sold in your Quarry	**Exact price per truck (RwF)**
	Average
Truck Fuso (3m³)	30,582
Truck Nissan (5 m³)	25,956
Heavy duty Truck (10 wheels) (10m³)	42,893
A pile of natural stones	6,506

Source: Results of the Tech Audit, 2020

3.1.9 Technology gaps and associated challenges

The tech Audit results indicate that the majority of primary extractors of natural stone are manually operated (92.9%). The typical functional features of majority of the primary extractors were found to use traditional hand used tools and informally trained human resources. The results of the Tech audit also revealed that6% of the primary extractors use partially manually operated technology in their extraction activities of natural stones. It was further indicated in the results of this tech audit that only 1% use powered equipment in extraction of natural stones. These quarries are owned by the most developed processing plants of natural stones in the country. The statistics and their respective ratios are here with provided in table 10 below:

Table 10: Level technology (level automation) used in primary extraction

Categorize quarries operations in your District using the following terms	Count	Percent
Fully manual operated	169	92.9
Partially manually operated	11	6.0
Powered equipment (fully automated)	2	1.1
Total	**182**	**100**

Source: Results of the Tech Audit, 2020

3.1.10 Most highly rated challenges faced by primary extractors in their business

Regarding challenges facing the primary extractors of natural stones, the results of Tech-Audit identified lack/limited access to modern technology required (which was rated at 73.6%) in extraction of natural stones, limited access to financial capital was rated at 72.0%, Inadequate infrastructure (poor roads) was rated at 67.9% as one of the major challenges facing the primary extractors in the country. Limited demand (61.0%) for natural stones and inadequate skilled labor were rated 61% and 53.8% respectively.

The challenges faced by the primary extractors of natural stones used in construction sector is one of themes that were discussed in the FGDs, the rating as indicated in table 11 below is in harmony with the results of the FGDs and Key Informant Interviews conducted. Some participants of the FGDs in Gakenke District highlighted that the issue of poor infrastructure and limited access to finance are very serious problems in terms of road net most especially the Quarries that are allocated in the in rural areas tend to be affected by heavy rains during the wet season. "The issue of poor roads is a serious one given that during the rainy season our roads become impassable," underlined one the participants in the FGDs in Gakenke District.

Table 11: Most highly rates challenges faced by primary extractors

Rated Challenge	Count	Percent
Limited energy, power and water	53	29.1
Poor infrastructure (roads)	122	67.0
Lack of skilled labor	98	53.8
Lack/limited of financial capital	131	72.0
Lack/limited technology required	134	73.6
High taxes	89	48.9
Limited demand	111	61.0
Competition from other quarries	73	40.1
Bureaucracy in seeking permits	51	28.0
Environmental protection cost	47	25.8

Other	19	10.4

Source: Results of the Tech Audit, 2020

3.1.11 Availability of the market and market segments for unprocessed natural stones

The results of tech audit showed that 79.7% of primary extractors supply individuals with construction projects, 14.3% for construction companies and 1.6% for processing plants (those that add value) to extracted natural stones. This implies that majority of the processing plants of natural stones have their own quarries and therefore do not outsources raw materials (natural stones). Below is a table 12 indicating availability of the market primary extractors target to supply.

Table 12: Availability of the market

The most common clients of natural stones in quarries	Count	Percentage
Individuals with construction projects;	145	79.7
Construction companies	26	14.3
Factory/plant that process (Add value) natural stones	3	1.6
Others	8	4.4
Total	**182**	**100**

Source: Results of the Tech Audit, 2020

3.1.12 Targeted market segments by primary extractors

In terms of targeted market segments of the primary extractors, the results of the tech audit indicated that the majority of them supply natural stones to perceived middle income clients (57.1%), 24.2% target high end clients and18.7% for low income clients in the market. It was further revealed by respondents that the trend of clients that buy unprocessed natural stones was found not to be consistent (65.9%). Some of the reasons behind the inconsistencies in the number of clients for the natural stones include impassable roads during the rainy season; poor quality of natural stones (Product) in certain areas and affordability of products (natural stones) to some segments of the market for natural stones.

Table 13 below shows the target market segments:

Table 13: Targeted market segments and reasons for inconsistencies in clients' turn up for natural stones

Targeted segments market	Count	Percent
High end clients	44	24.2
Middle income client	104	57.1
Low income earners	34	18.7
Total	**182**	**100**

Reasons of not having consistent clients	Count	Percent
Impassable roads by heavy rains	65	54.2
Inaccessibility (road)	74	61.7
Poor quality of produced products	40	33.3
Affordability	31	25.8

Source: Results of the Tech Audit, 2020

3.1.13 Supply contracts with clients of unprocessed natural stone

The results of Tech-Audit showed that the majority of primary extractors (64.3%) do not have any contracts with their clients of natural stones. There were only 35.7% of respondents that revealed the existence of contracts in different forms. The most contracts they had were verbal (56.9%) and the ones written and bearing specimen of both parties (43.1%). This implies that majority of the primary extractors are mainly characterized by informal functional operations and some are irregular in their operations.

Table 14: Contracts between primary extractors of natural stones and their clients

On existence of contracts between primary extractors and their clients	Count	Percent
Yes	65	35.7
No	117	64.3
Total	**182**	**100**
Type of contracts given	**Count**	**Percent**
Verbal Contracts	37	56.9
Written and bearing signature of both parties	28	43.1
Total	**182**	**100**

Source: Results of the Tech Audit, 2020

3.1.14 Protection and sustainability of environment by the primary extractors

The results of tech Audit revealed that, the majority of primary extractors of natural stones have license that allow them to operate are issued by a competent authority (77.5%); Those that were found to have a license of non-commercial small-scale quarry license with one hectare of land (1 Ha) accounted for 70.3%.

The majority ofprimary extractors of natural stones who use traditional hand used tools and deployed informally trained human resources were found to be aware of the negative impact caused by their extraction activities (96.7%). It was further revealed from the results the Tech audit that because of the negative impact caused by natural stone extraction activities and the need to comply with the environmental promotion and protection requirements as required by the government, 100% of the primary extractors were reported to be rehabilitating the affected land following the extraction activities and also do Afforestation.

Table 15: Certification and rehabilitation of environment

The types of quality/safety certificates or product certificates that the owner of quarry have	Count	Percent
Quarry area license from a competent authority as one (1ha) hectare in case of a non-commercial small-scale quarry license;	128	70.3
Quarry area license from a competent authority as five (5ha) hectares in case of commercial small-scale quarry license (at least 5MillionsRwF);	19	10.4
Level of awareness on the negative impact of natural stones extraction on environment	**Count**	**Percent**
Yes	176	96.7
No	6	3.3
Total	**182**	**100**
Some common and known practices by Primary extractors for	**Count**	**Percentag**

protecting and rehabilitation environment from degradation resulting from Quarry activities		**e**
Rehabilitating land (Gusibaibirombi)	86	48.9
Forestation and re-afforestation on the degraded land	87	49.4
Nothing done after extraction	1	0.6
Others	2	1.1
Total	**176**	**100**

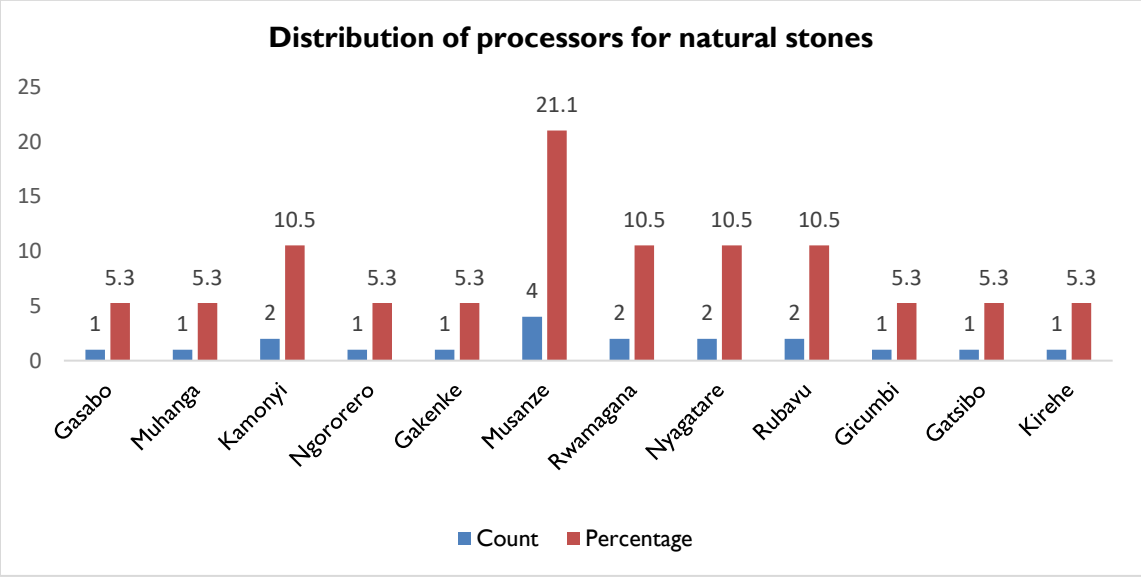
Source: Results of the Tech Audit, 2020

3.2 Analysis of Processing of Natural Stones

3.2.1 Distribution of processors of natural stones

Typical Tech audit for processing plants involved in natural stones value addition was preceded by the profiling of these companies in terms of compilation of their geographical location of their businesses, products produced, ownership, business categorization in term of SMEs classification, working environment (conditions, schedules), legal status and registration and major business activities.

Figure 4: Distribution of processors of natural stones



Source: Results of the Tech Audit, 2020

The Results of the Tech-Audit of value chain of natural stones was conducted in 28 Districts and of19processing plants of natural stones were identified in 12 Districts as are indicated in the figure 4 above. Although Musanze, Nyagatare, Kamonyi, Rubavu and Rwamagana districts have more than 1 factory, rest of the seven (7) districts as indicated in the figure 4 above were found to have one processing plant of natural stones.

The results of these Tech Audit, of the 19 factories audited processing plants were represented by either their Managing directors, Technical Directors and designated Technical staff to answer a set of questions that were meant for processors of the natural stones.

In terms of working within the designated industrial zones,12 factories (80.0%) among 19auditedprocessing plants operated outside of industrial zone, and 7 factories (20.0%) operate in the designated district industrial zones (parks).

Regarding the scale of visited factories, 9 factories out of 19 factories were identified as small scale with 4-30 employees and other 6 factories are in medium scale employing between 31 and 100 employees. The table 16 below provides the picture on the general information.

Table 16: General information on profiles of natural stone processing plants

The office of the factory visited	**Count**	**Percentage**
Head office of the factory	6	31.6
Single unit factory	11	57.9
Branch	2	10.5
Total	**19**	100
On whether the operated in designated industrial zones	**Count**	Percent
Outside industrial zones	16	84.21
In an industrial zone	3	15.79
Total	**19**	100.00
Classification of the processing plants in terms of size	**Count**	Percent
Small scale factory (Firms employing 4 - 30 employee)	10	52.6
Medium scale factory (Firms employing 31 - 100 employee)	9	47.4
Total	**19**	100

Source: Results of the Tech Audit, 2020

3.2.2Working environment and oriented business information of the identified processing plants

The results of tech-audit of value chain of natural stones showed that 18 out of 19 identified factories are regular in their operations and only 1 happened to be experiencing irregular operations because of mainly inadequate market as revealed by the management of the plant.

It was also revealed that 18 processing plants own individual Quarries and process natural stones for supply to others, 1processing plant (5.3%) buy natural stones for processing and selling stone products to others.

Regarding the types of stone products processed by each of the processing plants, 8 plants (42.1%) are much more involved in the production of the aggregate (gravel) of

different sizes used in construction of roads or structures of different sizes, 5 factories (26.3%) produce claddings which are used in finishing and decorations of buildings, 2 factories are more involved in cobblestones and slates (10.5%), and other 2 processing plants (10.5%) deal in non-processed stones for constructing foundations for different structures. One (1) factory (5.3%) process Granite tiles and slates as well as stone aggregate and powder (5.3%).

Table 17: Working environment and oriented business information

Working status of the factories that processed natural stone products	**Count**	**Percentage**
Regular operations	18	94.7
Irregular operations	1	5.3
Total	**19**	**100**
Major business activities of the factory	**Count**	**Percentage**
Buying Natural stones for processing and selling stone products to others,	2	10.5
Own Quarry and process natural stones for selling to others;	15	78.9
Own Quarry and process stone as well as do construction activities	2	10.5
Total	**19**	**100**
Types of natural stone products processed by factories	**Count**	**Percentage**
Non processed stones for constructing foundations for different structures	2	10.5
Aggregate of different sizes	8	42.1
Cut natural stones used in finishing and decorations of buildings (Claddings)	5	26.3
Cobblestones and slates	2	10.5
Granite tiles	1	5.2
Aggregates and powder	1	5.2
Total	**19**	**100**

Source: Results of the Tech Audit, 2020

Table 18: Ownership, nationality and shareholding status of processing plants of natural stones

Owners of the factory by nationality	**Count**	**Percentage**
Rwandan	17	89.4
Foreign (Other rest of world)	2	10.5
Total	**19**	**100**
Status and origin of the factory	**Count**	**Percentage**
Foreign private	3	15.7
Local Private	16	84.3
Total	**19**	**100**
Legal status and shareholdings of the factories	**Count**	**Percentage**
Sole proprietorship	8	42.1
Limited by shares	10	52.6
Partnership	1	5.2
Total	**19**	**100**

Source: Results of the Tech Audit, 2020

The 17 (89.4%) out of 19processing plants identified and visited were owned by the Rwandans. The 2 factories were owned by foreigners. Legal status and shareholding status of the factories, 8 out of 19 are in sole proprietorship (42.1%) and 10 factories (52.6%) are limited by shares and 1 factory (5.2%) are of partnership status.

3.2.3 Staff establishment and length of employees contracts awarded

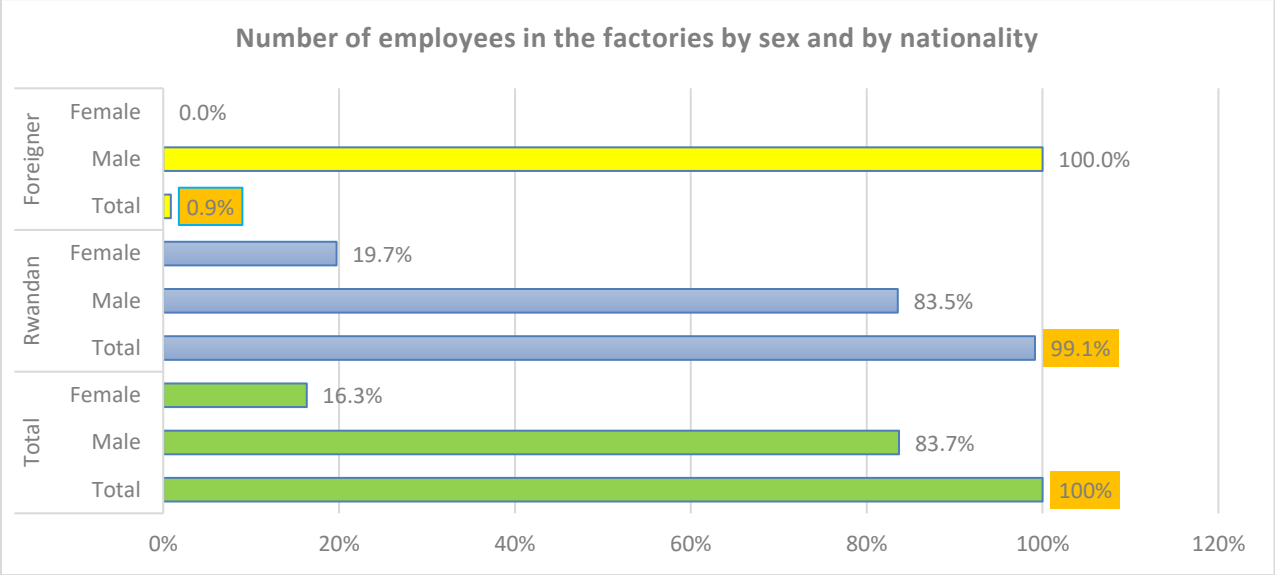
In the 19audited processing plants that add value to natural stones, 925 employees were identified in total, 774 (83.6%) are male and 151 (16.32%) are female. Regarding employee contracts, 240 (25.9%) factory workers were internees (Students undergoing Industrial attachment and apprenticeship programs), and 685 (74.0%) workers had formal employee contracts with their respective companies (Processing plants) ranging from 1 month to an open permanent contract.

Table 19: Number of working persons in the factories by contract and by Sex

Length of contract/ payment status	Type of contract	Total	Male	Female
Unpaid workers	Industrial attachment	132	119	13
	Apprentice	108	54	54
	Total	**240**	**173**	**67**
Paid workers	Open contract-Permanent	279	242	37
	Fixed contract above 6 Months	192	174	18
	1-6 Months	109	97	12
	Less than 1 Month	91	78	13
	Professional internship	14	10	4
	Total	**685**	**601**	**84**
Total		**925**	**774**	**151**

Source: Results of the Tech Audit, 2020

Number of employees by nationality and gender



Source: Results of the Tech Audit, 2020

The results in this figure indicate that, most employees 917 out 925 are Rwandan by nationality and only 8 employees were identified as non Rwandans (Foreign experts).

3.2.4 Deployed human resources in the factories that process natural stones

The results in the table below indicate that, the distribution of the number of employees in the areas of working in the factories, the most workers were deployed in production departments (133), followed by the employees (86) who served in the units in charge of raw materials reception; temporary employees (85) who were mainly casual workers.
In terms of the skills and competencies of the deployed staff, employees that possessed technical school degrees were deployed in production and raw material reception, employees with university degrees were more visibly deployed in Research and development (R&D).

Table 20: Skills of employees and the operational department by qualifications

Area of working in the factory	Total workers	# Workers with a university degree	# workers with a technical school degree	# Workers other types of degrees	# employees who received further trainings/short courses in relation to the job, including visit to bigger firms
Permanent staff					
Supply/raw material reception	**86**	11	28	23	24
Production	**133**	18	56	50	9
Quality control	**11**	7	3	1	0
R & D	**29**	27	2	0	0
Marketing and sales	**21**	11	3	1	6
Administration	**25**	17	6	2	0
Other	**15**	5	0	4	6
Casual workers	**85**	1	15	32	37

Source: Results of the Tech Audit, 2020

3.2.5 Level of specialization in skills related to processing of natural stones and construction activities

According to the results of this technology audit, a few employees were identified with specialized areas of education and training background that are more relevant to the natural stone processing and/or construction sector.

It was revealed that only 17 employees in all the audited processing plants had education and training background (sciences and technologies fields including Geology, Civil engineering and architecture) that is more related to natural stone processing and/or construction sector. Surprisingly, a big number of employees in the audited processing plants did not have education and training background that was related to natural stone processing and/or construction sector.

The table 21 below depicts the proportion of employees with their respective education and training background.

Table 21: Level of specialized skills possessed by employees in the factories

Source	# of workers	# of workers with a sciences and technologies fields and Geology	# of workers with civil engineers and architects	# of workers with economy/ finance related training/ education	# of workers with a training in other areas	# of workers without a related training/ education
Permanent staff						
Supply/raw material reception	**86**	2	4	5	1	74
Production	**133**	4	3	3	1	122
Quality control	**11**	4	3	1	0	3
R & D	**29**	3	3	22	1	0
Marketing and sales	**21**	1	1	2	0	17
Administration	**25**	3	4	6	4	8
Other	**15**	0	0	0	0	15
Casual workers	**85**	1	0	0	20	64

Source: Results of the Tech Audit, 2020

3.2.6 Level of continuous trainings offered by the factories to enhance employees' skills and competences

The results in the table below indicate that, 12 out of 19 factories organized and provided technical trainings to their employees in repair and maintenance of machines, and only 10 processing plants had given training to their employees on product development and Quality as well as safety guidelines.

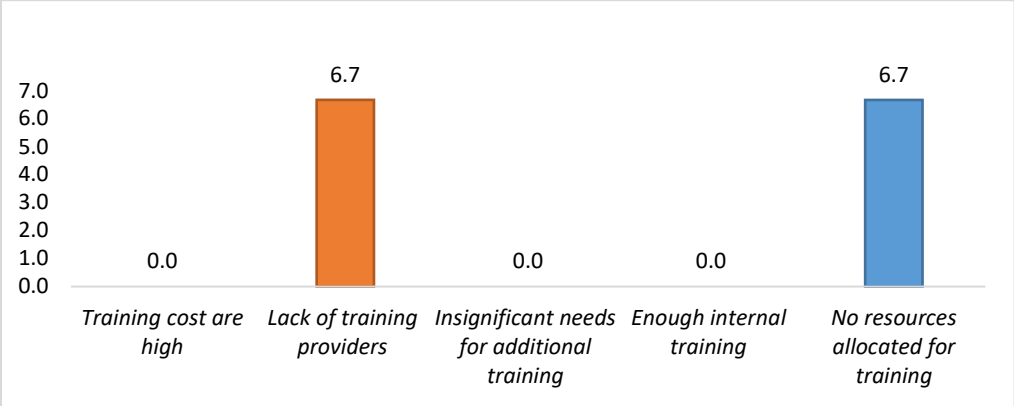
The results also revealed that only 3 processing plants had organized trainings for their employees in accounting, marketing, and administration. It should however be noted that capacity development of employees is not given due attention it deserves especially in enhancing capacity of the technical staff in order improve their operational efficiency in terms of increasing the levels of production and productivity.

Table 22: Continuous training offered to the employees

Types of continuous training offered to employees (N=19)		
Area of training	**Count**	**Percent**
Operating processing machines	12	63.1
Product development	10	52.6
Quality and safety related	10	52.6
Economy/Finance/Administration/Marketing		
Accounting	3	15.7
Marketing	3	15.7
Administration	3	15.7

Source: Results of the Tech Audit, 2020

Figure 5: The reasons behind not providing the training to the employees



Source: Results of the Tech Audit, 2020

As depicted in the figure 5 above, the reasons for limited prioritization of capacity development and training is associated and inclined on inadequate resources by companies to further develop their staff. Albeit the identification of the lack of training providers as one of the reasons for not conducting continuous training and development of the staff may not necessarily be a problem since they can also be outsourced from the region and even beyond.

3.2.7 Level of technology and sources of innovation in the surveyed natural stones processing plants

The results in the table 23 below indicated that internal innovation ranged between 6.7% to 60.0%, innovation born from the quality control department (9), production department (6), administrative department (5) and Research and development department (5) have more contribution to internal innovation. The most external

sources of innovation are from the clients (66.7%), competitors and consultants on 40% respectively. The table below displays the details.

Table 23: Identified sources of innovations in natural stones processing plants

Source of innovation ideas – who is the source?	Count		Percent	
	Yes	No	Yes	No
Internal Source of Innovation				
R&D Department	5	10	33.3	66.7
Quality control department	9	6	60.0	40.0
Production department	6	9	40.0	60.0
Supply chain department	2	13	13.3	86.7
Administration department	5	10	33.3	66.7
Marketing & sales department	4	11	26.7	73.3
Others	1	14	6.7	93.3
External Source of Innovation				
Clients	10	5	66.7	33.3
Competitors	6	9	40.0	60.0
Suppliers	5	10	33.3	66.7
Consultants	6	9	40.0	60.0
Research institutions	3	12	20.0	80.0
Universities	2	13	13.3	86.7
Others	1	14	6.7	93.3

Source: Results of the Tech Audit, 2020

3.2.7.1 Nature and type of innovations

In 19 audited processing plants, the most innovations identified included introduction of a new product on the local market, modification/improvement of existing products, and new products related to existing products which were rated between 60.0% - 73.3%.

Table 24 Existence of innovation

Nature and type of innovations	Count	Percent
New product on the local market	11	73.3
Modification/improvement of existing products	9	60.0
New products related to existing products	9	60.0
Innovation in waste management	7	46.7
Innovation in up cycling	7	46.7
New product on the international market	6	40.0
Innovation in knowledge use (education and training)	6	40.0
New product with additional technical support	4	26.7
Innovation in the supply chain (transport of raw material…)	2	13.3
Innovation in infrastructure (equipment, space and size)	1	6.7

Source: Results of the Tech Audit, 2020

3.2.8 Technology used in extraction of natural stones by processors

As revealed from the results of the Technology Audit, 31.6% of the processing entities indicated that they use traditional tools which included heavy hummer (Kinubi); Umutarimba; Spikes (Ibihadiko), Axes, Spades, Hand hoes, among others) and 52.6% were found to be using modern stone extracting machines with engines (Pokers; and excavators); (6.7%) used diamond wires to extract and undertake primary cutting of stones and 13.3% used Explosives (Intambi).

In addition, the audited natural stone processing plants used explosives, natural crushing/or cutting, and the rest relied on natural heating of rocks using firewood to facilitate processors in breaking huge and hard rocks hidden underground or on surface. The table 25 below depicts the summary of results.

Table 25: Tools and technology used to break natural stones hidden underground

The common tools used to extract natural stones from underground	Count	Percentage
Traditional tools (including heavy hummer-Kinubi; Umutarimba; Spikes (ibihadiko), Axes, Spades, Hand hoes, among others)	6	31.6
Modern stone extracting machine with engines(Pokers; Excavators)	10	52.6
Explosives (Intambi)	2	10.5
Use of Diamond wires	1	5.3
Total	**19**	**100**
Technology used in breaking of hard hidden or on surface rocks	**Count**	**Percentage**
Explosives/Intambi)	4	21.1
Stone crushing /cutting	10	52.6
Others (Heating and other traditional techniques of breaking rocks)	5	26.3
Total	**19**	**100**

Source: Results of the Tech Audit, 2020

3.2.8.1 The modern tools used in extraction of natural stones by plant activities, categorization and country of origin for machines

The 19processing plants that were audited confirmed that that they extract and process natural stone using of machines; 10 plants claimed to use modern equipment in quarry exploration, and 3 factories have no technology to explore required natural stones; in drilling and blasting of natural stones, the only 10 out of 19 factories use modern equipments/ machine and do drilling, lifting and loading of extracted natural stones. The 14 factories (73.7%) use machine and equipments for transportation as indicated in the table 26 hereunder.

Table 26: Technology used in primary extraction and transportation of natural stones

During Quarrying /extraction:	Quarry exploration		Extraction: Drilling or/and blasting		Primary cutting		Lifting & loading		Transportation	
	Count	%	Count	%	Count	%	Count	%	Count	%
Not done	3	15.7	7	36.8	3	15.7	5	26.3	4	21.0
No equipment/machine	6	31.5	2	10.5	5	26.3	3	15.7	1	5.3
Use equipment/machine	10	52.6	10	52.6	11	58.0	11	58.0	14	73.7
Total	**19**	**100**	**19**	**100**	**19**	**100**	**19**	**100**	**19**	**100**

Source: Results of the Tech Audit, 2020

3.2.9 Level of automation of technology used in different stages of production

The results of the Tech audit also indicated the level of the automation of the technology used in natural stones extraction. The audit focused on establishing whether the machines/tools used were manually operated, partially manually operated and fully automated. The table below depicts the categorization based on the level of automation:

Table 27: Categorization based on the level of the automation of equipments used extraction natural stones by activity

Equipment categorization	Quarry exploration		Extraction		Crushing/ primary cutting		Lifting & loading		Transportation	
	Count	%	Count	%	Count	%	Count	%	Count	%
Not done	1	11.1	0	0.0	0	0	0	0.0	0	0.0
Manually operated	0	0.0	0	0.0	0	0	1	9.1	0	0.0
Partially manually operated	8	88.9	9	81.8	3	42.9	8	72.7	8	80.0
Powered equipment	0	0.0	2	18.2	2	28.6	1	9.1	1	10.0
Automatically operated	0	0.0	0	0.0	2	28.6	1	9.1	0	0.0
Highly automated and sophisticated	0	0.0	0	0.0	0	0	0	0.0	1	10.0
Total	**9**	**100**	**11**	**100**	**7**	**100**	**11**	**100**	**10**	**100**

Source: Results of the Tech Audit, 2020

The identified equipment/machines were imported from different countries including European countries, and Asia countries and those fabricated locally (Rwanda) as indicated here below:

Table 28: Country origin of machines/Equipments used in extracting natural Stones

Country of origin	Quarry exploration		Extraction		Crushing/ primary		Lifting & loading		Transportation	
	Count	%	Count	%	Count	%	Count	%	Count	%
CHINA	1	12.5	2	25	2	28.6	1	14.3	1	10
ENGLAND	0	0	0	0	1	14.3	0	0	0	0
EUROPE	1	12.5	1	12.5	1	14.3	2	28.6	1	10
FINLAND	1	12.5	0	0	0	0	0	0	0	0
GERMAN	1	12.5	1	12.5	0	0	1	14.3	2	20
INDIA	1	12.5	1	12.5	0	0	0	0	1	10
ITALY	1	12.5	2	25	1	14.3	2	28.6	0	0
RWANDA	1	12.5	1	12.5	1	14.3	0	0	0	0
ASIA	0	0	0	0	0	0	0	0	1	10
DONT KNOW	1	12.5	0	0	1	14.3	1	14.3	4	40
TOTAL	**8**	**100**	**8**	**100**	**7**	**100**	**7**	**100**	**10**	**100**

Source: Results of the Tech Audit, 2020

The modern technology used in processing of natural stones by activities, categorization and country origin of machine

The Tech audit results also indicated the technology used in processing of the natural stones clearly targeting the key technology audit parameters which included un-loading and reception of the raw materials, tertiary cutting of natural stones, polishing, Packing and packaging, waste collection and up cycling, Lifting and loading, transport and distribution, ,unloading of final products distributed.

Table 29: Technology used in processing of natural stones at different stages of production

		Not done		No equipment/ Machine	Use equipment/ machine
Technology used in processing of natural stones at the factory level	**Un-loading**	**Count**	6	3	6
		%	40	20	40
	Tertiary Cutting	**Count**	6	2	7
		%	40	13.3	46.7
	Polishing	**Count**	10	3	2
		%	66.7	20	13.3
	Packing & packaging	**Count**	11	1	3
		%	73.3	6.7	20
	Lifting &loading	**Count**	8	2	5
		%	53.3	13.3	33.3
	Transport and distribution	**Count**	8	1	6
		%	53.3	6.7	40
	Waste collection and up cycling	**Count**	9	2	4
		%	60	13.3	26.7
	Unloading	**Count**	10	3	2
		%	66.7	20	13.3
	Other	**Count**	11	3	1
		%	73.3	20	6.7

Source: Results of the Tech Audit, 2020

Categorization of technology used at different stages of production

The technology deployed at different stages of production were categorized in order to establish their level of automation, the results showed that, the partially manually operated technology was the one rated highly (ranging between66.7% and 100%) more than any other level of automation. This implies that all plants that process natural stones use semi-automated installed technology in their respective lines of production.

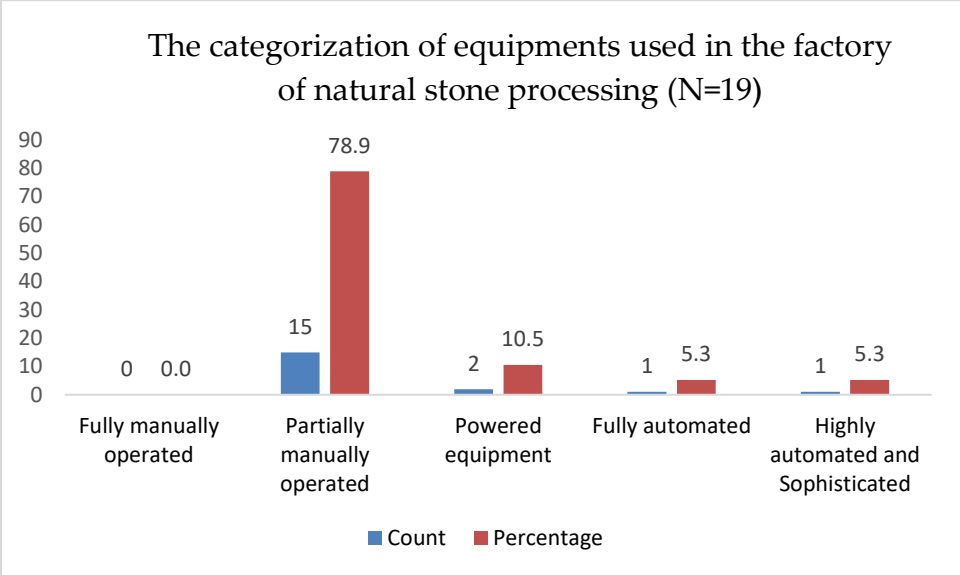
The highly automated and sophisticated technology was ranked at 0% across all in-factory level operations (stages of production). However, there was only 1 factory that was categorized as automatically operated especially in tertiary cutting and un-loading of the processed products. The fully automated technology was scored at low levels in the entire process of natural stone processing across all the factories.

Table 30: Technology categorization

Equipment categorization	Loading and Un-loading of raw materials		tertiary Cutting		Polishing		packaging		Lifting &loading		Transport and distribution		Waste collection and upcycling		Un-loading		Other	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Not done	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	16.7	0	0.0	0	0.0	0	0.0
Manually operated;	0	0.0	0	0.0	0	0.0	0	0.0	1	20.0	1	16.7	0	0.0	0	0.0	0	0.0
Partially manually operated;	4	66.7	6	85.7	2	100.0	3	100.0	4	80.0	4	66.7	3	75.0	2	100.0	1	100.0
Powered equipment;	1	16.7	1	14.3	0	0.0	0	0.0	0	0.0	0	0.0	1	25.0	0	0.0	0	0.0
Automatically operated;	1	16.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Highly automated and sophisticated	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	**6**	**100**	**7**	**100**	**2**	**100**	**3**	**100**	**5**	**100**	**6**	**100**	**4**	**100**	**2**	**100**	**1**	**100**

Source: Results of the Tech Audit, 2020

Figure 6: categorization of equipments used in processing of natural stones



Source: Results of the Tech Audit, 2020

Regarding the country origin of identified equipments and machines used in extracting of natural stones in 19 visited the factories; the china and Europe countries were the most suppliers of those reported equipments.

Table 31: The origin countries of equipments used in the stone processing

The Country of origin	Un-loading		Cutting – tertiary		Polishing painting		Packing & packaging		Lifting &loading		Transport and distribution		Waste collection and upcycling		En-loading		Other	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
CHINA	1	16.7	3	42.9	1	50	0	0.0	2	40	2	33.3	0	0	0	0	0	0
EUROPE	0	0.0	0	0.0	1	50	1	33.3	1	20	1	16.7	1	25	1	50	1	100
GERMANY	3	50.0	0	0.0	0	0	0	0.0	0	0	1	16.7	0	0	1	50	0	0
INDIA	0	0.0	0	0.0	0	0	0	0.0	1	20	0	0.0	0	0	0	0	0	0
ITALY	1	16.7	1	14.3	0	0	1	33.3	1	20	0	0.0	2	50	0	0	0	0
RWANDA	0	0.0	1	14.3	0	0	0	0.0	0	0	0	0.0	1	25	0	0	0	0
TURKY	1	16.7	0	0.0	0	0	0	0.0	0	0	0	0.0	0	0	0	0	0	0
USA	0	0.0	2	28.6	0	0	0	0.0	0	0	0	0.0	0	0	0	0	0	0
DONT KNOW	0	0.0	0	0.0	0	0	1	33.3	0	0	2	33.3	0	0	0	0	0	0
TOTAL	6	100.0	7	100.0	2	100	3	100.0	5	100	6	100.0	4	100	2	100	1	100

Source: Results of the Tech Audit, 2020

Table 32: Production capacity of the factory

Production capacity in average	Average
Length of the production cycle	5 **(In Hrs)**
Factory installed production capacity (Units per day)	54 (**in tons**)

Source: Results of the Tech Audit, 2020

3.2.10 Packaging and branding of natural stone products

Packaging of natural stone products is not common in many processing plants especially those involved in the processing of claddings and slates. However, some companies are found to use pallets during transportation of their products from one point to another. A few companies especially those that process tiles from natural stones sometimes do packaging depending and branding of these tiles.

Table 33: Source of equipment and materials used in packing processed products

Source of equipment used in packaging	**Percentage**
Sourced locally – In Rwanda	33.3
Sourced regionally – In EAC & Great lake region	0.0
Sourced internationally	73.3
The source packaging materials	**Percentage**
Sourced locally – In Rwanda	33.3
Sourced regionally – In EAC & Great lake region	0.00
Sourced internationally	13.3
Make them ourselves / by local artisans	13.3

Source: Results of the Tech Audit, 2020

As indicated in the table above, 73.3% use equipment imported from abroad to facilitate the process of packaging while 33.3% of these packaging equipment are assembled locally (Rwanda). The rest of the required packing materials are made in Rwanda (33.3%) while 13.3% of these materials used in packaging are imported from abroad and 2 factories (13.3%) claim to use in-factory fabricated materials.

3.2.11 The ability to afford technology

In terms of affordability of modern technology used both at primary and processing level of natural stones, 15 (78.9%) out of 19 factories audited indicated that their companies 'capital was inadequate to acquire new technologies that would see their companies improve their levels of production and productivity. This can be explained by reliance on either grants or loans which are being serviced by these companies for the limited machines used in their different production lines. The details are provided in the table 33 below:

Table 34: Ability to afford technology

Ability to afford technologies	Count	Percent
The firm's resources and incomes are enough to acquire new technology	4	21.1
The firm's resources are not enough to acquire new technologies	15	78.9
If factory use loans and grants	**Count**	**Percent**
The firm uses loans	10	52.7
The firm uses grants to acquire new technology	5	26.3
Other	4	21
How accessible are technologies/machines utilized	**Count**	**Percent**
Easily accessible - (the firm has government's support to access new and affordable technology)	2	10.5
Somehow easy - (both firms and government have to share the cost to access new and affordable technology).	1	5.2
Not easy at all - (firms are struggling to have access to new and affordable technology)	15	78.9
Other (use personal equity)	1	5.2

Source: Results of the Tech Audit, 2020

3.2.12 Most prioritized areas that required improvement

As part of the Technology audits results, processing plants were prioritized areas in their plants that most needed improvement in order to increase production and productivity in their plants.

Table 35: Prioritized areas that require improvement

1. Process area	Percentage
Automation	66.7
Production control	33.3
Capacity building of staff	66.7
Research and Development	33.3
Improvement of production method	83.3
2. Quality of products area	**Percentage**
Quality control	50.0
Supply chain of raw material	50.0
Processes	75.0
Complying with Standards	62.5
Other	25.0
None	46.7
3. Management area	**Percentage**
Top management	0.0
Supervisors	0.0
Technical staff	50.0
Other	16.7
None	60.0

Source: Results of the Tech Audit, 2020

As depicted in the table 35, the most prioritized areas that required improvements were technology and human resources for the factories in order improve their levels of production and productivity. Most Processing plants indicated that they required improvements in their area of processing which implied improving the levels of automation in the installed technology; improved production controls; enhanced capacities of the technical staff; enhancing the research and development department and the improved production methods.

3.2.13 Quality assurance and standards status

Regarding quality assurance and standards, only 12 factories out of 19 audited indicated that they had a quality control department (63.1%). The table below shows the rate at which quality control techniques were rated.

Table 36: Quality assurance and standards

Kindly testify the existence of following quality	**Percentage**
Existence of quality control department	80.0
Available quality control techniques (Quality checks and compliance):	**Percentage**
The raw materials quality specifications	73.3
The in-process product quality specifications	86.7
The final product quality specifications	80.0
Quality checks conducted by external organizations	33.3
Existence of controls (and monitoring) at determined CCPs	53.3
Cases of products' re-call in case of quality control problems	46.7
Quality records keeping	86.7

Source: Results of the Tech Audit, 2020

It is evident that 80% of the processing plants that had the department in charge of Quality control indicated that they had laid out quality control techniques at different stages of production. It should however be noted that even those processing plants that had no specific Quality control department conducted quality control in their lines of production.

3.2.14 Environmental and safety certificates obtained

The Tech audit results further indicated that the safety certificated offered to the factories in quarrying and processing of natural stones for construction, most of them 14 (73.6%) out of 19 factories got certificates on environmental impact assessment or a certificate of clearance issued by a competent authority.

Others 5 factories got quarry area license from a competent authority for the one (1ha) hectare in case of a non-commercial; a commercial Quarry area license from a competent authority for those with five (5ha) hectares of land in case of commercial small-scale quarry license (at least 5 Million RwF).

Table 37: Environmental, safety and product standard certificates obtained

Types of safety certificates or product certificates obtained	Count	Percentage
S-mark (Standardization mark)	5	33.3
Environmental impact assessment and a certificate of approval issued by a competent formal authority	14	66.7
Quarry area license from a competent authority one (1ha) hectare in case of a non-commercial small-scale quarry license	5	33.3
Quarry area license from a competent authority five (5ha) hectares in case of commercial small-scale quarry license (at least 5 Million RwF)	5	33.3
Quarry area license from a competent authority Fifty (50ha) hectares for a large-scale quarry license (at least one hundred million Rwanda Francs (RwF100,000,000)	1	6.7
Quarry area license from a competent authority Larger than fifty (50 ha) hectares for a large-scale quarry license	1	6.7

Source: Results of the Tech Audit, 2020

The form and quantity of raw materials received by processing plants

The results in table 38 below indicate that, 16 out of 19 factories had received 106,073 Tones from their own quarries, 6 factories outsourced raw materials of natural stones for processing (4,334 tons per year), 4 factories received 189 tones sourced from both own quarry and out sourced, and 2 factories received 1,810 tons of semi processed stone products, and 4 received 1,070 tons from others (outside of the country). The table below illustrates the findings:

Table 38: The sources of raw materials and quantities received by processing plants

The form and quantity of raw materials received by the factories (Suppliers of raw materials)	Number of Establishments	Tons /year
Own a quarry	12	106,073
Natural stones out sourced	6	4,335
Both from quarry and out sourced	4	189
Semi processed stone products	2	1,810
Other forms of inputs (mostly imported ingredients: Discs; Diamond wires, among others)	4	1,070

Source: Results of the Tech Audit, 2020

The outsourced raw materials as % of total quantities of raw materials used in production of natural stones products

The results in the table 39 below indicate that, majority of the processing plants of the natural stones were found to own individual quarries as their main source of raw materials in terms of the natural stones. However, there other ingredients (inputs) that are normally outsourced and used in production. Table 39 below provides a picture on raw material supply.

Table 39: Outsourcing of raw materials

Own individual quarry	**Count**	**Percentage**
0.0%	0	0
1-20%	0	0
41-60%	2	10.6
61-80%	0	0
81-100%	17	89.4
Total	**19**	**100**
Outsourced from cooperatives (owner) quarry	**Count**	**Percentage**
0%	14	73.6
1-20%	4	21
41-60%	1	5.3
Total	**19**	**100**
Outsourced from middlemen/aggregators	**Count**	**Percentage**
0%	14	73.6
1-20%	5	26.4
Total	**19**	**100**
Outsourced from established local collection centers	**Count**	**Percentage**
0.0%	17	89.4
1-20%	1	5.3
81-100%	1	5.3
Total	**19**	**100**
Outsourced from foreign suppliers	**Count**	**Percentage**
0%	19	100
Total	**19**	**100**

Source: Results of the Tech Audit, 2020

Space for production and the ability to expand

As indicated in the table below, 17of the 19 audited processing plants indicated that they had sufficient space for production and future expansion. This implies that in case of any support extended to these processing plants they would have room for increased production and/or expansion of their operations. This would automatically increase employment opportunities and also reduce on the natural stone products imported from different countries.

Table 40: Availability of space for future expansion

Space for future expansion	Count	Percentage
Yes	17	89.4
No	2	10.6
Total	19	100.0
Space ownership	**Count**	**Percentage**
Own space	17	89.4
Rented space	2	10.6

Source: Results of the Tech Audit, 2020

3.2.15 Highly rated challenges that affect Production of processing plants

Some of the highly rated challenges that affect production and productivity processors of natural stones were ranked as follows: Inadequate technology (80.0%) vis a vis the required; Expensive and inconsistence supply of energy and water (66.7%), inadequate skills (66.7%), inadequate financial capital (66.7%) and poor infrastructure (60.0%).

Table 41: Highly rated challenges that affect Production of processing plants

The main challenges faced the factories during Production?	Count	Percentage
Inadequate technology required	12	80
Expensive and inconsistence supply of energy and water	10	66.7
Inadequate skilled labor	10	66.7
Inadequate financial capital	10	66.7
Poor infrastructure	9	60
Limited demand	7	46.7
High taxes	6	40
Environmental protection cost	6	40
Inadequate raw materials	5	33.3
Competition from other companies	5	33.3
Bureaucracy	4	26.7
Other	3	20

Source: Results of the Tech Audit, 2020

3.2.16 Financial Management, turnover and operational capital

According to the results of the Tech Audit, 16 out of 19processing plants audited regularly use books of accounts, and it is also reported that they complete them at a range of between 75%-100% as depicted in the table42 below. Furthermore, 9 processing plants indicated that they used specialized accounting softwares in their financial management practices.

Table 42: Level of books of account and types of accounting books

The factory use regular books of Accounts	Count	Percentage
Yes	16	84.2
No	3	15.8
The following books of account is used by the factories	**Count**	**Percentage**
Ledgers	9	75.0
Journals	12	100.0
Balance sheet	12	100.0
Income statement (Profit and loss account)	12	100.0
Invoice	12	100.0
Specialized accounting software	9	75.0

Source: Results of the Tech Audit, 2020

Recorded Annual turnover for the audited processing plants

The results of this tech audit revealed that, the annual turnover of audited processing plants for natural stones varied in terms of their recorded financial capacity. 1 processing plant had registered less than RwF 300,000; 2 factories have annual turnover that ranged between RwF 300,000 and RwF12 million;8plants registered between 12 and 20 million Francs and 4 factories recorded an annual turnover that was between 20M and 50M, and lastly 4had annual turnover of More than 50 million Rwandan Francs.

The results of the operational expenses recorded indicated that 1 processing plant had employed capital of less than RwF 500,000; 10 factories had registered between a range RwF 500,000 andRwF15Million and followed by the 8 factories were between a range of20andmore than 50 million of employed capital.

Table 43: Turnover, employed capital, taxation and foreign transactions recorded

Annual total turnover in 2019 per factory in RwF	Count	Percentage
Less than 300.000	1	5.3
300.000-<12.000.000	2	10.5
12-<20 million	8	42.1
20 to 50 million	4	21.0
More than 50 million	4	21.0
Current employed capital/operational expenses in RwF	**Count**	**Percentage**
Less than 500.000	1	5.3
500.000-15.000.000	10	52.6
More than 15 to 75 million	7	36.8
More than 75 million	1	5.3
Type of taxes	**Count**	**Percentage**
Value Added Tax (VAT)	11	73.3
TPR/PAYE	12	80
Withholding Income Tax	10	66.7
Import Duties Tax	9	60
Trading License Tax	14	93.3
Rental Income Tax	4	26.7

Source: Results of the Tech Audit, 2020

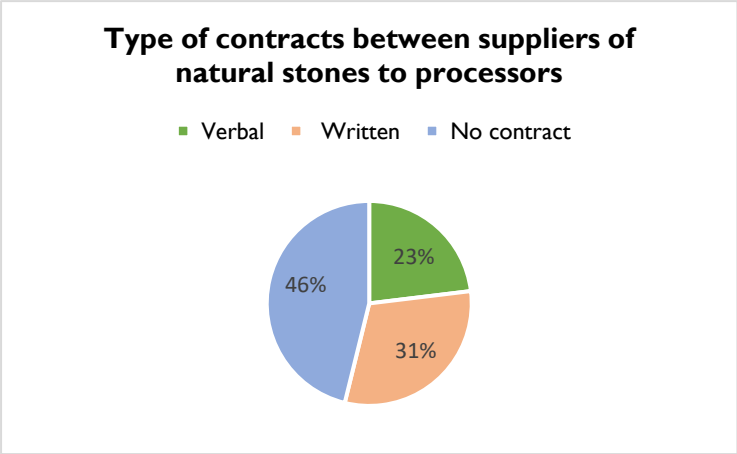
Table 44: Transaction in natural stone products with foreign countries

Transaction of natural stones products with a foreign country in the last 12 months	Count	Percentage
Export of natural stones products (claddings) in DRC	4	21.1
Import inputs for production	0	0.0
Both (export and import)	0	0.0
No transaction	15	78.9
Total	**19**	**100**

Source: Results of the Tech Audit, 2020

As indicated in the table above, there are only 4 processing plants that had had transactions with the neighboring country (DRC) especially exporting claddings in the last 12 months.

Figure 7: The nature of contracts between processing plants and suppliers of raw materials



Source: Results of the Tech Audit, 2020

As indicated in the figure above,46% of the processors of natural stones that outsource raw materials from other extractors had no contracts; 23% had verbal contracts for supplying raw materials to these factories and 31% had written contracts bore specimen of both parties.

The results in the table 45below illustrate the key elements contained in the contracts between inputs suppliers (Supplier of raw materials of natural stone and processors of stones products).

Table 45: Main terms that feature most in the contracts

The Contents of the contract specify any of the following	Count	Percentage
Length of agreement	5	55.6
Delivery and payment conditions	5	55.6
Quality control measures	2	22.2
Degree of contract formalization	3	33.3
Opportunities for enforcement of contractual obligations	3	33.3
Non-financial and financial services provided	3	33.3
Existence of sub-contracting	2	22.2
Scope for changes	3	33.3

Source: Results of the Tech Audit, 2020

Table 46: Market access and targeted clients for processed natural stone products

Targeted market segments	Count	Percentage
High end clients	14	73.6
Middle income client	3	15.9
Low income earners	2	10.5
Consistence growth of clientele for natural stone products	**Count**	**Percentage**
Yes	14	73.6
No	5	26.4
Reasons of non Consistence in the growth clientele of stone products	**Count**	**Percentage**
Impassable roads because heavy rains	0	0.0
Poor quality of produced products	0	0.0
Affordability	4	60.0

Source: Results of the Tech Audit, 2020

Table 47: Marketing strategies used by companies involved processing of natural stones products

The main marketing strategies of the factories	Count	Percentage
Word of mouth advertising	7	70.0
Open shows and showroom display	4	40.0
Direct selling marking	3	30.0
Internet marketing	3	30.0
Dominance in marketing (established name)	3	30.0
Paid media - Advertisement and promotions	4	40.0
Niche marketing	1	10.0
Cause related marketing (Market influence)	3	30.0
Participating in local, regional and international exhibitions	2	20.0

Source: Results of the Tech Audit, 2020

As depicted in the table 47above, the highly rated strategy of advertising of processed natural stone products was found to be word of mouth; use of paid media and showrooms. It should however be noted that some companies have processing plants which are meant to supply inputs (raw materials) into what they do such as natural stone processing plants owned by construction companies, they may not need advertising the products they produce because they are supplied to their sister companies that do construction activities.

Table 48: Level of competition of processed natural stones products on the market

Highlighted share of the type of competitor	Share	Percentage
Local competitors (National level)	0%	33.3
	1-20%	25.0
	41-60%	8.3
	61-80%	8.3
	81-100%	25.0
Regional competitors	0%	75.0
	1-20%	25.0
International competitors	0%	50.0
	1-20%	16.7
	21-40%	16.7
	41-60%	0.0
	61-80%	8.3
	81-100%	8.3

Source: Results of the Tech Audit, 2020

The high shares of market competitors were reported in local and international competitors that deal with producing and selling natural stone processed products. International level competitors include companies that export natural stone products and/or their perfect substitutes. Stone products and/or perfect substitutes of stone products such as claddings and tiles flooded on local markets in Rwanda are imported from countries in East Asia most especially Chain and Taiwan. Other common stone products and related substitutes on Rwandan markets are imported from Egypt and South Africa.

3.2.17 Environmental Protection and sustainability

The results of tech Audit in 19 factories that processed natural stone products and that had their own quarries (94.7%)are convicted that the extraction of natural stones has a negative impact on the environment. 6 processing (42.9%) rehabilitated the land against environmental degradation and protect the land following the extraction of stones or processing of stone products. 7 factories did afforestation to rehabilitate land.

Regarding business Environmental Impact Assessment, 15 factories (73.3%) had conducted business Environmental Impact Assessment before extracting and processing natural stones.

Table 49: Environmental awareness and protection

Are you aware that the extraction of natural stones has a negative impact on the environment?	**Count**	**Percentage**
Yes	18	94.7
No	1	5.3
How do you prevent against environmental degradation and protect the land following the extraction of stones or processing of stone products?	**Count**	**Percentage**
Rehabilitating land/ Gusiba ibirombe	6	42.9
Forestation to rehabilitate land	7	50.0
Nothing done after extraction	0	0.0
Others	1	7.1
Did you conduct your business Environmental Impact Assessment?	**Count**	**Percentage**
Yes	15	79.0
No	4	21.0
Do you measure Carbon emission?	**Count**	**Percentage**
Yes	0	0.0
No	19	100

Source: Results of the Tech Audit, 2020

3.3 Analysis of the appreciation of end users' views on quality of stone products

The analysis here below is the interpretation of end users' views on the appreciation of quality of natural stone products as explained below;

As illustrated in table 50 below 52 end users (43.7%) rated the quality of natural stones as high, 61 end users (51.3%) rated the quality as moderate and 6 end users (5.0%) rated the quality of natural stone product as that of low quality.

Table 50: Appreciation of the quality stone products made in Rwanda

	Count	**Percentage**
High quality	52	43.7
Moderate quality	61	51.3
Low quality	6	5.0
No	0	0.0
Total	**119**	**100**

Source: Results of the Tech Audit, 2020

The appreciation and rating of the quality of natural stone products by the end-users as indicated in table 47 here above was also echoed by interviewees and participants of the Focus Group Discussions. One of the participants in the FGDs organized in at the level of Nyarugenge District highlighted that quality of natural stone products made in Rwanda are of good quality but the challenge is on the market prices attached to these products. "For me, I find the quality for instance of the Granite tiles made in Rwanda undisputable but the issue is the price of these tiles; they are so

expensive for most Rwandans. The government should look into how this factory can be supported to supply affordable granite tiles". There was however a number of discussants that participated in Focus Group Discussions in Eastern Province who repeatedly highlighted that the claddings sold by some of the processing plants in Rwanda do not have the same measurements in terms of size and this has a negative implication of the quality of this natural stone product. "The natural stone claddings produced locally are made from very good quality natural stones but the problem is the quality in cutting them; the size is not harmonized and no quality polishing revealed one of the participants in the Focus Group Discussion in Gatsibo District".

Results of the Focus Group Discussions held in Gasabo District indicated that natural stone products made in Rwanda are durable and of good quality because the composition of the stones they made in. They highlighted the granite tiles and slates processed by East African Granite Industries Ltd (EAGI) and the claddings made from sand stones as well as Volcanic rocks (solidified volcanic lava) by various companies are of good quality and are worthy the money one can spend on them."The claddings imported from Chain and from the rest of the World are not real natural stones and on other hand, beauty of the claddings made from Rwandan natural stones is outstanding and they are more durable".

Table 48 depicts the level of appreciation of quality of personnel used in the extraction of natural stones in quarries and stone processing plants, 75 respondents (63%) said they appreciated personnel whereas 44 respondents (37%) did not appreciate the quality of the technical personnel deployed.

Table 51: Appreciation of personnel used in extraction of natural stones in Quarries and stone processing plants

	Count	Percentage
Yes	75	63
No	44	37
Total	**119**	**100**

Source: Results of the Tech Audit, 2020

Level of competitiveness of the Rwandan made natural stone products

The level of competitiveness of the natural stone products made in Rwanda can be understood as the ability of the existing processing plants of natural stone products to offer products that meet the quality of the local market at competitive prices (lower prices compared to the prices from other substitute products imported from the rest of the World).

Table 52 illustrates the level of competitiveness of processed natural stone products on the local markets and their rated level of competitiveness in terms of both price and quality by the end-users of these natural stone products. As depicted in the table hereunder (Table 52) 32.8% revealed that the locally made natural stone products were highly competitive in both price and quality. However, the majority of the respondents (52.9%) revealed that they were relatively competitive in terms of price and quality of these natural stones products as indicated in table 49 below. Albeit ratings of highly competitive (32.8%) and relatively competitive (52.9%) by majority of the respondents, 14.3% of the respondents rated natural stone products made in Rwanda are not competitive in terms of both price and quality.

This opinion was repeatedly echoed in the results of the Focus Group Discussions and the interviews conducted in terms of limited competitiveness. "There is need to put in place policy guidelines and ensure that support in terms of technology is extended to these nascent companies involved in the processing of the natural stones, otherwise they cannot compete with cheap Chinese products flooded on Rwandan markets", underscored one of the policy level officials interviewed.

Table 52: Level competitiveness of processed natural stone products

	Count	Percentage
Highly competitive in both quality and price;	39	32.8
Relatively competitive in both quality and price;	63	52.9
Not competitive in both quality and price.	17	14.3
Total	**119**	**100**

Source: Results of the Tech Audit, 2020

In terms of the efforts invested by primary extractors in rehabilitation and upholding of environment established requirements, 58% of the respondents revealed that there were low levels of efforts invested by these actors as indicated in table 53 below.

Table 53: Level of efforts invested by extractors of natural stones to protect and sustain the environment

Level of awareness on the damage caused by extraction of natural on environment	Count	Percentage
Yes	112	94.1
No	7	5.9
Total	119	100
Total	**119**	**100**
Level of efforts invested in sustaining the environment	**Count**	**Percentage**
Very low efforts	12	10.7
Low efforts	65	58
Higher efforts are being invested by extractors and processors	28	25
Others	7	6.3
Total	**112**	**100**

Source: Results of the Tech Audit, 2020

3.4 Calculations of the greenhouse gases emissions from stone processing

3.4.1Methodology

The greenhouse gases (GHG) emissions from the production of different natural stone, sand stones and granite stone was estimated through factories processing activities which require the consumption of (i) electricity and (ii) fuel/diesel. The liquid fuels such as diesel, residual fuel oil are mainly consumed in various mining and quarrying companies. The scope of the work did not consider the fuel/diesel consumptions for the transport of raw materials. It should be noted that natural heating using firewood was not considered due to the lack of records in concerned factories.

Table 54 provides the data from the inventory conducted with detailed quantity of diesel and electricity consumption per ton of production. This evaluation was used to estimate the GHG emissions per factory guided by established standard methodology of the **Intergovernmental Panel on Climate Change (IPCC) 2006** guidelines[12]and the **IPCC inventory software version 2020**.The 2006 IPCC Guidelines estimate carbon emissions in terms of the carbon species which are emitted. As described in the IPCC 2006 guidelines and adopted best practices, GHG emissions from energy industries are generally calculated by multiplying the fuel combustion by the corresponding emission factors. For the electricity emissions associated with

[12]2006 IPCC Guidelines for National Greenhouse Gas Inventories

on-grid electricity generation, the estimation was based on the emissions intensity of grid generation in Rwanda for 2020 which is also estimated at 0.39 Ton CO_2e/ MWh[13].

Table 54: Quantity of electricity/ liquid fuels consumption during stone processing

Name of company	Quantity of power/ liquid fuels used in stone processing
EDECON	400 L diesel/ton
INGERI Business Company	62 kwt/ton
TVCSCEC Ltd	500 L diesel/ton
Carriere de Mille Collines	182 kwt/ton
East African granite industries	342 kwt/ton
Stone Craft industries	124.4 kwt/ton
Fair Construction	131.42 kwt/ton
NPD co.	400 L diesel/ ton
3M Quarries ltd	43.2 kwt/ton
GM civil contractor	132.5 L of diesel / ton
Dutureheza ltd	267kwt/ton
Stone business center ltd	409.4kwt/ton
Stone masters	135 kwt/ton
CAMOSAG Ltd	119 kwt/ton
PK company ltd	220 kwt/ton
Enhakole Ltd	103.24 kwt/ton
Rwanda Mountain Tea	200 L diesel /ton

During the diesel combustion process, most carbon is immediately emitted as CO_2 and another part as CH_4 and N_2O gases. Tier 1 method was used for combusted fuel/diesel estimation. Since CO_2 emissions are independent of combustion technology this GHG estimate has to provide default emission factors as shown in table 52 for CO_2, CH_4 and N_2O that are applicable to all combustion processes in different factories. Country specific values of net calorific values (NCV) and density were considered for emission factors, default values as provided in the IPCC 2006 guidelines were applied. The aggregated emissions in CO_2e were estimated using the

[13]Republic of Rwanda, 2020. Update of Rwanda's Nationally Determined Contribution

global warming potentials provided by IPCC Second Assessment Report (SAR). It is considered that the dominant activities, in which liquid fuels/diesel are used in these factories, include electricity generation for stones extraction and processing.

Table 55: Emission factors and physical characteristics of diesel oil used for energy generation

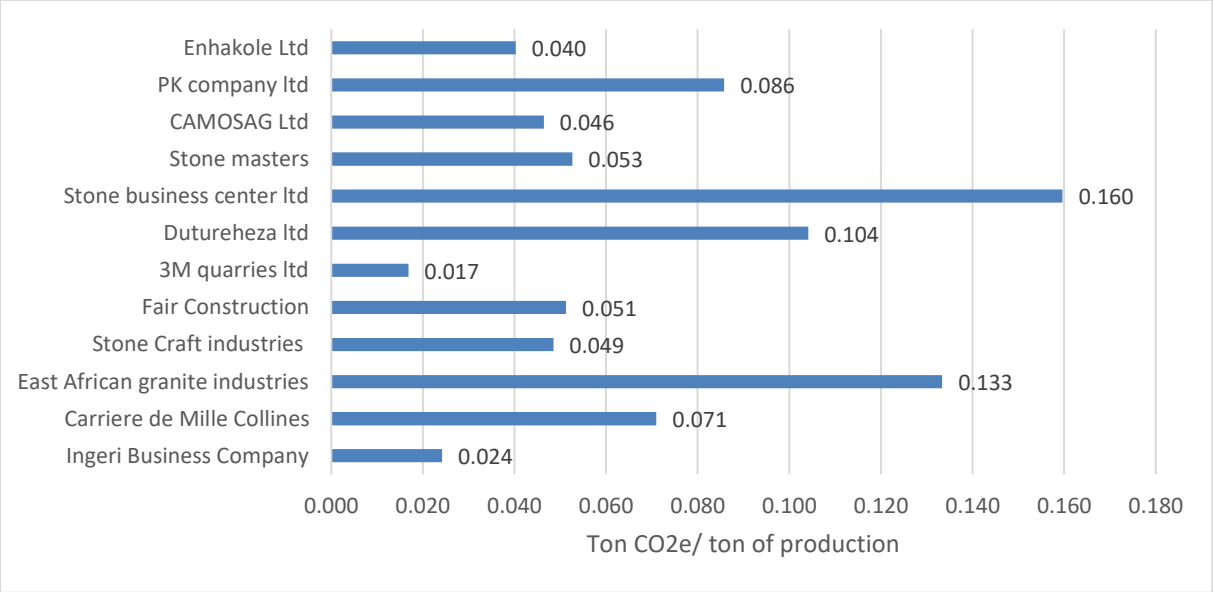
Fuels	Conversion factor/NCV	Density	Emission factor ($kgTJ^{-1}$)		
Unit/gases	**TJ/Gg**	**Kg/L**	**CO_2**	**CH_4**	**N2O**
Diesel oil	43	0.84	74,100	3	0.6

Source: IPCC 2006, Kobil& SP

3.4.2Greenhouse gases emissions from stone processing

The Greenhouse gases emissions generated from natural stone processing by using on-grid electricity is summarized in Figure 8. The GHG emissions were ranging from 0.017 to 0.160 Ton CO_2e/ ton of production, i.e. from 17.0to 160.0 kg CO_2e/ton of production. The average GHG emissions from the twelve factories processing natural stone through on-grid electricity is estimated to 70.0 kg CO_2e/ton of processed stones. Obviously, there is a huge standard deviation ± 44 kg CO_2e/ton of processed stones which is due to different technology used by each factory and the lack of long-term or proper record of electricity used in some factories.

Figure 8: GHG emissions from on-grid electricity consumption per ton of production



A sharp increase in GHG emissions is observed from factories using diesel oil in natural stone processing activities. Among the 17 factories that had recorded and shared the relevant data, only 5 were using diesel as the main energy used in natural

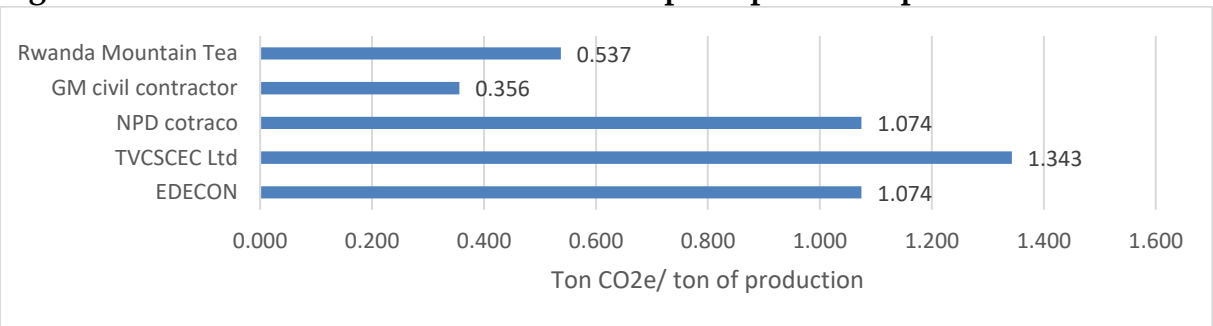
stones processing. As shown in Table 53, CO_2, CH_4 and N_2O are emitted during the diesel combustion with CO_2 accounting for more than 95% of the total GHG emissions. The two of the 19 stone processing plants indicated that they do not have reliable records of the energy used in their daily production. It should however be noted that, the two companies demonstrated that they are small and actually 1 of the 2 had a medium sized stone crusher as part the only machine that added value to the extracted natural stones to make aggregate.

Table 56: Aggregate GHG emission from diesel used per ton of production

		Ton CO2e /ton of production			
SN	Name of company	CO_2	CH_4	N_2O	Total
1	EDECON	1.0706	0.0009	0.0027	1.0742
2	TVCSCEC Ltd	1.3382	0.0011	0.0034	1.3427
3	NPD cotraco	1.0706	0.0009	0.0027	1.0742
4	GM civil contractor	0.3546	0.0003	0.0009	0.3558
5	Rwanda Mountain Tea	0.5353	0.0005	0.0013	0.5371

As shown in Figure 9, GHG emissions generated from natural stone processing by using diesel as the source of energy is ranging from 0.356 to 1.343 Ton CO_2e/ton of production, i.e. from 356 to 1,343 kg CO_2e/ton of production. The average GHG emissions from the five factories processing natural stone by using diesel as the source of energy is estimated to be876.8 kg CO_2e/ton of processed stones. This data shows that fossil fuel combustion in power generation accounted for a larger share of overall ton of natural stone processing/production. It should be reminded that these emissions do not take into account the transport emissions for raw materials.

Figure 9: GHG emissions from diesel consumption per ton of production



3.5 SWOT analysis

S/N	Strengths	Remarks
1.	Availability of raw materials especially natural stones of different categories in terms of their composition and usage.	There are a variety of raw materials (natural stones) which include: Granite, Sandstone, Slates, Quarts, Marble, Gneiss, Basalt rock and Quartzite rock. This is a great advantage to leverage on and produce more products for a wider market in Rwanda and beyond
2.	Existence of basic skills required in primary extraction and processing of natural stones;	Despite the inadequacy in specialized skills needed in both primary extraction and processing, one can confidently confirm that the sector currently has basic skills that one would use in both primary extraction and processing.
3.	Existence of basic machines used in different production lines on the side of processors and primary extraction where Quarries especially those owned by processing plant use	The machines employed are basic and can upgraded to modern machines that currently used in developed countries and/or developing.
	Weaknesses	**Remarks**
1	Lack of drillers and geo-physical sensors used in the exploration and determination of quantities of natural stone available;	There are no drillers and geo-physical sensors cheap and readily available within the country that extractors and processors can use;
2	Lack of modern machines used in primary extraction of natural stones such as excavators and cutting machines loaded with discs and use of diamond wires;	A majority of primary extractors use traditional tools or manually operated equipment for extraction which are not effective and efficient;
3	Lack of loading machines such as fork lifts and wheel loaders of natural stones to transportation trucks;	Many primary extractorsuseman power to load the natural stones onto transport trucks;
4	Lack of modern machines used in secondary cutting and/or customized cutting of natural stones at the level of processors;	A majority of processors use traditional tools for secondary cutting and/or customization; this is a weakness on side of the processors in terms of the quality and quantity of the final products;
5	Under-utilization of the installed capacity for majority of the processing plants (granite and cobble stone plants);	Due to limited market to sell their natural stone products, many processors don't produce in accordance to the installed capacity of

		their plants, this is a gap;
6	Inadequate skills in the processing of natural stones (no specific people trained/qualified in natural stone processing);	Many processors don't have a formal training for the jobs they do, the skills are informally transferred to them, this is a weakness that affects the final product's quality;
7	Inadequate skills required in repair and maintenance of machines used in the different production processes;	Due to inadequate skills available in undertake repair and maintenance of machines used in production lines, many machines tend to break down and repair takes long and this slows down production and productivity of the processing plants
8	Inadequate skills in the exploration of natural stones (Geologists);	There is no exploration done before extraction. This is because there are no enough geologists and other relevant sector experts required;
9	Lack of database of mapped rocks, their location, quality and quantities;	With lack of database of mapped rocks, their location, quality and quantities partly undermines the efforts of luring investors in processing of natural stones used in construction sector;
10	Inadequate product differentiation based on market segments;	Processors of natural stones have not been keen widening the product range that factor in income brackets of different potential customers
11	Inadequate marketing strategies in majority of processing plants of natural stones products;	"Word of mouth" was the most dominant marketing strategy employed by majority of the processors. This limits their vigour to penetrate the local and regional markets
12	Irregular functional operations of the majority of primary extractors and small scale processors of natural stones;	Many primary extractors and small processors don't prioritise their these activities but rather handle extraction and processing as a secondary economic activity and this carries negative impact on their businesses
#	**Opportunities**	**Remarks**
1	Availability of markets for natural stone products at local and regional level (processed and non-processed);	With well-developed market strategies, natural stone products are able to reach all the available markets;
2	Existing of the policy, legal and regulatory framework that is supportive of the natural stone industry;	There are supportive policy environment that is friendly for new entrants within the natural stones for construction sector but also the smooth operations of those already in;
3	Existence of the political will to support the development of the	Open call programme offers opportunity for nascent industries to

	nascent industries through "Open Call Programmes";	grow and expand their operation, this is a great opportunity for growth and expansion as well as increased competitiveness;
4	Availability of basic transport infrastructure(roads-paved and non-paved) to facilitate the movement of natural stones and processed natural stones products;	Paved and unpaved roads presence is an opportunity for the natural stone industry to transport products to the processing industry and/or the market
5	Cheap and easy expropriation of owners of potential quarries given that majority of that land is under-utilized in terms of farming (crop and livestock).	Expropriation of land owner for natural stone mining is friendly because it is well mainstreamed policy wise and these owners can't use the land for farming (crop and livestock).
	Threats	**Remarks**
1	Stiff competition of cheap substitute stone products imported from abroad;	The increased stiff competition of cheap natural stone products substitutes imported tend to undermine the locally produced stone products which finally carry a negative impact on the growth and development of local stone processing plants
	Natural hazards such as landsides and flooding that tend to make unpaved roads impassable;	Natural hazards such as landsides and flooding that tend to make unpaved roads impassable during the rainy seasons that this affects the business of primary extractors and processors located in rural areas
2	The perceived heavy taxes levied on the Natural stone products;	Heavy taxes automatically have undermine profit margins of processors and/or primary extractors and at end of the day this affects the development of these sector
3	Expensive and irregular supply of utilities (water and electricity) used in the production of natural stone products;	Irregular supply of utilities (water and electricity) coupled with their high costs undermine the production and productivity of the actors a long the chain
4	The unstable foreign exchange market rate consistently affects the cost of imported consumables and other spare parts used in the production of natural stone products.	The unstable foreign exchange rates tend to consistently increase the cost of imported consumables and other spare parts used in the production of natural stone products

4.0 Discussion and summary of findings

4.1 Efficiency and existing technologies at the level of primary extractors

Given the technology used in exploration and extraction of natural stones as well as the human resources deployed therein, the levels of efficiency are still very low. The low levels of efficiency observed among majority of actors involved in primary extraction of stones are as a result of the rudimentary technological practices that dominate this node of the natural stones value chain, the following functional features characterize them as non efficient in almost all of their business activities:

- **Extended period of time for delivery of clients' orders**; as already highlighted, it takes long time for primary extractor (Quarries) to deliver natural stones ordered by their customers. This carries an embedded impact on the cost of transport and period of construction activities as claimed by the end users;
- **Quality of the natural stones; because of use of traditional tools**, majority of the primary extractors produce asymmetrical natural stones (irregular shapes) which has an implication in terms of concrete used in construction activities and also an implication on wall durability of different structures. In addition, using asymmetrical stones requires addition costs when it comes to finishing and beautification of walls;
- **Quantity of extracted stones;** in terms of profitability, primary extractors take long time and use high number of human resources to mine stones and this carries additional overhead costs on the side of the business;
- **High quantities of waste and limited capacity to do up cycling**; Given the use of rudimentary technology in primary extraction of natural stones, extractors incur a lot of wastage in terms of broken pieces of stones (Ibiparara).Furthermore, with limited capacity to do up cycling like some of the processing plants with modern technology, they are unable to transform waste into other stone products such as fine sand and/or aggregate of different sizes which can also add value to their businesses;
- **Poor road network in some mining areas**

  Poor infrastructure in terms of road networks that connect primary extractors to national and/or district paved roads tend to negatively affect the business of the primary extractors of the natural stones. The situation of poor roads is aggravated by the unexpected occurrence of natural hazards such as landsides and floods that end making these unpaved roads impassable and limit the business of primary extractors during the rainy seasons.

- **Last but not least**, for one to acquire a license to extract natural stones, he or she is normally required to rehabilitate the land after primary extraction. However, the

rehabilitation requires high costs in terms of the human resources and equipment that may be needed to rehabilitate the degraded site. Among other things done in the process of rehabilitation, the extractors are supposed to refill the dug halls which in many cases it is not well done. With inadequate compaction which is associated with the use ofparticular technology which majority of them do not have, running water (soil erosion) tend to destroy people's property.

4.2 Efficiency and existing technologies at the level of processors

The results of the Technology Audit of the processors of natural stones exhibited levels technology in the stage of exploration; extraction and processing. Majority of the processors own quarries which deploy traditional hand used tools and informally trained human resources.

Limited efficiency levels

The findings show that**existing technologies** are heavily dominated by partially and fully manually operated machines and traditional hand used tools that are deployed for primaryextraction and/or processing ofnatural stones with a few extractors and processors having installed automated machines that do extraction and/or processing of stones. This implies that majority of the processors take long time to deliver production cycle (more than 5 hrs).

Product quality and differentiation

Findings show that the quality of Natural stone and Natural stone products is highly determined by technology, tools and the human resources skills used in extraction and production of natural stone products, the quality of natural stones product is still limited simply because the machines and tools used in extraction and processing are still traditional, manually, partially manual and/or semi-automated. Findings further revealed thata majority of natural stone products made in Rwanda are not customized to the range of needs of various potential buyers who fall in different income brackets (market segments). There is no evidence as to whether there was thorough assessment of market by some processors in order to ensure that all income categories of end users are targeted in the context of increasing the market share for stone products.

- Under-utilization of the installed capacity for majority of the processing plants (including granite and cobble stone processing plants) this was found to causedby the low demand of their products;

Limited relevant skills for improved production and productivity of processing plants

With regard to **capacityof employees**, it was generally found that the skills available in the field of extraction and processing of natural stone were acquired through informal trainings, it was noted in the interpretation of the results of this tech audit that the available sets of skills are more inclined to the informal training. With the available skills sets at the labor market, quality of products produced and/or extracted may not be competitive on the local, regional and international markets.

Lack of natural stone database and absence of laboratories for testing composition of natural stones

There are no available laboratories for testing natural stones composition especially during the exploration stage in mining of natural stones. The absence of laboratories for testing natural stones composition as required in construction activities comes as a gap in addition to lack ofa comprehensive national level database of mapped rocks, their location, quality and quantities. Lack of a national level database indicating mapped geographical areas with given types of natural stone and their indicative quantities does not strategically position Rwanda to lure investors to invest in the processing natural stones.

High costs of production

There are high costs of production involved in the processing of natural stones this automatically makes the natural stone products expensive. Processing of natural stones requires electricity and water utilities which are perceived expensive and irregular in their supply in most geographical areas across the country (especially those operating in upcountry).It should be emphasized that irregularity especially in electricity supply tends to affect the normal functionality of the installed machines used in different production lines.Furthermore, the unstable foreign exchange market rates consistently affect the cost of imported consumables and other materials used in the production of natural stone products.

Limited levels of up cycling of the waste

In the results of the Tech audit,it was indicated that the range of stone products processed is still limited and this is partly because of limited technological capacity to conduct up cycling for the waste. Majority of the audited processing plants do not do transformation of their waste into other products that can be supplied at the market of natural stones and stone products. Up cycling is one of the avenues that would increase the product range and diversify the products that would improve options of the products supplied on the local and regional markets.

Social and Environment standards

- **Social aspect**

Socially, the economic activities associated with the extraction and processing of natural stones used in construction sector employees many Rwandans most especially those who are involved in the informal primary extraction of natural stones. However, given the business nature of the people who operate Quarries operate more informally than a professional business which seeks to expand and upgrade its operations.

- **Environmental protection front**

The activities of both extraction and processingof natural stones have negative impact on people's welfare including oil erosion, noise pollution, destruction of people's property especially blasting rocks, psychological damages and other social hazards that may be experienced in the long run.Albeit the environmental policies and guidelines in place to regulate natural stone mining activities, the levels of enforcement and compliance to established environmental protection are still lacking.

5.0 Proposed set of recommendations
5.1 Technology and Production

5.1.1 Technology required in Exploration of natural stones

Currently, the technology used in exploration of natural stones is far behind today's competitive geo-physical and geo-chemical technologies. Most of the processing plants in Rwanda use technology that is not effective. Therefore, technologies such as tomographic imaging, the use of geophysical sensors and GPS and drilling technologies are required for effective exploration and sustainable extraction and processing, efficiency, extension and optimization.

The modern technology that is proposed for effective and efficient exploration of the natural stones can be implemented through Public Private Partnership arrangements where some companies can be mobilized and supported by the Government to invest in this technology which is highly rated in identification of quality and quantity of the natural stones in a given Quarry. Natural stone exploration using geophysical sensors and GPS, and drilling technologies has been much more successful in countries such as Italy, India, Egypt, Brazil, China and South Africa. The following are the proposed technologies at the stages of extraction and processing of natural stones:

5.1.2 Technology required in primary extraction of natural stones

The recommended technology that is most modern in primary extraction of natural stones includes the use **diamond wires, discs, blasting and wheel loaders as well as Excavators** for increased efficiency and effectiveness depending on the targeted stone products to be produced. For instance blasting technology is more suitable for extractors who are involved in the production of aggregate of different sizes. It should be emphasized that blasting would not be recommended for companies involved in processing of claddings or tiles. The recommended technologies deployed in Quarries are most successful in countries such as Italy, India, Egypt, Brazil, China and South Africa.

It should however be mentioned that natural stone exploration, extraction and processing is a bit advanced in Rwanda compared to the rest of countries in the East African region. Currently Tanzania is extracting and exporting unprocessed marble and granite to China while for the last two years Uganda has also been involved in the extraction and processing of Marble.

We strongly recommend that NIRDA, other government institutions such as BRD and/or BDFas well as relevant Development partners todevelop financialproducts with embedded subsidies and/or incentives to facilitate processors of natural stones to secure relevant and modern technology required in primary extraction.

Given that the investment in the technology used in primary extraction is capital intensive, there is need to organize processors of natural stones to jointly share the costs of investment with support of the government especially for the given machines that can easily be shared by more than one investor. The other option would be the use of Public Private Partnership arrangement (PPPs) which can also be explored in terms of its feasibility.

5.1.3 Technology required in processing of natural stones

Regarding processing technology, the current levels of technology need to be upgraded in order to guarantee improved production and productivity levels as well as competitiveness on the local and regional markets. The upgrading of the technology should include securing of **Multi-wire machines; Block cutters machines; Polishing Machines; Maema Machines**(for rough surfaces)**; Bridge saw machines; Welding machines** (used in customization of different sizes)**; Edge polishing Machine (**used in maintenance services**); Grooving machines; Crushers; and Splitting machines.** The recommended technologies used in modern processing of natural stones have successfully been implemented in countries including **Italy, India, Egypt, Brazil, China and South Africa.**

The limited technology currently being used by majority of natural stone processors partly explain a limited product diversification and quality to respond to all needs of the end users of stone products and hence low levels of competitiveness in the local and regional markets.

5.2 Organizing study tours for experience sharing and inspiring innovations

Supporting benchmarking visits of Rwandan Natural stone processors to other countries to inspire innovation

5.3 Inclusive development and upgrade of primary extractors

There is need to mobilize and sensitize primary extractors of natural stones who still use traditional hand used tools in extraction to gradually work on securing small and affordable stone crushers to minimize on the levels of wastage in terms of the small stones-Ibiparara (which can be transformed into aggregate of different sizes) that tend to be in masses when traditional tools are used in extraction. The in-built plan should be facilitating them to graduate from primary extraction that relies more on rudimentary technology to processors of natural stones that use modern technology as highlighted in section 5.1.3 here above.

5.4 Need to build/ upgrade human resource skills

Given the inadequate level of specialized skills in natural stone exploration, extraction and processing where majority of the deployed staff do not have relevant education and training background in natural stone extraction and processing and/or construction, attention should be paid on developing an inclusive capacity development program for sustainability of the required skills at Rwanda labour market.

The capacity building program shall focus more on training areas identified by processors including technical support on acquiring and maintaining more advanced technologies, innovation and creativity and marketing as well as business management.

5.5 Need to sustainably increase local market share

Results of the Tech audit revealed that, the majority (80%) of natural stone processors rated inadequate technology as the first challenge constraining their operations, followed by expensive and inconsistence supply of energy and water, inadequate skilled labour, and financial capital on the second level.
However, issues such as limited demand were not rated as one of the major challenges by the majority of respondents. The majority of these processors use word of mouth to advertise their products which in many cases prove ineffective especially in reaching many people within and outside the country.

There is need therefore to support these processing plants which are still at nascent stage of development to appropriately market their products using internet marketing, participating in locally and regionally and as well as international organized exhibitions.

On the issues of inconsistence supply of energy and water, there is need for the Ministry of Trade and Industry with the technical support of NIRDA to play an effective advocacy role of ensuring that there is always stable supply of the necessary utilities (Electricity and Water) and at subsidized costs.

5.6 Need to reduce environmental protection costs

Environmental Impact Assessment (EIA) is becoming a widely used tool in providing clearance and issuance of license for extracting and/or processing of natural stones. Abandoned Quarry sites in Rwanda should be rehabilitated to become high-value ecological areas. There are countless examples where these can contribute to the well-being of local residents by being rehabilitated as natural spaces or leisure parks and can be used to generate income.

Promote the culture of upcycling as a process of transforming by-products, waste materials, useless or unwanted stone products into new products perceived to be of greater quality.

Policy level recommendations

- Incentives to local natural stone producers to give them comparative advantage in order to encourage implementation of import substitution strategies which include promotion and support of the young processing plants involved in natural stone extraction and processing;
- Awareness creation about the value of natural stone products in Rwanda and in the region. There is need for the Government to support local processing plants to market their products within and outside country through organizing public exhibitions and use of other media outlets that can effectively do marketing;
- As part of supporting the processing plants at nascent stage of development, there is need to introduce subsidies and/tax holidays for investors in natural stone extraction and processing such as exemption of imported consumables used natural stones processing and spare parts used repair and maintenance of the installed machines in different production lines;
- Introducing technical courses related to natural stone extraction processing and construction within TVET system (Curricular) Rwanda. Currently there are no known TVET courses that are related to extraction and processing of natural stones;
- Develop standards for key natural stone products Made in Rwanda. In order to have competitive edge in both local and regional as well as international markets.

Business advisory support and business model Adjustments

Natural stone processors should be trained in support services which are important in promoting businesses in the country and beyond. These shall include:

- Training in book keeping;
- Basic accounting and budgeting;
- Taxation;
- Human resource Management; and
- Group marketing and economies of scale.

Annexes

Annex 1: List of Stakeholders Interviewed

S/N	NAMES	INSTITUTION	POSITION	TELEPHONE
1.	Mr. KAKA BENON	MoE	Director of Planning	0788306059
2.	Mr. Remy Norbert DUHUZE	REMA	Director/Environmental regulation and pollution control	0788612725
3.	Mr. DONAT NSENGUMUREMYE	RMB	Director of Mineral extraction and processing unit	0781521358
4.	Mr. JADO BIKORIMANA	NIRDA	Director of Planning and M&E	0785459818
5.	Mr. John TWAHIRWA	RHA	Director of planning	0788559023
6.	Mr. Mathias PIANI	ENABEL	Intervention Manager	0786776319
7.	Mr. MUTWARE BIENVENUE	East African Cooperative of East Africa(Transporters)	Operations Manager	0788494727
8.	Mr. Emmanuel MUHIZI	EDECON	Director	0788454596
9.	Ms. FATOU DIEYE	SKAT	Regional Coordinator	0788314694
10.	Mr. Samuel MUGENZI	SKAT	Mechanic Engineer	
11.	Mr. Vital NZABAMWITA	SKAT	Geographer	
12.	Mr. MAREMBO JMV	INGERI Business Company	Site Manager	0782597433
13	Mr. TELESPHORE BIZUMUREMYE	TVCSCEC Ltd	Site Agent	0783000907
14	Ms. Alice TASCA	ASA Design	Principal architect	0728667860
15	Mr. Jean Paul SEBUHAYI UWASE	MASS Design	Architect	0785811036

Annex 2: Profiles of Natural Stones Processors

Processor	Province	District	Sector	Cell	Village	Contact (Telephone and/or email)	Product (s) produced	No of staff	Level of automation of the Installed technology
EDECON	North	Gicumbi	Mutete	Musenyi	Kimisugi	0788454596	Claddings and aggregate	51	Semi-Automated
INGERI Business Company	West	Rubavu	Nyakiriba	Bisizi	Makoro	0782597433	Aggregate	12	Semi-Automated
TVCSCEC Ltd	West	Rubavu	Nyundo	Terimbere	Nombe	0783000907	Aggregate	80	Fully Automated
Carriere de Mille Colline	Kigali City	Gasabo	Jabana	Bweramvura	Nyakabingo	0789113289	Aggregate	50	Highly automated and Sophisticated
East African Granite Industries	East	Nyagatare	Nyagatare	Rutaraka	Rutaraka	0788307969	Granite Tiles	82	Fully Automated
Stone Craft industries	South	Kamonyi	Nyarubaka	Kambyeyi	Kirwa	0788425680	Cobble stones and Slates	29	Partially manually operated
Fair Construction	South	Muhanga	Muhanga	Tyazo	Nyahinda	0783187940	Aggregate of different sizes	60	Partially manually operated
NPD Cotraco.	North	Musanze	Gashaki	Kigabiro	Birwa	0784055588	Aggregate of different sizes	50	Fully automated
3 M quarries ltd	East	Gatsibo	Kabarore	Karenge	Mutarama	0785063880	Aggregate	46	Partially manually operated
GM civil contractor	East	Rwamagana	Mwulire	Bicumbi	Sabusaro	0788673886	Aggregate	14	Partially manually

Processor	Province	District	Sector	Cell	Village	Contact (Telephone and/or email)	Product (s) produced	No of staff	Level of automation of the Installed technology
									operated
Dutureheza ltd	North	Gakenke	Mugunga	Nkomane	Nyagasozi	0788833436	Aggregate	20	Partially manually operated
Stone business center ltd	South	Kamonyi	Runda	Ruyenzi	Rubumba	0788304026	Tiles	25	Partially manually operated
Stone masters Ltd	East	Nyagatare	Karangazi	Mbare	Ryabega	0788301289	Claddings and granite products	55	Partially manually operated
CAMOSAG Ltd	North	Musanze	Nkotsi	Bikara	Barizo	0788494005	Claddings	50	Partially manually operated
PK company ltd	East	Kirehe	Kigina	Rwanteru	Rwanteru I	0788459205	Aggregate	14	Partially manually operated
Enhakole Ltd	North	Musanze	Musanze	Rwambogo	Gakoro	0788277390	Claddings and Aggregate	70	Partially manually operated
Rwanda Maintain Tea	West	Ngororero	Gatumba	Cyome	Mpara	0788758870	Aggregate	27	Partially manually operated
Peniel Global Ltd	North	Musanze	Gashaki	Kigabiro	Birwa	0788350999	Claddings made from volcanic rocks(solidified lava)	42	Partially manually operated

Processor	Province	District	Sector	Cell	Village	Contact (Telephone and/or email)	Product (s) produced	No of staff	Level of automation of the Installed technology

Annex 3 a: Questionnnaire for Primary Extractors

ANNEXES: QUESTIONNAIRE-PRIMARY EXTRACTORS/
UMUGEREKA: IBAZANYANDIKO RIGENEWE ABACUKUZI B'AMABUYE KAREMANO

Annex 1:

Questionnaire for Primary Extractors of the Natural Stones in District/

Umugereka wa 1: Ibazanyandiko rigenewe abacukuzi b'amabuye karemano mu karere

Dear Respondent,

Natural stones are viewed as one of key priority value chains in Rwanda that brings together a number of small and medium enterprises. /Amabuye karemano ni Kimwe mu byibanze bigize uruhererekane rw'inyongera gaciro mu Rwanda bityo akaba ahuza barwiyemeza mirimo bacirirtse ndetse nabisumbuyeho.

NIRDA has prioritized Natural stones value chain with a view to making it more competitive through technology upgrading and capacity development of all the actors along the value chain. / NIRDA yashyize imbere uruhererekane nyongeragaciro rw'amabuye karemano mu rwego rwo kuyongerera ubu ubushobozi, binyuze mukuzamura ikigero cyikorana buhanga rikoreshwamo ndetse no guteza imbere abagira uruhare muri urwo ruhererekane nyogeragaciro.

In light of the above, a technology is being carried out to obtain views and feedback from primary extractors, processors, current and future customers of stones and products as construction materials, and we are requesting you to provide information that will assist in improving this sector. The information provided will be treated with strict confidentiality. /Hagendewe kubyavuzwe haruguru rero, hakaba hakomeje gukoreshwa ikoranabuhanga mu kugirango twakire ibitekerezo n'ishusho rusange, bivuye mu bacukuzi, abatunganya, abasanzwe ari abaguzi ndetse n'abaguzi bejo hazaza b'amabuye karemano ndetse n'ibikoresha byifashishwa mubwubatsi biyakomokaho mugihe yabanje gutunganirizwa mu uruganda. Tukaba twifuzako mwaduha amakuru azagira umumaro ndetse akaba yakifashishwa mu kuzamura imikorere yuru rwego. Amakuru muri budusangize afatwa ndetse akabikwa nkibanga rikomeye kandi kuburyo bwizewe.

We thank you for your kind contribution as one of the above respondent./ Tubashimiye byimazeyo uruhare rwanyurwiza muri iki kigaro nk'uradufashishe kuduha amakuru akeneye.

SECTION 1: GENERAL INFORMATION/IGIKA CYA MBERE: UMWIRONDORO RUSANGE

Enumerator's Information / Umwirondoro w'uyoboye ikiganiro:											
Names of the Enumerator/Amazina y'uyoboye ikiganiro											
Enumerator's Code/ Umubare uranga ubaza							**Starting time/ Igihe dutangiriye**				
Interview Dates/ Itariki ikiganiro kiberaho							**Ending time / Igihe turangirije**				

ADDRESS/ LOCATION/ AHO BIKORERWA

1.1. Firm's location and which product/ Aho ubucuzi bw'amabuye buherereye n'ubwoko bw'amabuye acukurwa.			
Province/ Intara:		**Sector**/ Umurenge:	
District/ Akarere:		**Cell**/Akagari:	
		Village/Umudugudu:	
Geo coordinates: Indanga miterere y'agace:	**Latitude:**	**Longitude:**	

Q1. What type of stones and/or processed stone products do you normally in your construction works?/Ese ubusanzwe ni ubuhe bwoko bw'amabuye cyangwa ibiyakomokaho mukoresha mu ubwubatsi?	1= Non processed stones for raising foundations for different structures/ Amabuye ataratunganirijwe mu uruganda, yifashishwa mukuzamura umusingi winyubako zitandukanye 2= Gravel used in concrete mixing/Amubuye mato cyane akoreshwa mukuvanga Beto 3=Cut natural stones used in finishing and decorations of buildings/ Ibisate by'amabuye karemano bikoreshwa aho bikenewe mu gihe bari kurangiza kubaka ndetse no gutaka inyubako 4=Cobblestones and sets/ Amabuye ashyirwa mu

	mihanda. 5=Road pavers 6=Granite tiles 7= Stone Claddings 8=Slabs; 9= Slates 10=Rough and fine sand 11=Aggregates and powder 12 = Other, please specify ……..

SECTION 2: QUARRYING INFORMATION IN DISTRICT

Q2. QUARRY REPRESENTATIVE/ Uhagarariye ikirombe cy'amabuye

Names/Amazina			
Position/ Umwanya ahagarariye	a) Manager of Quarrying;/ Umuyobozi w'ikirombe b) Extractor of natural Stone;/ Umucukuzi w'amabuye karemano c) District Staff in charge of Natural Resources in Sector;/ Umukozi w'akarere ushizwe umutungo karemano mu kagari		
Tel. No/ Numero yo guhamagara:		Email	

Q 3. Quarry category (Tick corresponding number)/ Icyiciro cy'irombe cy'amabuye (Hitamo ahuye n'igisubizo)	**Tick/** Emeza
1. Micro scale (Firms employing 1 – 3 people)/ Igice gito cyane(hakoresha abakozi bari hagati 1 kugeza kuri 3)	
2. Small scale (Firms employing 4 – 30 people)/ Igice gito (hakoresha abakozi 4 kugeza kuri 30)	
3. Medium scale (Firms employing 31 – 100 people and at least 5 millions capital) / Igice cyiri murugero (hakoresha abakozi 31 kugeza 100 kandi byibuze hafite igishoro fatizo cya Miliyoni 5 z'Amanyarwanda)	
4. Large scale (Firms employing more than 100 people, at least 100 millions capital)/ Hanini cyane (Hakoresha abakozi barenga 100, kandi byibuze hafite igishoro fatizo cya Miliyoni 100 z'Amanyarwanda)	

Q4 Working schedule status/ Ingenabihe y'imikorere mu kazi	**Tick/** Emeza

1. Regular Working/ Akazi gahoraho	
2. Temporarily working/ Akazi k'igihe gito	
3. Other, please specify (.....), ubundi buryo, bugaragaze	

Q.7 Quarrying status ownership/ Imiterere yanyiri icyirombe gicukurwamo amabuye	**Tick/** Emeza
a) Individual/Umuntu umwe kugiti cye	1
b) Cooperative/ Ishyirahamwe	2
c) Company / Icyigo cy'ubucukuzi	3

Q.11. Quarrying owners by nationality/ Ufite uburenganzira nkanyiri cyirombe gicukurwamo amabuye hagendewe ku ubwenegihugu	**Tick/** Emeza
Rwandan	1
Foreign (East African Community)/ Abanyamahanga (Umuryango w'Afurika y'iburasirazuba)	2
Foreign (Other African countries)/Abanyamahanga (baturuka mu ibihugu by'Afurika)	3
Foreign (Other rest of world)/ Abanyamahanga (baturuka mu bindi bihugu byo ku isi)	4
Joint (Rwandan + Other African)/(U Rwanda + Ibindi bihugu by'Afurika)	5
Joint (Rwandan + Other rest of world)/(U Rwanda + ibindi bihugu byo ku isi)	6
Joint (Rwandan + EAC)/(U Rwanda + Umuryango w'Afurika y'iburasirazuba)	7
Joint (more than one non-Rwandan)/ (Ibihugu bitarimo u Rwanda)	8

SECTION3: TECHNOLOGY DIAGNOSIS(provide a District status)/ IGIKA CYA 3: Isuzuma ry' ikoranabuhanga

3.1. Knowledge and skills of primary extractors of Natural Stonesin your District/ Ubumenyi n'ubumenyingiro bw'abacukuzi b'amabuye karemano mu karere kanyu

3.1.1 Based your expertise in this quarry in extracting Natural stones in your District; Do you use acquired academic skills and knowledge in your District (TVET or engineering skills)?/ Mugendeye kubunararibonye bwanyu mubijyanye n'ubucukuzi bw'amabuye karemano mu	1= Yes/ Yego 2= No/ Oya

karere kanyu; ubuna mukoresha ubwenge n'ubumenyingiro mwavanye mu ishuri (Haba amashuri y'imyuga cyangwa ubwo aba enjeniyeri)?	
3.1.2 If Yes, rate the level at which the acquired academic skills and knowledge (TVET or engineering skills) are used in natural stone extraction in your District)/ Niba ari yego, dufasha gutondeka ikigero cyuko ubumenyi n'ubumenyingiro byifashishwa mu bucukuzi bw'amabuye karemano mu karere kanyu.	**1**=10-20% **2**=20– 50% **3**=50%-80% **4**=80%-100%
3.1.3 If No, how do people working with your quarry acquire the skills and knowledge required in natural stone extraction in your District?/ Niba ari oya, Ni ubuhe buryo abakora mu bucukuzi bw'amabuye mu karere kanyu bunguka ubumenyi n'ubumenyingiro kubijyanye n'ubucukuzi bw'amabuye karemano?	**1**= Informal apprenticeship training (trained on the job by experienced relative or friend);/ **2**= Short term organized training organized by development partners or government with no certificate issued;/ Abafatanyabikorwa mu iterambere cyangwa leta babaha amahugurwa y'igihe gito adatanga impamyabumenyi. **3** = Used personal talent and technical ability/ Hakoreshwa impano ndetse n'ubusobozi bw'umuntu mu ikorabuhanga. **4**= Others, specify (……..)/ Ibindi, mubisobanure…..
3.1.4. Some natural stones are not used in construction activities because of composition (Quality); Do you have any adopted method for identification of quality stones demanded by your clients in this District?/Hari amabuye akunze gukoreshwa mu ibikorwa by'ubwubatsi bitewe n'ubwiza bwayo. Ese haba hari uburyo mwashyizeho mujya mukoresha mugutoranya amabuye meza acyenewe n'abaguzi mu karere kanyu?	1= Yes/ Yego 2= No/ Oya
3.1.5 If yes, please select among the following/ Niba ari yego, hitamo muri ubu buryo bukurikira	**1**=Natural selection using our experience in identification of quality stones required clients/ Dukoresha uburyo karemano tujyegendeye ku ubunararibonye bwacu mu kumenya ubwiza bw'amabuye abaguzi bacyeneye

	2= We use installed machines which sieve and separate the wanted from unwanted extracted natural stones/ Dukoresha Imashini zabugenewe mu gutunganya amabuye karemano yacukuweakenewe agatandukanywa n'adakenewe 3=Detectors or sensors of quality natural stones/ Utwuma dupima ndetse tukumva ubwiza bw'amabuye karemano 4=Others, specify…….Ibindi,mubisobanure…
3.1.6 Do you have any technology for exploration and determination of the quantity of natural stones available in the area of extraction in your District?/ Ese mwaba mufite ikoranabuhanga mukoresha mu kuvumbura no kumenya ingano yamabuye karemano ari mu gice gicukurwamo amabuye mu karere kanyu?	1= Yes/ Yego 2= No/ Oya
3.1.7 If yes; share with us the installed machine (technology) that facilitates your company/Coop to determine volume/quantities of natural stones hidden underground that can be extracted in your District./ Niba ari yego, dusangize ikaronabuhanga cyangwa imashini zibafasha kumenya ubunini cyangwa ingano y'amabuye karemano ari mu butaka ashobora gucukurwa mu karere kanyu.	…….
3.1.8 If No, How do you get to know that a given Quarry has higher or lower quantities and quality of natural stones for extraction in your District?/ Niba ari oya, Ese ni ubuhe buryo mukoresha kugirango mu menye niba ikirombe gifite ingano n'ubwiza bwinshi cyangwa bucye bw'amabuye karemano yo gucukurwa, mu karere kanyu?	…….

3.2 Technology used in term of materials used in extracting or breaking natural stones/ Ikoranabuhanga mu buryo bw'ibikoresho rikoreshwa mu gucukura cyangwa kumenagura amabuye karemano

	Tools used in natural stone extraction/ Ibikoresho bikoreshwa mu ubucukuzi bw'amabuye karemano
3.2.1 What common tools do you use to extract natural stones from underground in your District?/ Ni ibihe bikoresho mukunze gukoresha mucukura amabuye mu ubutaha hano mu karere kanyu?	1=Traditional tools (including heavy hummer-kinubi; umutarimba; ibihadiko, Axes, Spades, Hand hoes, etc)/ ibikoresho gakondo (birimo Kinubi, umutarimba, ibidahiko, ishoka, isuka) 2= Modern stone extracting Machine with mounted engines(Pokers; caterpillars, etc)/ Ibikoresho by'ubucukuzi biteyimbere 3=Explosives;/Urutambi 4=Use of metal Discs; 5=Use of Diamond wires 6= Crasher machines
	Technology used for facilitating breaking or crashing stones in pieces/ Ikoranabuhanga rikoreshwa mu kumenagura no gushwanyaguza amabuye mo ibice.
3.2.2 Which technology do you use to facilitate natural stone extraction (easy breaking or crashing of huge rocks hidden underground or on surface) in your District?/ Ese ni irihe koranabuhanga ribafasha mu ubucukuzi bw'amabuye karemano mu karere kanyu (koroshya icukurwa ry'amabuye ari hasi cyangwa ari hafi mu butaka)	1= Natural heating using Firewood/ 2= Explosives/Urutambi) 3= Stone crashing /cutting 4=Others, specify……..

Q 24 Where do you generally source machines/tools that are used in extraction in your District? (Tick all that apply)/ Ese nihe mukura ibikoresho mu koresha mu bucuzi bw'amabuye mu karere kanyu? (Emeza aho aribyo hose)	
Sourced locally – In Rwanda/**Biva mu Rwanda**	
Sourced regionally – In EAC & Great lake region/**Biva mu karere – Ibihugu bigize umuryango w'Afurika y'iburazirazuba & n'akarere k'ibiyaga bigari**	
Sourced internationally/ Biva mubi hugu muza mahanga	

Q32 Kindly give types of quality/safety certificates or product certificates that the firm has/Twagirango mudufashe kumenya ubwoko bw'ibyangobwa byemeza ubwiza/ Umutekano w'ikigo cyanyu		
Types of certificate/ Ubwoko bw'icyangombwa	**Yes/ Yego**	**No/ Oya**
a) 1. S-mark (Standardization mark)		
b) Environmental impact assessment and a certificate of approval issued by a competent formal authority/		
c) Quarry area license from a competent authority as/ Acage icyirombe kirimo hafite ibyangomba byatanzwe n'urwego rubitiye ububasha. d) one (1ha) hectare in case of a non-commercial small-scale quarry license; / Ni ubuso bwa Hegitari 1ha, hafite icyangombwa cy'icyirombe gihambwa icyirombe gito kandi kitari icy'ubucuruzi		
e) Quarry area license from a competent authority as/ Acage icyirombe kirimo hafite ibyangomba byatanzwe n'urwego rubitiye ububasha. f) five (5ha) hectares in case of commercial small-scale quarry license (at least 5Millions RwF); / Ni ubuso bwa Hegitari 5ha, hafite icyangombwa cy'icyirombe gihambwa icyirombe gito kandi kitari icyubucuruzi		
g) Quarry area license from a competent authority as/ Acage icyirombe kirimo hafite ibyangomba byatanzwe n'urwego rubitiye ububasha. h) fifty (50ha) hectares for a large-scale quarry license (at least one hundred million Rwanda Francs (Rwf 100,000,000).Hatife ubuso bwa Hegitari 50ha, Icyakombwa cy'icyirombe gifite byibuze agaciro ka milliyoni 100 z'amanyarwanda		
i) Quarry area license from a competent authority as/ Acage icyirombe kirimo hafite ibyangomba byatanzwe n'urwego rubitiye ububasha. j) larger than fifty (50ha) hectares for a large-scale quarry license.Icyangombwa cy'icyirombe gifite ubuso bwa Hegitari 50ha		
k) Other (Specify)ibindi , mubigaragaze		

SECTION 4: PRODUCTION CAPACITY ASSESSMENT/ Gusuzuma ingano y'umusaruro uva mu ubucukuzi bw'amabuye

4.1 Production capacity in your District

4.1.1What is the commonunit of measurement of production in your District?/ Ese ni uruhe rugero ngenderwaho mugupima umusaruro uva m'ubucukuzi bw'amabuye mu karere kanyu?	**Unit of measuring natural stones** 1 = Truck Fuso (of 3m^3); 2 = Nissan Trucks (of 5 m^3); 3 = Heavy duty Trucks (of 10m^3); 4 = Heap/pile of stones (Ikirundo) 5= Universal measures (m2, m3, tones,..) 5 = Others (Specify….)
4.1.2. What is your production per	**Capacity of production (For instance number of**

month (Estimate in trucks of 3m³ or any other means identified above)/ Eseumusaruro uva m'ubucukuzi bw'amabuyeubu ungana iki mu kwezi (Gereramya nk'ikamyo ya 3m³ cyangwa ku urugero mukoresha mupima mwagaragaje haruguru)?	**Trucks of3m³)) per month/ Ingano y'umusaruro uboneka(nk'umubare w'amakabyo ya 3m³/Mu kwezi)** Write Number of trucks…/ Andika umubare w'ikamyo…..
4.1.3. Are you happy with your production?/ Ese mushimishijwe n'umusaruro mubona?	1= Yes/ Yego 2 = No/ Oya
4.1.4 If No, why?/ Niba ari Oya, biterwa ni iki?	……
4.1.5 Are there any specific challenges encountered in natural stones extraction? If Yes, please highlight them/ Ese haba hari imbogamizi muhura nazo mubucukuzi bw'amabuye karemano? Niba ari Yego, mwazidusangiza.	……

4.2 Expenses incurred for producing one unit of truck (choose among these options: 3m³, 5m³, 10m³ or Pile (Ikirundo) of stones)/ ibyishyurwa kw'ikamyo imwe y'amabuye yacukuwe.(Hitamo muri ibi bikurikira: 3m³, 5m³, 10m³ cyangwa Ikirundo cy'amabuye.

Expenses/ Ibyishyurwa	**Amount spent in RwF/ truck/Pile/ Amafaranga yishyurwa Rwf/ ku ikamyo/ Ikirundo**
4.2.1 Firewood/Inkwi	……
4.2.2 Gasoline/Mazutu	……
4.2.3 Value of depreciation of materials used/	……
4.3.4Value of explosives/ Urutambi	……
4.3.5 Wages for work/ per truck/ Imishahara y'abakozi/ kuri buri kamyo	……
4.3.6 Rental charges (In case the Quarry is rented/leased)/ ubwishyu bw'ubukode (niba icyirombe gikodeshwa)	……..
4.3.7 Cost of depreciation of tools used	……..
4.3.8 Costs of consumables (such as food and Drinks and others) used at the extraction site (	

4.3 Earning/ Total Revenue (Rwf/ Truck)/ Inyungu/ Ayinjira yose (Rwf/ Ikamyo)

4.3.1 How does truck of Natural stones extracted is sold in your Quarry/ Uko ikamyo y'amabuye igirishwa mu icyirombe cyanyu	***Exact price per truck (RwF)/ Igiciro k'ikamyo (Rwf)***
4.3.1.1 Truck Fuso (3m³);/Ikamyo ya Fuso (3m³)	……..
4.3.1.2 Truck Nissan (5 m³);/ Ikamyo ya Nissan (5 m³)	……..
4.3.1.3 Truck 10 wheels (10m³);/ Ikamyo ya y'ibiziga 10	……..
4.3.1.4 A pile of natural stones/ Ikirundo cy'amabuye karemano	……..

4.6 Categorize quarries operations in your District using the following terms (Tick what applies)/ Dushyirire mu ibyiciro, imikorere y'ibirombe by'amabuye mu karere kanyu mugendeye kuri ibi bikurikira (Emeza ahakwiye hose)	
(a) Fully manual operated/ Hakoreshwa ingufu z'amaboko	**1**
(b) Partially manually operated/ Ingufuz'amaboko n'imashini	**2**
(c) Powered equipment/ ibikoresho bisaba ingufu	**3**
(d) Fully automated/ ibikoresho byikoresha	**4**
(e) Highly automated and Sophisticated/Imashini zikoresha zomurwego rwo hejuru	**5**
(f) Other (specify), Ibindi (bigaragaze)	**6**

4.7 What are challenges during extraction / Ese ni izihe mbogamizi ziri mu ubucukuzi bw'amabuye karemano?		
	Tick all that apply/ Emeza ahakwiye hose	Comments/ Ibitekerezo
Limited energy, power and water/ Ingufu, amashanyarazi, n'amazi ni bicye	1	
Poor infrastructure (roads, toilets, …)/	2	
Lack of skilled labor/Ntabakozi babifitiye ubumenyi	4	
Lack/limited of financial capital/ Kubura/ gukira igishoro fatizo gicye.	5	
Lack/limited technology required/ kubura/ ikoranabuhanga ricye kuricyenewe	6	
High taxes/ Imisoro iri hejuru	7	
Limited demand/ Abaguzi ni bacye	8	
Competition from other quarries/ Guhanganira isoko n'ibindi birombe	9	

by'ubucukuzi		
Bureaucracy in seeking permits	10	
Environmental protection cost/ Ikiguzi cyo kurengera ibidukikije	11	
Other: please Specify/ Ibindi, mubigaragaze		

SECTION 5: MARKET ASSESSMENT/ IGIKA CYA 5: ISUZUMA RY'ISOKO

5.1 About availability of clients/ Ibijyanye n'ubwinshi bw'abaguzi	
5.1.1 What's your target market / local perspective in your District?/Ese isoko ryanyu ni irihe?Turebeye hano mu karere kanyu.	1= High end clients/ Abaguzi bo mu rwego rwo hejuru 2= Middle income client/ abaguzi binjiza mu rugero 3= Low income earners/ Abakiriya binjiza bicirirtse
5.1.2 Do you have consistent clients?/ Ese mwaba mufite abaguzi bahoraho?	1= Yes/ Yego 2 =No/ Oya
5.1.2.1 If No, why? (all apply)/ Niba ari Oya, kubera iki? (Impamvu izarizo zose)	1=Impassable roads by heavy rains/ Imihanda yangijwe nimvura ikaba itanyurwamo 2= Accessibility (road)/ Uburyo bwo kuhagera (nk'imihanda) 3= Poor quality of produced products;/ Ubwiza bw'umusaruro ntago buhagije 3= Affordability/ Ubushobozi bwo kubigura 4=Others, Please specify …… Ibindi, mubigaragaze…..
5.1.3 Do you normally have contracts to supply natural stones products to your clients?/ Ese mwaba mugira amaserano y'imikoranire n'abaguzi, yo kuhaba ibikomoko ku mabuye karema?	1 = Yes / Yego 2 = No/ Oya
5.1.4 If Yes, What is a type of contracts are normally given?/ Niba ari Yego, ni ubuhe bwoko bw'amasezerano y'imikoranire mugirana?	1 = Verbal Contracts;/ Ubwoko bw'amasezerano ngenga mikoranire bwemeranijweho mu magambo gusa. 2 = Written contracts and bearing specimen of both parties/ Ubwoko bw'amasezerano ngenga mikoranire bwanditse kandi bugizwemo uruhare na buri ruhande. 3= We don't need contracts, we supply whoever comes/ Ntabwo ducyeneye kugirana amasezerano, ducuruza kubatugana bose.
5.1.5 Who are your most common clients in this District?/ Nonese ni abahe baguzi banyu bimena muri aka karere?	1= Individuals with construction projects;/ Banyirubwite bafite imishinga y'ubwubatsi 2= Construction companies/ Ibigo by'ubwubatsi 3= Factory/plant that process (Add value) natural stones/ Inganda z'itunganya (zongerera agaciro) amabuye karemano

	4=Others, please specify …… Abandi, mubagaragaze…
5.1.6 The stones /stone Products you supply are mainly used for what?/ Nonese, amabuye cyangwa ibikomoka ku mabuye mucuruza ahanini bikoreshwa iki?	1=Construction of residential and commercial buildings (especially in raising foundations, etc);/Ubwubatsi bw'imiturirwa n'inyubako z'ubucuruzi (cyane cyane mu kuzamura umusingi w'inzu) 2=Construction of bridges and retaining walls along highways;/Ubwubatsi bw'ibiraro n'inkuta zicyicyije imihanda 3=Decoration and finishing of structures;/Mu gutaka no mugihe bari kurangiza kubaka inyubako Others, Please specify…../ Ihandi, muhagaragaze….

SECTION 6: ENVIRONMENT PROTECTION/ KURINDA IBIDUKIKIJE

5.1 Are you aware that, the extraction of natural stones has a negative impact on environment?/ Ese mwaba mubizi yuko ubucukuzi bw'amabuye bushobora kugira ingaruka mbi kubidukikije?	1= Yes/ Yego 2= No/ Oya
5.2 If yes, How do you protect and sustain the environmental degradationof the land following the extraction of stones or processing of stone products?/ Niba ari Yego, ni gute murinda ndetse mukabungabunga ibidukikije nkubutaka mugihe mumaze gucukura amabuye cyangwa gutunganya ibiyakomokaho?	1= Rehabilitating land/ Gusiba ibirombe/ 2= Forestation to rehabilitated land/ Gutera amashyamba 3= Nothing done after extraction/ Nyuma y'ubucukuzi ntagikorwa 4= Others, please specify…… Ibindi, mubigaragaze….

This is the end of the audit, thank very much for your collaboration, and kindly put your signature here ……..

Nihano dusoreje icyiganiro cyacu, tubashimiye cyane ko mwitanze, mutwemerere mushyire umukono hano……

Annex 3 b: Questionnaire for Processors

ANNEXES: QUESTIONNAIRE/ UMUGEREKA: IBAZANYANDIKO

Annex 1: Umugereka wa 1:

Questionnaire for Processors of Natural Stones (Companies and/or Cooperatives that add value on extracted natural Stones)

Ibazanyandiko rigenewe abatunganya amabuye karemano (Ibigo/Amashyirahamwe yongeragaciro ku mabuye karemano yacukuwe)

Dear Respondent,

Natural stones are viewed as one of key priority value chains in Rwanda that brings together a number of small and medium enterprises./ Amabuye karemano ni kimwe mu byibanze bigize uruhererekane rw'inyongeragaciro mu Rwanda bityo akaba ahuza barwiyemeza mirimo bacirirtse ndetse n'abisumbuyeho.

NIRDA has prioritized Natural stones value chain with a view to making it more competitive through technology upgrading and capacity development of all the actors along the value chain. NIRDA yashyize imbere uruhererekane nyongeragaciro rw'amabuye

karemano mu rwego rwo kuyongerera ubushobozi, binyuze mukuzamura ikigero cyikorana buhanga rikoreshwamo ndetse no guteza imbere abagira uruhare muri urwo ruhererekane nyogeragaciro.

In light of the above, a technology audit is being carried out to obtain views and feedback from primary extractors, processors, current and future customers of stones and products as construction materials, and we are requesting you to provide information that will assist in improving this sector. The information provided will be treated with strict confidentiality. Hagendewe kubyavuzwe haruguru rero, hakaba hakomeje gukoreshwa ikoranabuhanga mu kugirango twakire ibitekerezo n'ishusho rusange, bivuye mu bacukuzi, abatunganya, abasanzwe ari abaguzi ndetse n'abaguzi bejo hazaza b'amabuye karemano ndetse n'ibikoresha byifashishwa mu ubwubatsi biyakomokaho mu gihe yabanje gutunganirizwa mu uruganda. Tukaba twifuzako mwaduha amakuru azagira umumaro ndetse akaba yakifashishwa mu kuzamura imikorere yuru rwego. Amakuru muri budusangize afatwa ndetse akabikwa nkibanga rikomeye kandi ku buryo bwizewe.

We thank you for your kind contribution as one of the respondents./ Tubashimiye byimazeyo uruhare rwanyu rwiza muri iki kigaro nk'uradufashishe kuduha amakuru akeneye.

SECTION 1: GENERAL INFORMATION/ UMWIRONDORO RUSANGE

1.1 ENUMERATOR INFORMATION/UMWIRONDORO W'UYOBOYE IKIGANIRO

Enumerator's Information Umwirondoro w'uyoboye ikiganiro:											
Name of the Enumerator/ Amazina y'uyoboye ikiganiro											
Enumerator's Code/ Umubare uranga ubaza							**Starting time/ Igihe dutangiriye**				
Interview Dates/ Itariki ikiganiro kiberaho							**Ending time / Igihe turangirije**				

1.2 ADDRESS/ LOCATION OF THE FACTORY AND GEO-COORDINATES

1.2.Firm's location/ Agace uruganda ruherereyemo			
Province/ Intara:		**Sector/** Umurenge:	
District/ Akarere:		**Cell/** Akagari:	
		Village/ Umudugudu:	
Geo coordinates/ Indanga miterere y'agace:	**Latitude:**	**Longitude:**	

SECTION 2: FACTORY'S INFORMATION

2.1 FIRM'S REPRESENTATIVE AND ADDRESS/ UHAGARARIYE URUGANDA N'IMYIRONDORO YE

Names/ Amazina	**Tick corresponding number/ Muhitemo umubare ukwiye**
Q1. Positionheld by the	1. Managing direcctor/ Umuyobozi mukuri

informant/ Umwanya utanga amakuru ahagarariye	2. Technical director/ 3. Techical Staff		
Tel. No/ Nimero yoguhamagaraho:	.....	Email	

Q2. Plant/factory type office (audited)/ Aho ikiganiro cyabereye

Head office of the factory / Ku biro bikuru by'uruganda	**1**
Single unit factory/ Uruganda rugizwe n'igice cyimwe	**2**
Branch/ Ishamwi ry'uruganda	**3**
Sub-branch / Igice gito cy'ishami ry'uruganda	**4**

2.2 CATEGORY OF THE FACTORY BY SIZE/ ICYICIRO CY'URUGANDA HAKURIKIJWE UBUNINI

Q 3. Firm's category (Size)/ ICYICIRO CY'URUGANDA (Ubunini)	**Tick/ Emeza**
5. Micro scale (Firms employing 1 – 3 people)/ Igice gito cyane (hakoresha abakozi bari hagati 1 kugeza kuri 3)	
6. Small scale (Firms employing 4 – 30 people) Igice gito (hakoresha abakozi 4 kugeza kuri 30)	
7. Medium scale (Firms employing 31 – 100 people and at least 5 millions capital) Igice cyiri murugero (hakoresha abakozi 31 kugeza 100 kandi byibuze hafite igishoro fatizo cya Miliyoni 5 z'Amanyarwanda)	
8. Large scale (Firms employing more than 100 people, at least 100 millions capital) Hanini Cyane (Hakoresha abakozi barenga 100, kandi byibuze hafite imari shingiro ya Miliyoni 100 z'Amanyarwanda)	

2.3 WORKING CONDITIONS AND PRODUCTS OF THE FACTORY/ AMABWIRIZA NJYENGA MIKORERE N'UMUSARURO W'URUGANDA

Q 4 Working place/ zone/ Aho uruganda rukorera/ Icyanya ruherereyemo	**Tick/ Emeza**
a. Outside industrial zones/ Hanze y'icyanya cyahariwe cy'inganda	
b. In an industrial zone/Mu cyanya cyahariwe inganda	
c. In the Free Economic Zone – National zone/ Icyana cy'inganda	

Q5. Working schedule status/ Ingenabihe y'imikorere mu kazi	**Tick/ Emeza**
a. Regular Working/ Akazi gahoraho	
b. Temporarily working/ Akazi k'igihe gito	
c. Other, please specify (.....)/ubundi buryo, mubugaragaze	

Q.6 Major business activities of the factory/ Ibikorwa by'ingenzi bikorwa n'uruganda	**Tick/ Emeza**
a. Buying Natural stones for processing and selling stone products to others,/ Kugura amabuye yo gutunganya ndetse no kugurisha ibituruka kumabuye abandi	1
b. Own Quarry and process naturalstones for selling to others;/ Dufite icyirombe kandi tunatunganya amabuye karemano yo kugugurisha abandi.	2
c. Buying Natural stones for Processing and own construction activities; Tugura amabuye karemano yo gutunganya kandi dufite ibikorwa by'ubwubatsi	3
d. Own Quarry and process stone as well as do construction activities/ Dufite icyirombe, dutunganya amabuye kandi tunakora imirimo ijyanye n'ubwubatsi.	4
e. Other, please specify (……..)Ibindi mubigaragaze……	5

Types of Products Processed by the factory/ Ubwoko bw'umusaruro uturuka ku mabuye uruganda rukora	
Q7What type of stones and/or processed stone products that most usedin construction activities?/Ni ubuhe bwoko bw'ibikomoka ku mabuye bikunze gukoreshwa mu ubwubats?	1= Non processed stones for constructing foundations for different structures/ Amabuye ataratunganirijwe mu uruganda, yifashishwa mukuzamura umusingi winyubako zitandukanye 2= Gravel used in concrete mixing/ Amubuye mato cyane akoreshwa mukuvanga Beto 3=Cut natural stones used in finishing/ and decorations of buildings/ Ibisate byamabuye karemano bikoreshwa aho bikenewe mu gihe bari kurangiza kubaka ndetse no gutaka inyubako 4=Cobblestones and sets/ 5=Road pavers 6=Granite tiles 7= Stone Claddings 8=Slabs; 9= Slates 10=Rough and fine sand 11=Aggregates and powder 12 = Other, please specify ……..Ibindi, Mubigaragaze

Q.8Your institution's working sector/ Urwego rw'imirimo uruganda rubarizwamo	**Tick**
a. Private sector/ Urwego rutegamiye kuri leta	1
b. Cooperative / Ishyirahamwe	2
c. Public/ Urwego rwa Leta	3
d. Mixed sector (Public Private Partnership) / Urwego rwa Leta rufanatije n'urwego rutegamiye kuri leta	4

SECTION 3: OWNERSHIP, LEGAL STATUS AND REGISTRATION OF THE FACTORY/

Q.9Owners of the factory by nationality/ Ufite uburenganzira nkanyiri rugandahagendewe kubihugu	Tick
a. Rwandan	1
b. Foreign (East African Community) / Anyamahanga (Umuryango w'Afurika y'iburasirazuba)	2
c. Foreign (Other African countries)/Anyamahanga (baturuka mu ibihugu by'Afurika)	3
d. Foreign (Other rest of world)/ Anyamahanga (baturuka mu bindi bihugu byo ku isi)	4
e. Joint (Rwandan + Other African)/ (U Rwanda + Ibindi bihugu by'Afurika)	5
f. Joint (Rwandan + Other rest of world)/ (U Rwanda + ibindi bihugu byo ku isi)	6
g. Joint (Rwandan + EAC)/ (U Rwanda + Umuryango w'Afurika y'iburasirazuba)	7
h. Joint (more than one non-Rwandan)/ (Ibihugu bitarimo U Rwanda)	8

Q10 Firm's ownership composition– By origin of the owners/				
	Foreign private	Local Private	Public (Government)	Nongovernmental Institutions (like pension funds, mutual funds)
Ownership share	=1	**=2**	**=3**	**=4**

Q.11 Legal Status and Shareholdings/ Ubuzima gatozi n'imigabane	Tick
a. Sole proprietorship	1
b. Cooperative/ Ishyirahamwe	2
c. Limited by shares/ Uburyozwe buhiniye kumigabane	3
d. Limited by guarantee/	4
e. Limited by shares and by guarante	5
f. Unlimited	6
g. Partnership/ Ubufatanye n'abandi	7

Q.12. Is the quarry registered or licensed by any of the following institutions? (Answer all questions, tick all apply)/ Mbese ikirombe cyaba cyaranditswe cyangwa cyarahawe icyemeze nimwe muri izi nzego zikurikia?

a. Sector/ Akagari	
b. District/ Akarere	
c. Rwanda cooperative Agency (RCA) only Cooperative/	
d. Private sector Federation (PSF)	
e. Social Security Board (RSSB)	
f. Rwanda Development Board (RDB)	
g. Rwanda Revenue Authority (RRA)	
h. Ministry of environment (MoE)	
i. Other (please mention it)	

SECTION 4: HUMAN RESOURCES AND SKILLS ASSESSMENT/

Q13.What are the total number of working employees in factory/ Umubare wose hamwe w'abakozi bose ungana iki?			

Q14. Number of working persons according to length of contract /payment status and sex/ Umubare w'abantu bakora bitewe n'igihe cy'amasezerano/ Uko bishyurwa n'igitsina

Length of contract/ payment status/ Igihe cy'amasezerano/ uburyo bw'imishyurire		**Total/ Yose hamwe**				**Male/ Gabo**			**Female/ Gore**		
Unpaid workers/ Abakozi batishyurwa	Industrial attachment										
	Apprentice										
	Total										
Paid workers/ Abanyamakuru bishyurwa	Open contract- Permanent										
	Fixed contract above 6 Months										
	1-6 Months										
	< 1 Month										
	Professional internship										
	Total/ Yose Hamwe										
Total/ Yose hamwe											

Q.15. Number of employees according to sex and nationality/ Umubare w'abakozi hashingiwe ku gitsina n'ubwene gihugu

Total/ Bose hamwe			Rwandan/ Abanyarwanda			Foreigner/ Abanyamahanga		
Total	Male/ **Gabo**	Female/ **Gore**	Total/ Bose hamwe	Male/ **Gabo**	Female/ **Gore**	Total/ Bose hamwe	Male/ **Gabo**	Female/ **Gore**

Q.16.0 Human resources: qualifications and training					
Source	**Number of employees/ Umubare w'abakozi**	**Number of employees with a university degree/ Umubare w'abakozi bafite impamya bumenyi ya Kaminuza**	**Number of employees with a technical school degree/ Umubare w'abakozi bafite impamya bumenyi y'amashuri y'ikoranabuhanga**	**Number of employees other types of degrees/ Abakozi bafite ubundi bwoko bw'impamya bumenyi**	**Number of employees who received further trainings/short courses in relation to the job, including visit to bigger firms/ Umubare w'abakozi bahaweandi mahugurwa/ Amasomoy'i gihe gito kubijya n'akazi nko gusura inganda nini**
Permanent staff/ Umukozi uhoraho					
1. Supply/raw material reception/					
2. Production/ Gutunganya					

3. Quality control/ Gusigasira ubwiza						
4. Research and development/ Ubushakashatsi n'iterambere						
5. Marketing and sales/ Imenyekanisha n'ubucuruzi						
6. Administration/ Ubutegetsi						
7. Other / Ibindi						
8. Casual workers/ Abakozi badahoraho						

Q.16.1 Human resources: Field of study (stone and construction material)/						
Source/ Inkomoko	**Number of employees/ Umubare w'abakozi**	**Number of employees with a sciences and technologies fields and Geology/ Umubare w'abakozi**	**Number of employees with civil engineers and architects/ Umubare w'abakozi**	**Number of employees with economy/finance related training/education/ Umubare w'abakozi bahawe amahugurwa/bigishije ibijyanye n'ubukungu ndetse n'icungamutungo**	**Number of employees with a training in other areas/ Umubare w'abakozi bahawe andi mahugurwa**	**Number of employees without a training/education/ Umubare w'abakozi batigeze bahabwa amahugurwa/ bigishwa**
Permanent staff/ **Umubare w'abakozi**						

1. Supply/raw material reception						
2. Production/ Gutunganya						
3. Quality control/ Gusigasira ubwiza						
4. R & D/ Ubushakashatsi n'iterambere						
5. Marketing and sales/ Imenyekanisha bikorwa n'ubucuruzi						
6. Administration/ Ubutegetsi						
7. Other/ Ibindi						
8. Casual workers/ Abakozi badahoraho						

Q.16.2 Types of continuous training offered to employees during the last 10 years / Ubundi bwoko bw'amahugurwa yakomeje guhabwa abakozi mu gihe cy'imyaka 10 ishize			
Area of training/ Igihe bahuguwemo	**Yes/ Yego**	**No/ Oya**	
1. Operating processing machines/ Gukoresha imashini zikoreshwa mu gutunganya			
2. Product development			
3. Quality and safety related			
4. Economy/finance/administration/marketing/ Ubukungu/ finance/ Ubutegetsi/ Imenyekanishabikorwa			
a. Accounting/ Icungamutungo			
b. Marketing/ Imenyekanisha bikorwa			
c. Administration/ Ubutegetsi			
d. Other/ Ibindi:			
5. Other areas (specify)/ Ahandi (muhagaragaze)			

Q.16.3 If no continuous trainings offered, what are the reasons?/ Niba ntamahugurwa yakomeje gutangwa. byatewe ni iki?		
	Tick where applicable/ Emeza aho bikwiye	**Comments/ Ibitekerezo**
1=Training cost are high/ Gutanga amahugurwa birahenze	**1**	
2=Lack of training providers/ Abatanga amahugurwa barabuze	**2**	
3=Insignificant needs for additional training / Ntampamvu zatuma dutanga andi mahugurwa	**3**	
4=Enough internal training / Amahugurwa yo mu ruganda imbere arahagije	**4**	
5=No resources allocated for training/ Nta mutungo wagenewe amahugurwa	**5**	
6=Other (specify)/ Ibindi (bigaragaze)	**7**	

SECTION 5: INNOVATION AND CREATIVITY ASSESSMENT

Source of innovation ideas – who is the source?/		
Q.17a.Internal Source of Innovation		
a. R&D Department/ Ishamiubushakashatsi n'iterambere		
b. Quality control department/ Ishamigusigasira ubwiza		
c. Production department/ Ishami		
d. Supply chain department/ Ishami		
e. Administration department/ Ishami ry'ubutegetsi		
f. Marketing & sales department/ Ishamiimenyekanisha n'ubucuruzi		
g. Others / Ibindi		

Q.17.b. External Source of Innovation/		
a. Clients/ Abaguzi		
b. Competitors/ Abomuhiganywa		
c. Suppliers/ Abaranguza		
d. Consultants/		
e. Research institutions/ Ibigo by'ubushakashatsi		
f. Universities/ Amashuri yaza kaminuza		
g. Others (Specify)/ Ibindi (Mubigaragaze)		

Degree/existence of innovation – what type of innovation		
Q.17.c. Degree/existence of innovation	**Yes**	**No**
a. New product on the local market/ Igicuruzwa gishya ku isoko rusange		
b. New product on the international market/ Igicuruzwa gishya ku isoko muzamahanga		
c. Modification/improvement of existing products/ Guhindura/ kongera igicuruzwa gisanzwe		
d. New products related to existing products/ Igicuruzwa gishya gifitanye isano n'igisanzwe		
e. New product with additional technical support/ Igicuruzwa gishya gifashwa n'ikoranabuhanga		
f. Innovation in the supply chain (transport of raw material…)/		
g. Innovation in infrastructure (equipment, space and size)/ Udushya mu bikorwaremezo(		
h. Innovation in knowledge use (education and training) Udushye ubumenyi bukoreshwa		
i. Innovation in waste management/ Udushya mu gucunga imyanda		
j. Innovation in up cycling/ Udushya mu		
k. Other (specify)Ibindi (bigaragaze)		

SECTION6: TECHNOLOGY DIAGNOSIS/ GUSUZUMA IKORANABUHANGA

6.1 Knowledge and skills of primary extractors of Natural Stonesused by the factory/ Ubumenyi n'ubumenyingiro bw'abacukura amabuye karemano akoreshwa mu ganda.

Q18.1. Based on your expertise in this quarry in terms of extracting Natural stones; Do you use acquired academic skills and knowledge (TVET or engineering skills)? Mugendeye ku ubunararibonye bwanyu muri iki kirombe mubijyanye n'ubucukuzi bw'amabuye karemano mu karere kanyu; Ese mukoresha ubwenge n'ubumenyingiro mwavanye mu ishuri (Haba amashuri y'imyuga cyangwa ubwo aba enjeniyeri)	1= Yes/ Yego 2= No/ Oya
Q18.2 If Yes, rate the level at which the acquired academic skills and knowledge (TVET or engineering skills) are used in natural stone extraction/ Niba ari yego, dufasha gutondeka ukigero cyuko ubumenyi n'ubumenyingiro byifashishwa mu ubucukuzi bw'amabuye karemano mu karere kanyu.	**1=**10-20% **2=**20– 50% **3=**50%-80% **4=**80%-100%
Q18. If No, how do people working with your quarry acquire the skills and knowledge required in natural stone extraction?/ Niba ari oya, Ni ubuhe buryo abakora mu bucukuzi bw'amabuye bunguka ubumenyi n'ubumenyingiro kubijyanye n'ubucukuzi bw'amabuye karemano?	**1**= Informal apprenticeship training (trained on the job by experienced relative or friend); **2**= Short term organized training organized by development partners or government with no certificate issued;/ Abafatanyabikorwa mu iterambere cyangwa leta babaha amahugurwa y'igihe gito adatanga impamyabumenyi. **3** = Used personal talent and technical ability/ Hakoreshwa impano ndetse n'ubusobozi bw'umuntu mu ikorabuhanga. **4**= Others, specify (……..)/ Ibindi, mubigaragaze

Q18.4 Some natural stones are not used in construction activities because of their composition (Quality & durability); Do you have any adopted method for identification of quality stones required at the factory?/ Hari amabuye adagukoreshwa mu ibikorwa by'ubwubatsi bitewe n'ubwiza ndetse nogukomera kwayo. Ese haba hari uburyo mwashyizeho mujya mukoresha mugutoranya amabuye meza acyenewe gukoreshwa mu ruganda?	1= Yes/ Yego 2= No/ Oya
Q18.5 If yes, please select among the following/ Niba ari yego, hitamo muri ubu buryo bukurikira	**1**=Natural selection using our experience in identification of quality stones required by clients **2=** We use installed machines which sieve and separate the wanted from unwanted extracted natural stones 3=Detectors or sensors of quality resources 4=Others, specify…….
Q. 18.6 Do you have any technology for exploration and determination of the quantity of natural stones available in the area of extraction?/ Ese mwaba mufite ikoranabuhanga mukoresha mu kuvumbura no kumenya ingano yamabuye karemano ari mu gice gicukurwamo amabuye?	1= Yes 2= No
Q18.7 If yes; share with us the installed machine (technology) that facilitate your company to determine volume/quantities of natural stones hidden underground that can be extracted/ Niba ari yego, dusangize ikaronabuhanga cyangwa imashini zibafasha kumenya ubunini cyangwa ingano y'amabuye karemano ari mu bitaka ashobora.	…….

Q.18.8 If No, How do you get to know that a given Quarry has higher or lower quantities and quality of natural stones for extraction?/ Niba ari oya, Ese ni ubuhe buryo mukoresha kugirango mu menye niba ikirombe gifite ingano n'ubwiza bwinshi cyangwa bucye bw'amabuye karemano yo gucukurwa?	…….

6.2 Technology used in terms of materials used in extracting or breaking natural stones/Ikoranabuhanga mu buryo bw'ibikoresho rikoreshwa mu gucukura cyangwa kumenagura amabuye karemano

	Tools used in natural stone extraction/ Ibikoresho bikoreshwa mugukura amabuye karemano
Q. 19.1 What common tools do you use to extract natural stones from underground?/ Ni ibihe bikoresho mukunze gukoresha mucukura amabuye mu ubutaha hano mu karere kanyu?	1=Traditional tools (including heavy hummer-kinubi; umutarimba; ibihadiko, Axes, Spades, Hand hoes, etc) 2= Modern stone extracting Machine with mounted engines(Pokers; caterpillars, etc); 3=Explosives; 4=Use of metal Discs; 5=Use of Diamond wires 6= Crasher machines
	Technology used for facilitating breaking or crashing of stones in pieces
Q19.2 Which technology do you use to facilitate natural stone extraction (easy breaking or crashing huge rocks hidden underground or on surface)?/ Ese ni irihe koranabuhanga ribafasha mu ubucukuzi bw'amabuye karemano mu karere kanyu (koroshya icukurwa ry'amabuye ari hasi cyangwa ari hafi mu butaka)	1= Natural heating using Firewood 2= Explosives/Urutambi) 3= Stone crashing /cutting 4= Others, specify……..

Q20. Tools used in natural stone technology extraction and their processing/ Ibikoresho bikoreshwa mu ikoranabuhanga ry' ubucukuzi n'itunganywa ry'amabuye.

Available processing technology in use/ Ikoranabuhanga rikoreshwa mu mugutunganya amabuye karemano				
No	**Stage/Unit operation/Urwego/**		**If 2; Equipment categorization*/ Niba ari 2; Ishyirwa mu byiciro ry'ibikoresho**	**Country of origin/ Igihugu bikomokamo**
a)	**During Quarrying /extraction/ Mu gihe cy'icukurwa ry' amabuye:** What common tools/equipment do you use to extract natural stones from underground?/ Ese ni ibihe bikoresho mukunze gukoresha mu gucukura amabuye karemano mu butaka?			
	0=Not done/ ntibirakorwa1=No equipment/machine/ ntabikoresho/imashini 2= Use equipment/machine/ Dukeresha ibikoresho/Imashini			
1	Quarry exploration/ Gushakisha ikirombe			
2	Extraction: Drilling or/and blasting			
3	Crushing/ primary			
4	Lifting & loading/ Guterura no gupakira			
5	Transportation/ Gutwara			
b)	**In natural stone processing:** Which tools/equipment do you use to facilitate processing of natural stone for construction ?/ **Mu gutunganya amabuye karemano:** Ni ibihe bikoresho ukoresha mukoroshya itunganywa ry'amabuye karemano akoreshwa mu bwubatsi?			
1	Un-loading: Gupakurura			
2	Cutting – tertiary:			
3.	Polishing painting			
4.	Packing & packaging:			
5.	Lifting &loading			
6.	Transport and distribution / Kubitwara no nokubigeza ku isoko			
8.	Waste collection and			

	upcycling/ Kwegeranya impanda no			
9.	En-loading			
10	Other , please specifies/ Ibindi, mubigaragaze			

*Equipment categorization: **0**= Not done **1**= Manually operated; **2**=Partially manually operated;**3**=Powered equipment; **4**=Automatically operated; **5**=Highly automated and sophisticated./ Ishyirwa mu byiciro ry'ibikoresho: 0= Not done 1= Hakoreshwa ingufu z'amaboko; 2=Ingufuz'amaboko n'imashini; 3=ibikoresho bisaba ingufu 4=ibikoresho byikoresha 5=ibikoresho byikoresha byo murwego rwo hejuru

Q21 a Notice: a list of machines used at different stages of production shall be collected with name, model, installed production capacity, producers and origin./ **Icyitonderwa:** Imashini zose zikoreshwa kuri buri rwego mu gutanganaga amabuye zishyirwa hamwe n'amazina, ubwoko, ikigero cy'umusaruro ishobora gutanga, uwagikoze ndetse n'inkomoko yayo

Q 21b. Where do you generally source machines from? (Tick all that apply)/ Nihe mukura imashini? (Emeza ahakwiye hose)	
Sourced locally – In Rwanda/ **Biva mu Rwanda**	
Sourced regionally – In EAC & Great lake region/ **Biva mu karere – Ibihugu bigize umuryango w'Afurika by'iburazirazuba & n'akarere k'ibiyaga bigari**	
Sourced internationally/ Biva mubi hugu muza mahanga	

Q22.a How long does one production cycle take?/	
Number of hours/ Umubare w'amasaha	
Q 22.b Factory installed production capacity – (units /h)/ Ububasha bw'uruganda mu gutunganya	
Q 22.c. Average annual production (units)/ Umusaruro ku mwaka	

Q23 Where do you source packaging materials from? (Tick all that apply)/ Nihe muvana ibikoresho byo gufinika no gupakira	
1=Sourced locally – In Rwanda/ **Biva mu Rwanda**	
2=Sourced regionally – In EAC & Great lake region/ **Biva mu karere – Ibihugu bigize umuryango w'Afurika**	

by'iburazirazuba & n'akarere k'ibiyaga bigari	
3=Sourced internationally/ Biva mubi hugu muza mahanga	
4=Make them our selves / by local artisans/ Turabyikorera/ Bituruka muhanyabugeni bo mu gace	

Q 24.a. How is your ability to afford technologies/ Ubushobozi bwo gukoresha ikoranabuhanga bungana iki	
a. The firm's resources and incomes are enough to acquire new technology/ Umutungo n'iby'uruganda rwinjiza birahagije kugirango tugire ikoranabuhanga rishya.	
b. The firm's resources are not enough to acquire new technologies/ Umutungo w'uruganda ntago uhagije kugirango tugire ikoranabuhanga rishya	
Q 24.b If b (Tick all that apply)/ niba ari b (Hitamo ibikwiye byose)	
1=The firm uses loans/ Uruganda rukoresha inguzanyo	
2=The firm uses grants to acquire new technology/ Uruganda rukoresha inkunga ngo rukoreshe ikoronabuhanga rishya.	
3=Other (Specify)/ Ibindi (mubigaragaze)	

Q 25 How accessible are technologies/machines utilized (Tick all that apply)/ Ibikoresho by'ikoranabuhanga bibasha kuboneka bingana iki?	
Easily accessible - (the firm has government's support to access new and affordable technology)./ **Biboneka kuburyo bworoshye -**(uruganda ruterwa inkunga na leta kugirango tubashe kubona ndetse no gukoresha ikoranabuhanga rishya)	**1**
Somehow easy - (both firms and government have to share the cost to access new and affordable technology).**Bisankaho byoroshye –**(uruganda na leta bafatanya kwishyura ikiguzi cy'ikoranabuhanga	**2**
Not easy at all - (firms are struggling to have access to new and affordable technology)/ uruganda rufite ibibazo byo kubasha gukkoresha ikoranabuhanga	**3**
Other (Specify)/ Ibindi (Mubigaragaze)	**4**

Q 26 Which ones of the following areas in your business are you planning on

improving/changing technologically and in terms of human resources?/ Ni ibihe muri ibi bice muteganya kuba mwakorera ingufu/ guhindura mubijyanye n'ikoranabuhanga n'umutunga		
		Remarks
1. Process area/ Igice cyitunganya musaruro		
Automation/ Imashini zikoreshwa	**1**	
Production control	**2**	
Capacity building of staff/ Kongerera ubushobozi abakozi	**3**	
Research and Development/ Ubushakashatsi n'iterambere	**4**	
Improvement of production method/ Guteza imbere uburyo bw'itunganya	**5**	
Other (Specify)/ Ibindi (Mubigaragaze)	**6**	
None/ Ntaha hari	**7**	
2. Quality of products area/ Igice cy'ubwiza bw'umusaruro		
Quality control	**1**	
Supply chain of raw material/ Ibikenerwa mu ruhererekane bw'ubucuruzi	**2**	
Processes	**3**	
Complying with Standards/ Kubahiriza ubuziranenge	**4**	
Other (Specify)/ Ibindi (Mubigaragaze)	**5**	
None/ Ntabihari	**6**	
3. Management area/ Igice cy'ubuyobozi		
Top management/ Ubuyobozi bukuru	**1**	
Supervisors/ Abagenzuzi	**2**	
Technical staff/ Abakozi	**3**	
Other (Specify)/ Abandi	**4**	

(Mubagaragaze)		
None(Ntaba hari)	**5**	

Q.27. 1 Does the firm have enough space for production and the ability to expand in the short run?/ Ese uruganda rufite umwanya uhagije wo gutunganirizamo n'ububasha bwo kwaguka mu gihe gito		
Yes/ Yego	**1**	**Comments**
No/ Oya	2	
Q.27.2 Space ownership (tick where applicable)/		
Own space/ Ni ahacu bwite	1	
Rented space/ Turahakodesha	2	
Other (specify)/ Ibindi, ubagaragaze	3	

Q28. Categorize the firm using the following terms (Tick where applicable)/ Dufashe gushyira uruganda mu cyiciro ukurikije ibi bikurikira (Emeze aho bikwiye)	
Fully manually operated/ Hakoreshwa ingufu z'amaboko	1
Partially manually operated/ Ingufuz'amaboko n'imashini	2
Powered equipment/Ibikoresho bisaba ingufu	3
Fully automated/ Ibikoresho byikoresha	4
Highly automated and Sophisticated/Ibikoresho byikoresha byo murwego rwo hejuru	5
Other (specify)/ Ibindi (Bigaragaje)	6

Q29.What are challenges faced during Production?/ Ni izihe mbogamizi muhura nazo mugutunganya umusaruro?	**Q29Remarks**
a. Limited energy and water/Umururo n'amazi ni bike	
b. Poor infrastructure/ Ibikorwaremezemo bidahagije	
c. Inadequate raw materials/ Ibikoresho ntago bihagijwe	
d. Inadequateskilled labor/ Abakozi binzobere ntago bahagije	
e. Inadequatefinancial capital/ Imari shingiro ntago ihagije	
f. Inadequatetechnology required/ Ikoranabuhanga rikenewe ntago rihagije	

g. High taxes/ Umusoro uri hejuru	
h. Limited demand/ Abaguzi baracyari bacye	
i. Competition from other Firms/ Guhanganira isoko n'izindi nganda	
j. Bureaucracy	
k. Environmental protection cost/ Ikiguzi cyokurinda ibidukikije	
l. Other: please Specify/ Ibindi, Mubigaragaze	

SECTION 7. FINANCIAL ACCOUNTING AND TRANSACTIONS/

	Yes
Q.30. Does the factory/plant maintain regular accounts?/Ese uruganda rwaba rucunga umutungo kuburyo buhoraho	No
Q30.1 if "YES" which of the following books is used (tick all apply)/ Ni ari Yego Ni ibihe muri ibi bitabo bikoreshwa? (Emeza aho bikwiye hose)	
a. Ledgers	
b. Journals	
c. Balance sheet	
d. Income statement (Profit and loss account)	
e. Invoice	
f. Specialized accountingsoftware	

Q. 31. Annual total turnover in 2019 per factory in Rwf/

a. Less than 300.000	1
b. 300.000-<12.000.000	2
c. 12-<20 million	3
d. 20 to 50 million	4
e. More than 50 million	5

Q28. Current employed capital/operational expenses in Rwf/ Imari shingiro imaze gukoreshwa/ Amafaranga agenda kubyishyurwa mu kazi

a. Less than 500.000/ Hasi ya 500.000	1
b. 500.000-15.000.000/ Hagati ya 500.000-15.000.000	2
c. More than 15 to 75 million/ Arenze miliyoni 15 kugeza kuri 75	3
d. More than 75 million/ Arenze Miliyoni 75	4
e. Less than 500.000	5

Q29. Did you have any transaction of natural stones products with a foreign country during the last 12 months (buy or sell the natural stones products)?/ Ese mwaba mwaragiranye ihererekanya musaruro n'ibihugu byamahanga mu mezi 12 ashize (Mugura cyangwa mugurisha ibikomoka ku mabuye karemano)?

1= Yes, Export of natural stones products/ 1= Yego, twohereza hanze y'igihugu ibikomoka ku mabuye karemano	
2 =Yes, Import inputs for production/ 2=Yego, Twinjiza mugihugu ibikomoka ku mabuye karemano	
3= Yes both (export and import)3= Yego byombi (Twohereza hanze ndetse tukanjiza mu gihugu)	
4= No transaction/4= Oya, ntahererekanya ribaho	

Q30. What type of taxes do you pay? (Tick all apply)/ Ni ubuhe bwoko bw'umusoro mwishyura? (Mwemeze aho bikwiye hose)

1=Value Added Tax (VAT)/ Umusoro kunyongera gaciro	
2= TPR/PAYE	
3=Withholding Income Tax	
5=Import Duties Tax/	
6=Trading License Tax	
7= Rental Income Tax/ Umusoro kunyungu y'ubukode	

SECTION 8: QUALITY ASSURANCE AND STANDARDS

8.1 Quality assurance and standards status assessment/

Q 31 Kindly testify the existence of following quality			
	Yes/ Yego	**No/ Oya**	**Remarks**
Q 32.a. Existence of quality control department/ Hari igice gishizwe kugenzura ubwiza			
Q 32.b. Available quality control techniques to check:			
a) The raw materials quality specifications/ Kugenzura ubwiza bw'ibokoresho bikoreshwa			
b) The in-process product quality specifications / Kugenzura uburyo umusaruro utunganywa			
c) The final product quality specifications/ Kugenzura ubwiza bw'umusaruro wanyuma			
Q 32.c. Is quality control of the products carried out by external organizations?/ Mbese igenzura ry'ubwiza bw'umusaruro			

ryaba rikorwa n'ibindi bigo byikorera			
Q 32.d. Existence of controls (and monitoring) at determined CCPs (critical control points)/			
Q 32.e. Existence of a product traceability system			
Q 32.f. Cases of products' re-call in case of quality control problems			
a) Often/ Buri gihe			
b) Rarely/ Gake			
c) Never/ Ntibibaho			
Q 32.g. Quality records keeping			

Q.33. Kindly give types of quality/safety certificates or product certificates that the firm has		
33.1.Types of safety certificates or product certificates obtained	**Yes**	**No**
a. S-mark (Standardization mark)		
b. Environmental impact assessment and a certificate of approval issued by a competent formal authority		
l) Quarry area license from a competent authority/ Acage icyirombe kirimo hafite ibyangomba byatanzwe n'urwego rubitiye ububasha. c. one (1ha) hectare in case of a non-commercial small-scale quarry license;/ Ni ubuso bwa Hegitari 1ha, hafite icyangombwa cy'icyirombe gihambwa icyirombe gito kandi kitari icyubucuruzi		
d. Quarry area license from a competent authority/Acage icyirombe kirimo hafite ibyangomba byatanzwe n'urwego rubitiye ububasha. e. five (5ha) hectares in case of commercial small-scale quarry license (at least 5 Million Rwf); / Ni ubuso bwa Hegitari 5ha, hafite icyangombwa cy'icyirombe gihambwa icyirombe gito kandi kitari icyubucuruzi.		
f. Quarry area license from a competent authority/ Acage icyirombe kirimo hafite ibyangomba byatanzwe n'urwego rubitiye ububasha. g. Fifty (50ha) hectares for a large-scale quarry license (at least one hundred million Rwanda Francs (Rwf 100,000,000)./		
h. Quarry area license from a competent authority/ Acage icyirombe kirimo hafite ibyangomba byatanzwe n'urwego rubifitiye ububasha. i. Larger than fifty (50ha) hectares for a large-scale quarry license./ Hatife ubuso bwa Hegitari 50ha, Icyakombwa cy'icyirombe gifite byibuze agaciro ka milliyoni 100 z'amanyarwanda		
j. Other (Specify)/ Ibindi (Mubigaragaze)		

SECTION 9: SOURCING OF RAW MATERIALS USED IN THE FACTORY

9.1 Sourcing of inputs and supplies /

Q.34. In what form and quantity are your raw materials received? (Sourcing of inputs and supplies)		
	Tick where applicable/ Emeza aho bikwiye	**Quantity/Year (Tones)Ingano ku mwaka (Toni)**
1= Own a quarry/ Icyirombe ni icyacu bwite		
2= Natural stones out sourced/ Amabuye karemano agurwa ahandi		
3= both from quarry and out sourced/ Aturuka hombi mu cyirombe cyacu n'ayo tugura ahandi		
4= Semi processed stone products/ Ibikomoka ku mabuye byatunganijweho igice		
5= Other forms of inputs (specify)/ Ubundi buryo (mubugaragaze)		

Q.35. Share with usthe out sourced raw materials as % of total quantities of raw materials used in producction (Percentage*)/ Mudusangize ijanisha ry'ibikoresho byose hamwe muvana ahandi byifashishwa mu gutunganya amabuye	
a) Directly from individual (owner) quarry area/ Aturuka kuri nyiri cyirombe cy'amabuye	
b) From cooperative's (owner) quarry area/ Aturuka ku ishyirahamwe rifite icyirombe cyamabuye	
c) From middlemen/aggregators/ Aturuka kumuhuza mu bucuruzi	
d) From cooperatives/ unions/federations of exploiters/ Aturuka mu mashyirahamwe/ amatsinda/ Inganga z'abacukuzi	
e) From local markets/ Aturuka ku masoko asanzwe hafi yacu	
f) Established collection local centers/	

g) From foreign suppliers / Aturuka mu bacuruzi bo hanze y'u Rwanda	
h) Others (specify)/ Ahandi, muhagaragaze	

*Score of 1 (1-20%): 2 (21-40%); 3 (41-60%), 4 (61-80%) and 5 (81-100).**Don't** fill if **0**

Q.36. What is the nature of contracts between the firm and suppliers of raw materials? (Tick where applicable)./ Ese ni iyihe miterere y'amasezerano y'imikoranire ari hagiti yanyu nk'uruganda n'ababacuruzaho ibikoresho mukoresha.	
(a) Verbal/ Amasezerano yemeranijweho mu magambo gusa	
(b) Written/ Amasezerano yanditse	
(c) Other (specify) / Ayandi, Muyagaragaze	
(d) No contract/ ntamasezerazo ahari	
Q.37. Does the contract specify any of the following? (Tick where applicable)/ Ese amasezerano yaba agaragaza ibi bikurikira? (Mwemeze aho bikwiye)	
(a) Length of agreement/ Igihe cyemeranijweho	
(b) Delivery and payment conditions/ Amabwiriza agenga Igihe ibicuruzwa bizira ndetse binishyurirwa	
(c) Quality control measures/ Ingamba zo kunoza ubwiza bw'ibicuruzwa	
(d) Degree of contract formalization	
(e) Opportunities for enforcement of contractual obligations	
(f) Non-financial and financial services provided/ Serivise zishyurwa n'izitishyurwa	
(g) Existence of sub-contracting/	
(h) Scope for changes/ Icyigero amasezerano ashobora kugiramo iminduka	

Q.38.Generally, what are the 5 main challenges with sourcing raw materials and other supplies?/ Muri rusange, Ni izihe mbogamizi ziri mu kugura ahandi ibikoresho ndetse n'ibindi bintu nkenerwa
.....
.....
.....
.....
.....

.....
Q.39. How have the suppliers overcome the challenges?/ Nonese, ni ubuhe buryo ababibacuruzaho bakuraho izo mbogamizi
....
Q.40. Any suggestion (by the firm) on how such met challenges can be overcome?/ Ese haba hari inyunganizi nk'uruganda mwatanga mu rwego rwo kuvanaho izo mbogamizi.
....

SECTION10. MARKET ASSESSMENT AND COMPETITION

10.1 About availability of clients/ Ibijyanye nokuboneka kw'abaguzi	
Q.41.1 What's your target market / local perspective/ Ese isoko ryanyu ni bande/ Turebeye hano hafi?	1= High end clients/ Abaguzi bo murwego rwo hejuru 2= Middle income client/ Abaguzi binjiza mu urugero 3= Low income earners/ Abaguzi binjiza macye
Q.41.2 Do you have consistent clients?/ Ese mwaba mufite abaguzi bahoraho?	1= Yes/ Yego 2 =No/ Oya
Q.41.3 If No, why? (all apply)/ Niba ari Oya, Biterwa ni iki? (mwemeze aho bikwiye hose	1=Impassable roads because heavy rains;/ Imihanda yangijwe nimvura ikaba itanyurwamo 2=Poor quality of produced products;/ Ubwiza bw'umusaruro ntago buhagije 3= Affordability/ Ubushobozi bwo kubigura 4=Others, Please specify …….. Ibindi, mubigaragaze…..
Q.41.4 Do you normally have contracts to supply natural stones products to your clients?/ Ese mwaba mugira amaserano y'imikoranire n'abaguzi, yo kubaha ibikomoko ku mabuye karema?	1 = Yes/ Yego 2 = No/ Oya
Q.41.5 If Yes, What is a type of contracts are normally given?/ Niba ari Yego, ni ubuhe bwoko bw'amasezerano y'imikoranire mugirana?	1 = Verbal Contracts;/ Ubwoko bw'amasezerano bwemeranijweho mu magambo gusa. 2 = Written and bearing signature of both parties/ Ubwoko bw'amasezerano bwanditse kandi bushyizweho umukono na buri ruhande. 3= We don't need contracts, we supply whoever comes/ ntabwo ducyeneye kugirana amasezerano, ducuruza kubatugana bose.
Q.41.6 Who are your most common clients?/	1= Individuals with construction

Nonese ni abahe baguzi banyu bimena?	projects;/ Banyiribwite bafite imishinga y'ubwubatsi 2= Construction companies/ Ibigo by'ubwubatsi 3= Factory/plant that process (Add value) natural stones/ Inganda zitunganya (zongerera agaciro) amabuye karemano 4=Others, please specify ……. Abandi, mu bagaragaze…
Q.46.7 The stones /stone Products you supply are mainly used for what?/ Nonese, amabuye cyangwa ibikomoka ku mabuye mucuruza ahanini bikoreshwa iki?	1=Construction of residential and commercial buildings (especially in construction of foundations, etc);/ Ubwubatsi bw'imiturirwa n'inyubako z'ubucuruzi (cyane cyane mu kuzamura umusingi w'inzu) 2=Construction of bridges and retaining walls along highways;/ Ubwubatsi bw'ibiraro n'inkuta zicyicyije imihanda 3=Decoration and finishing of structures;/ Mu gutaka no kurangiza kubaka inyubako Others, Please specify…../ Ibindi, mubigaragaze….

Q.47. What are your main marketing strategies?/ Ese, ni ubuhe buryo bw'ingenzi mukoresha mu imenyakanisha bikorwa ryanyu?
a. Word of mouth advertising/
b. Open shows and showroom display
c. Direct selling marking
d. Internet marketing
e. Dominance in marketing (established name)
f. Paid media - Advertisement and promotions
g. Niche marketing
h. Cause related marketing (Market influence)
i. Participating in local, regional and international exhibitions/ Kwitanira

	imurikagurisha ryo mugace ndetse niry'impuzamahanga
j.	Other: Specify/ Ubundi buryo :mubugaragaze

10.2Products' markets: **Q.48.**Kindly indicate the major products' destination markets for the last 4 years by Market share in %?/ Twagira ngo tubasabe mudufashe kutwereka amasoko y'ibicuruzwa nyamukuru mu gihe cy'imyaka 4 ishize, tugendeye ku ijanisha ry'imigabane y'isoko?	
Q.48.a Local market/ Isoko ryo mu Rwanda	
Q.48.b Regional market/ Isoko ryo mugace u Rwanda ruherereyemo	
Q.48.c Rest of the world market/ Isoko ryo mu bindi bice by'isi	
Q.48.d Europe/ Iburayi	
Q.48.eUSA/ Leta zunze ubummwe z'America	
Q.48.f ASIA/ Aziya	
Q.48.g Rest of the worl market	
Q.48.h Other specify/ Ahandi, muhagaragaze	

***Score** of/ Biri kucyigero cya 1 (1-20%): 2 (21-40%); 3 (41-60%), 4 (61-80%) and 5 (81-100).**Don't** fill if/ Ntimwuzuze niba **0%**(None)

Q.49. Do you have market competitors? (Yes /No)/ Ese, mwaba mufite abo muhanganira Isoko/ (Yego/Oya)	
Q.49.1 If yes highlight please share the type of competitor below:/ Niba ari Yego, twagirango mu dutoranayirize abo aribo muri aba	
Types of competition/ Ubwo bw'uwo duhanganira Isoko	**(%)**
Q.49.1 a Local competitors (National level)/ Abo duhanganira isoko bimbere mu gihugu	
Q.49.1.b. Regional competitors/ Abo duhanganira isoko bo mu karere u Rwanda ruherereyemo	
Q.49.1.c. International competitors/ Abo duhanganira isoko bo kurwego Muzamahanga	
Q.49.1.d. No competitors/ Ntabo duhanganira isoko	

*Score of/ Biri kucyigero cya1 (1-20%): 2 (21-40%); 3 (41-60%), 4 (61-80%) and 5 (81-100).**Don't** fill if/ Ntimwuzuze niba **0% (None)**

SECTION 11: ENVIRONMENTAL PROTECTION/ KURINDA IBIDUKIKIJE

Q.50. Are you aware that the extraction of	1= Yes/ Yego

natural stones has a negative impact on the environment?/ Ese mwaba mubizi yuko ubucukuzi bw'amabuye bushobora kugira ingaruka mbi kubidukikije?	2= No/ Oya
Q.50.1 If yes, How do you prevent against environmental degradation and protectthe land following the extraction of stones or processing of stone products?/ Niba ari Yego, ni gute murinda ndetse mukabubungabunga ibidukikije nkubutaka mugihe mumaze gucukura amabuye cyangwa gutunganya ibiyakomokaho?	1= Rehabilitating land/ Gusibaibirombe 2= Forestation to rehabilitate land/ Gutera amashyamba murwego ryogufata ubutaka. 3= Nothing done after extraction/ Nyuma y'ubucukuzi ntagikorwa 4= Others, please specify…….Ibindi, mubigaragaze
Q. 50.2 Did you conduct your business Environmental Impact Assessment?	1= Yes/ Yego 2= No/ Oya
Q.50.3 Do you measure Carbon emission?	1= Yes/ Yego 2= No/ Oya
Q.50.4. If Yes – what's your emission (Volume)?	

This is the end of the audit, thank very much for your collaboration, and kindly put your signature here …….

Nihano dusoreje icyiganiro cyacu, tubashimiye cyane ko mwitanze, mutwemerere mushyire umukono hano……

Annex 3 c: Questionnaire for End-Users

Annex 2: Questionnaire for the End Usersof extracted and/or processed products from natural stones used in construction/Umugerekawa 2: Ibazanyandikorigeneweabakoreshaibikomoka mu icukurwan'itunganywary'amabuyekaremanobikoreshwa muubwubatsi.

Dear Respondent,

Natural stones is viewed as one of key priority value chains in Rwanda that brings together a number of small and medium enterprises. / Amabuyekaremanonikimwe mu byibanzebigizeuruhererekanerw'inyongeragaciro mu Rwanda,bityoakabaahuzabarwiyemezamirimobaciriritsendetsen'abisumbuyeho.

NIRDA has prioritized Natural stones value chain with a view to making it more competitive through technology upgrading and capacity development of all the actors along the value chain. /NIRDA yashyizeimbereuruhererekanenyongeragacirorw'amabuyekaremano mu rwegorwokuyongereraubushobozi, binyuze mukuzamuraikigerocyikoranabuhangarikoreshwamondetse no gutezaimbereabagirauruharemuriurworuhererekanenyogeragaciro.

In light of the above, a technology is being carried out to obtain views and feedback from the current and future customers of stones and products as construction materials, and we are requesting you to provide information that will assist in improving the sector. The information provided will be treated with strict confidentiality. / Hagendewekubyavuzweharugururero, hakabahakomejegukoreshwaikoranabuhanga mukugirangotwakireibitekerezon'ishushorusange, bivuye mu basanzwebaguran'abazaguraamabuyendetsen'ibiyakomokahobikoreshwa mu ubwubatsi. Tukabatwifuzakomwaduhaamakuruazagiraumumarondetseakabayakifashishwa mu kuzamuraimikorereyururwego.
Amakurumuribudusangizeafatwandetseakabikwankibangarikomeyekandikuburyobwizewe.

We thank you for your kind contribution as one of the key stakeholder in this sector./Tubashimiyebyimazeyouruharerwanyunkabafatanyabikorwabingenzimuriururwego.

SECTION 1: GENERAL INFORMATION/ IGIKA CYA MBERE: UMWIRONDORO RUSANGE

Section 1: General Information/Igikacya 1:Umwirondoro

1.3. Enumerator's Information/ Umwirondorow'uyoboyeikiganiro:											
Names of the Enumerator/Amazina y'uyoboye ikiganiro											
Enumerator's Code / Umubare uranga ubaza							**Starting time/ Igihe dutangiriye**				
Interview Dates/ Itariki ikiganiro kiberaho							**Ending time/ Igihe turangirije**				

1.2 Location of the End-User of Natural stones and/or processed products from natural stones/ Aho ukoreshaamabuyekaremanocyangwaibiyakomokahobyabanjegutunganirizwa muurugandaatuye:	
Province/ Intara:	
District/ Akarere:	
Sector/ Umurenge:	
Cell/Akagari:	
Village/Umudugudu:	
Contact (Optional)/ Uburyobw'itumanaho	Telephone/ Numeroyoguhamagara:…… Email: ……

1.3 Background of the End user: /Umwirondorow'ukoreshaamabuye karemanocyangwaibiyakomokaho:	**Answers /Ibisubizo**
1.3.1 Name of individuals, Representative construction companies, Real Estate Developers, Association Masons, Institute of Engineers of Rwanda/ Amazinay'abanyirubwite, Uhagarariyeikigocyangwa Umukoresha, Kompanyiz'ubwubatsi, Real Estate Developers, Association Masons,Ikigocyabenjeniyeri mu Rwanda. ,	……
1.3.2 Sex/Igitsina	1 = Male/ Gabo; 2=Female/ Gore
1.3.3 Age/ Imyaka	……
1.3.4Level of education/ Icyicirocy'amashuriyarangije	1= Primary/ Amashuriabanza 2= O'Level? Icyicirocy'amberecy'amashuri yisumbuye

	3= Secondary/Amashuriy'isumbuye 4= TVET and Related/ Amashuriy'imyuga nandiyigishaimyugaicirirtse 5 = University level/ IcyicirocyaKaminuza
1.3.5Years of experience in using natural stones in constructionactivities?/Imyaka y'ubunararibonyemu gukoreshaamabuyekaremano ibikorwaby'ubwubatsi.	1= Less than 1 year/ hasiy'umwaka 1 2= 1– 3 Years/ umwaka 1 kugezakuri 3 3= 3 Years and above/ Imyaka 3 kuzamura

Section 2: Types of stones and stone products used in your construction activities/Igikacya 2: Ubwokobw'amabuyekaremanon'ibiyakomokahobikoreshwa mubwubatsi.

2.1 Natural stones and stone related products: /Amabuyekaremanon'ibiyakomokaho

2.1.1 What type of stones and/or processed stone products do you normally use in your construction works? / Ese ubusanzweniubuhebwokobw'amabuyecyang waibiyakomokahomukoresha mu bwubatsi?	1= Non processed stones for raising foundations for different structures/ Amabuyeataratunganirijwe mu uruganda, yifashishwa mukuzamuraumusingiwinyubakozitandukanye 2= Gravel used in concrete mixing / AmabuyematocyaneakoreshwamukuvangaBeto 3=Cut natural stones used in finishing and decorations of buildings/ Ibisatebyamabuyekaremanobikoreshwaahobike newe mugihebarikurangizakubakandetse no gutakainyubako 4=Cobblestones and sets/ Amabuyeashyirwa mu mihanda. 5=Road pavers/ Amabuyeyubakishwautuyiratwabanyamaguru mu muhanda 6=Granite tiles 7= Stone Claddings 8=Slabs; 9= Slates 10=Rough and fine sand 11=Aggregates and powder 12 = Other, please specify …… Ahandi,

	muhagaragaze
2.1.2 Who are your suppliers of the extracted natural stones and/or other stone products?/ Nibandebabaranguzaamabuyecyangwaibindibikomokakuubucukuzibw'amabuyekaremano.	**1=**Cooperatives/ Amashyirahamwe **2=** Natural stones processing companies/ Kompanyizitunganyaamabuyekaremano **3=** Associations of natural stone extractors/ Imiryangoy'abacukuzib'amabuyekaremano **4=**Individual natural stone extractors/ umucukuziwamabuyekaremanoubikorakugiticye 5= Others, please specify…….Abandi, mubagaragaze…….
Types of contracts between the end users and the suppliers of the natural stones and/or the stone products used in the construction activities/ Ubwokobw'amasezeranongengamikoranirehagatiy'abakoreshaamabuyekaremano mubikorwaby'ubwubatsindetsen'abaranguzaayomabuyen'ibiyakomokaho.	
2.1.3 Do you have contracts with your suppliers?/ Ese mwabamufitanyeamasezeranongengamikoraniren'ukuranguza	**1=** Yes/Yego **2=** No/Oya
2.1.4. If yes, what type of contracts do you normally have?/ Nibaahari, Ni ubuhebwokobw'amasezeranongengamikoranire mufitanye?	1= Verbal contracts/ Ubwokobw'amasezeranongengamikoranirebwemeranijweho mu magambogusa. 2= Written contracts bearing specimen of the two parties involved / Ubwokobw'amasezeranongengamikoranirebwanditsekandibugizwemouruharenaburiruhande.

Transport of the supplied natural stones and other processed stone products to the destination of end-users/ Uburyoamabuyekaremanondetsen'ibikomokakumabuyekaremanoyatunganirijwe mu ngandabijyanywakubaguzibabikoresha.	
2.1.5 Do you use transport in the delivery of the supplied natural stone products/ Ese mwabamujyamutwaraamabuyekaremanondetsen'ibikomokakumabuyekaremano murwegorwokubishyicyirizaabaguzibabikoresha?	1= Yes/ Yego 2= No/ Oya
2.1.6 If yes, which means of transport to do you use?/ NibaariYego, Ni ubuheburyomukoreshamuyatwara?	1= Man power/ Atwarwan'abantu 2=Trucks of 3M^3; 5M^3 and 10M^3/ Ikamyoza3M^3; 5M^3 and 10M^3

	Others please specify…….Ibindi, bigaragaze…
2.1.7 How is loading and unloading of done to ensure sustained quality and safety of products?/ Ni ubuheburyokuyapacyira no kuyapakururabikorwamo mu rwegorwokubungabungaubwizan'umutekawa yongobitangirika?	1=Use of man power to load and unload natural stone products supplied;/ Hifashishwaabantu mugupakirandetse no gupakururaibicurizwaby'amabuyekaremanond etsen'ibikomokakumabuyekaremano 2=Use of loading and unloading heavy duty machines; / Hakoreshwaimashinizabugenewe mugukoraakazigakomeyekogupakirandetse no gupakurura. Others specify ……/ Ibindi, bigaragaze….

2.2 Appreciation of the technology used in natural stone extraction/ Interaimazekugerwaho mu ikoreshwary'ikoranabuhangamu gucukuraamabuyekaremano.

2.2.1 Do you find tools used in extraction of natural stones such as Traditional tools; Diamond Wires; and Metal Discs efficient and effective in processing/manufacturing and/or extraction of quality natural stones products?/Ese mwabamubashakubonaibikoreshobikoreshwa mu bucukuzibw'amabuyekaremano,UrugeroDiamond Wires; and Metal Discsniibikoreshogakondobikunzegukoreshwa mu gucukura/gutunganya/cyangwagukoraibikomokakumabuyekarema no?	1 =Yes/ Yego 2=No/ Oya
2.1.2 If No, why?/ NibaariOya, biterwaniiki?	…… …..

2.3 Appreciation of Knowledge and skills used by primary extractors or Processors/ GushimaInteraimazekugerwaho mu bumenyin'ubumenyingirobw'abacukuzin'abatunganyaamabuyekaremanobibanze.

2.3.1 With your expertise in construction sector, Do you find the personnel used in extraction of natural stones in Quarries and stone processing plants competent(equipped with required skills and knowledge) ?/ Nkinzobere mu ubwubatsi, ese mubonaabakozibakoreshwa mu bucukuzibw'amabuyekaremano no kuyatunganyababifitemoubuhangabuhanitse (bahawe ubumenyin'ubumenyingirobucyenewe)?	1= Yes/ Yego 2= No / Oya
2.3.2 If Yes, rate the level of competence of personnel/technical staff used in natural stone extraction and stone processing in Rwanda/ Nibaariyego, erekanaicyigerocy'ubuhangabuhanitsebufitwen'umukozi/ abashinzweibikorwaby'ikoranabuhangamuubucukuzibw'amabuyekaremanondetsen'itu nganywaryayo mu Rwanda	**1**=10-20% **2**=20–50% **3**=50

	%-80% **4**=80%-100%

2.4 Appreciation of the Quality of natural stones and other stone products supplied on the local market/ Ubwizabw'amabuyekaremanondetsen'ibikomokakumabuyebicuruzwakumasokorusange.

2.4.1 Do you find of good quality the natural stones and/or stone products produced by local companies, cooperatives competitive on the local markets?/Ese mwabamubonaamabuyekaremano/ ibikomokakumabuyekaremanobyizakuruherugero? Yabaakorwanakompanyi zo mu gacekanyucyangwaamashyirahamweahiganiraamasoko.	1= High quality/ Byizacyane 2 =Moderate quality/ Byizagacye 3 =Low quality/ Sibyiza 4= No/ Oya
2.4.2 If Not ofhigh quality, why?/ NibaariOya, Ni ukuberaki?	1= Poor technology used especially in the processing of the extracted natural stones;/ Ikoranabuhangarikoreshwa mu gutunganyaamabuyeyacukuweriracyarihasicyane. 2= Inadequate technical skills and technology required in primary extraction and/or processing;/ Ubumenyingiro mu ikoranabuhangandetsenikorabuhangamurirusangerya bacukurandetsen'abatunganyaamabuyekaremanontagobuhagije. 3= Poor quality of the extracted stones/ Amabuyeacukurwantagoarimeza. 4= Others specify…… / Ibindi, mubigaragaze……
2.4.3 Do you find processed and by-products from natural stone made by local companies of good quality?/ Ese mubonaamabuyeyatunganijwendetsen'ibikomokakumabuyekaremanoaribyizakuruherugero?	1= High quality/ Byizacyane 2 =Moderate quality Byizagacye 3 =Low quality Sibyiza 4= No/ Oya
2.4.4 Rate the level of competitiveness of	1= Highly competitive in both quality and

processed natural stones products and by-products made locally on the local markets in terms of quality and prices/ Dufashegutondekaububasha mu ihatanakw'isokory'ibikomokakumabuye karemanobyatunganirijwe mu ngandaugendeyekubwiza no kubiciro.	price;/Ububashakamwihatana mubwiza no kubicirorurikurwegorwohejuru. 2=Relatively competitive in both quality and price;Ububashakamwihatana mubwiza no kubicirorurikurwegoruhwanyen'abandi 3=Not competitive in both quality and price/ Ububashakamwihatana mubwiza no kubicirorurikurwegorwohasi.
2.4.5 In case of low rates of competitiveness on local market, share with us the reasons behind the low competition/ Mu giherurikuurwegorwohasi, dusangizeimpamvuiterakubakurwegor wohasimwihatana.	1= Good quality but very expensive; Ni byizaarikobirahenzecyane. 2=Poor Quality and expensive;Si byizakandibirahenze. 3= High costs of production which make them very expensive/ Icyiguzicyokuyatunganyacyirihejurubityobigatamubi hendacyane. 4=Relatively cheaper but scarce on the market; / Ugereranijebirahendutsegusabiragoyekubibonakumas oko. Others specify……/ Ibindi, bigaragaze……..

Section 3:Appreciation of the efforts invested in Environmental Protection by actors along the value chain of the natural stones/ Igikacya 3: Gushimiraingufuzashyizwe mu kurindaibidukijije,bikozwen'abagirauruharebosemu uruhererekanerw'inyongeragacirorw'amabuyekaremano.

5.1 Are you aware that, the extraction of natural stones has a negative impact on environment?/ Ese mwabamuzinezakoubucukuzibw'amabuyekaremanobut ezaingararukambikuibidukikije.	1= Yes/ Yego 2= No/ Oya
5.2 If yes, how do you rate the level of efforts invested by extractors of natural stones to protect and sustain the environment degradation as a result of their extraction activities/ NibaariYego, nigutewatondekeingufuabacukuzib'amabuyekaremanob ashyiramo mukurinda no kubungabungaibidukikijebarindakoibikworwaby'ubucu kuzibyakwangizaibidukikije.	1= Very low efforts/ Bashyiramoingufunyeyacyane 2= Low efforts/ Bashyiramoingufunyeya 3= Higher efforts are being invested by extractors and processors/ Abacuran'abatunganyaamabuyebash yiramoingufunyinshi 4= Others, please specify……Ibindibisobanure….

Section 4: Recommendation to develop the sector

Igikacya 4: Ibyemezobyogufasha mukuzamuraururwego

4.1 What should be done to develop the stone value chain (give at least five in your order of priority?/Ese niikicyakorwa mu rwegorwogutezaimbereuruhererekanerw'inyongeragacirorw'amabuyekaremano(mutubwiremukurikijeurutondorwibikwiyekwitabwahokurushaibindi, ukomwebwe mubyumva).

1. ……
2. ……
3. ……
4. ……
5. ……

END AND THANK YOU

Annex 3 d: Interview guide/Themes for guiding FGDs

A. Efficiency, quality, product differentiation, social and environmental standards and business environment:

A.1 Dou you think that, the extraction of natural stones used in construction is the main activity that can increase income of households in your area?

……
……..

A.2 How can one maintain extraction of natural stones used in construction and at the same time protect and to sustain the environment?

……
……..

A.3 What are the types of stones (describe key features) most liked by the clients than others, please provide the criteria used to separate the wanted and unwanted quality of natural stones extracted?

……

A.4 Are you aware that the use of explosives in crashing stones in quarries can affect the neighborhood and cause noise pollution or cracks in people's houses? If yes, what are solutions do you propose for addressing this challenge?

……
……

B. Technology and Technological Capabilities

It is known that majority of primary extractors of natural stones use the traditional tools such as (Inyundo, Umutarimba; ibihadiko, igitiyo, isuka, etc); what is advantage of using traditional tools and disadvantage of using traditional tools

B.1 Advantage of using traditional tools:

……
…….

B.2 Disadvantages using traditional tools:

…….....
……

C. As Primary Extractors of Natural Stones, Share with us your Plans for improving Technology upgrade and other issues that impede your Development in this Sector

C.1 Improving Skills and knowledge related natural stones extraction:

……..

C.2 Improving technology required extraction of natural stones:

……

C.3 Improving market and pricing for extracted stones:

……..

C4. Upgrading the quality, value addition of extracted stones
……
C5. Extending Job creation in quarrying
……
……
C6. Improving collaboration between natural stone extractors and buyers
……
……

D. Main Challenges Faced by the Primary Extractors of Natural Stones

D.1. Challenge 1…….....
D.2. Challenge 2…….
D3. Challenge 3……
D.4. Challenge 4……...
D5. Challenge 5…….

E. Recommendations to the identified challenges

……
……
……..

END AND THANK YOU