

A Comparative Case Study of Amethyst Mining in Brazil and Tanzanite Mining in Tanzania

American University - December 2019

Sacha Brenac, Rachael Hilderbrand, Cleo Rogers, Hailee Shah,
Alyssa Tender, and Yujia Wan

Academic Supervisor: Hrach Gregorian, PhD

Executive Summary

This report presents the research findings of the fifth team of graduate students from the School of International Service at American University in fulfillment of their capstone requirement. In accordance with the statement of work, this report analyzes the impact on human security of amethyst and citrine in Brazil and tanzanite in Tanzania. The research team identified the human security risks per five United Nations (UN) Human Security Indicators: governance, economy, environment, health, and human rights.

There is not a universal tool that analyzes the global jewelry industries' impact on a host country. The jewelry industry can benefit host counties and local communities by creating jobs, increasing local revenue, and providing social services. However, these industries also can harm countries as mining can irreparably damage the local environment, cause chronic health problems for miners and residents of mining communities, and potentially present challenges to human rights.

The Jewelry Development Impact Index (JDII) is a research project by American University Graduate Students in coordination with the U.S. Department of State, Office of Threat Finance Countermeasures, and the University of Delaware, Minerals, Materials, and Society Program. This report, in combination with the four previous reports, contributes to a uniform measurement tool to assess the impact of the jewelry industry on local human security and development.

The research team used academic journals, business sector and NGO reports, news articles, and interviews with key stakeholders to score each country on a seven-point Likert. On this scale, a higher score (on a scale of one to seven) indicates that the industry does not present a significant human security risk. A low score indicates higher human security risks. According to the methodology employed, the human security risk in Brazil is 3.4 out of 7 and 3.58 out of 7 in Tanzania. Both scores indicate that, overall, the impact of amethyst and citrine in Brazil and tanzanite in Tanzania present a moderate level of risk to human security.

Human rights pose the highest risk to human security in Brazil. The lowest risk to human security is economic risk. The amethyst and citrine industries create local employment opportunities in mining and beneficiation. The highest human security risk in Tanzania is environmental due to weak environmental regulations. The lowest human security risk is governmental. There is one tanzanite mine in Tanzania, and there have been successful initiatives to increase governmental oversight.

Key Terms and Abbreviations

Jewelry Development Impact Index (JDII)

United States Dollar (USD)

Related to Brazil:

Association of Miners of Pedra Lavrada / *Associação de Garimpeiros de Pedra Lavrada*
(AGASPLA)

Brazilian Mining Association / *Instituto Brasileiro de Mineração* (IBRAM)

National Mining Agency / *Agência Nacional da Mineração* (ANM)

Cooperative of Miners in Médio Alto Uruguai / *Cooperativa dos Garimpeiros do Médio e Alto Uruguai* (COOGAMAI)

Financial Compensation on Revenue from Exploitation of Mineral Resources / *Compensação Financeira pela Exploração de Recursos* (CFEM)

Mining Permits / *Permissão Lavra Garimpeiro* (PLG)

National Department on the Production of Minerals / *Departamento Nacional de Produção Mineral*
(DPNM)

State Foundation for Environmental Protection / *Fundação Estadual de Proteção Ambiental*
(FEPAM)

Other Portuguese Terms:

Mine - *garimpo*

Miner - *garimpeiro*

Deposit - *jazida*

Related to Tanzania:

African Gemstone Mining Ltd (AfGem)

Artisanal and Small-Scale Mining (ASM)

Environmental Impact Assessment (EIA)

Environmental Management Plan (EMP)

Global Food Security Index (GFSI)

International Organization for Migration (IOM)

Large-scale Mining Corporation (LSM)

Natural Resource Governance Institute (NRGI)

Occupational Safety and Health (OSH)

Prevention and Combating of Corruption Bureau (PCCB)

Primary Mining License (PML)

State Mining Corporation (STAMICO)

Tanzania Minerals Audit Agency (TMAA)

Tanzanian Women Miners Association (TWMA)

State Mining Corporation (STAMICO)

Table of Contents

Executive Summary 2

Key Terms and Abbreviations 4

Introduction 7

Chapter 1: Brazil 8

1.1: Historical and Cultural Background 9

1.2: Governance Challenges 11

1.3: Economic Challenges 16

1.4: Environmental Challenges 22

1.5: Health Challenges 23

1.6: Human Rights Challenges 25

Chapter 2: Tanzania 30

2.1: Historical and Cultural Background 31

2.2: Governance Challenges 33

2.3: Economic Challenges 36

2.4: Environmental Challenges 44

2.5: Health Challenges 46

2.6: Human Rights Challenges 50

Chapter 3: Methodology 55

Chapter 4: Research Gap/Gap Analysis 57

Chapter 5: Two-Country Comparison 59

Chapter 6: Ten-Country Comparison 66

Chapter 7: Recommendations for Future JDII Development 74

Conclusion 75

Annex A. Two-Country Comparison Index 77

Annex B. Scoring Questions 79

Annex C. Impact of Reversing Questions 85

Annex D. Drivers of Risk – Brazil and Tanzania 90

Introduction

The international jewelry industry can simultaneously pose a risk to and benefit the various involved actors. Presently, there is not a universal tool to analyze the global jewelry industry's impact on a host country. Since Fall 2017, graduate students at American University's School of International Services have addressed this gap conducting ten comparative case studies to help build and assess a preliminary comparative tool. Between Fall 2017 and Spring 2019, four graduate research teams analyzed the impact of diamonds in Botswana, gold in Peru, rubies in Myanmar, lapis lazuli in Afghanistan, platinum in South Africa, sapphires in Madagascar, and emeralds in Colombia and Zambia.

This report analyzes the human security risks of amethyst and citrine in Brazil and tanzanite in Tanzania based on five United Nations (UN) Human Security Indicators: governance, economic, environment, health, and human rights. Chapter 1 discusses Brazil, while Chapter 2 discusses Tanzania. Each chapter contains a section focusing on historical context followed by sections on each of the five human security indicators.

The amethyst and citrine industries in Brazil and the tanzanite industry in Tanzania are distinct industries, yet they share many similarities. One of the most notable differences between the two countries are the number of mines. Brazil has over 500 amethyst and citrine mines, whereas Tanzania boasts the only tanzanite mine in the world. Neither of these gemstones are the most lucrative gemstone in their respective countries nor are they typically studied independent of the larger extractive industries in their countries.

Following the two case studies, there is a two-country analysis of Brazil and Tanzania, a reflection on the four previous reports conducted by American University graduate students. The report culminates in a ten-country comparative analysis.

Chapter 1: Brazil



1.1: Historical and Cultural Background

Brazil is a leading gemstone producer. Experts estimate that it is responsible for producing nearly half of all precious gemstones in the world.¹ Brazil extracts aquamarine, emerald, diamond, gold, opal, topaz, and many types of quartz, including amethyst and citrine.² While most studies of Brazil's extractive industries focus on lucrative minerals such as gold and diamonds, this report will document the mining of amethyst and citrine.



*Amethyst Mine in Sento Sé, Bahia, Brazil*³

Amethyst is a violet or deep purple quartz. It is usually extracted as a large geode and can be sold as such or cut into faceted stones for jewelry.⁴ Citrine is an orange or golden yellow quartz and does not naturally occur in Brazil. Instead, yellow or orange citrine is created by heating amethyst stones that are too light to have a significant commercial value.⁵ Since citrine is typically created from amethyst in Brazil, this report focuses on amethyst.

Amethyst deposits are found in many countries, including Australia, India, Madagascar, Mexico, South Africa, Sri Lanka, the United States, and Zambia, but Brazil has the largest deposits in the world.^{6,7} Before settlers discovered amethyst in southern Brazil in the early 19th century, it was sold at high prices, similar to diamonds and rubies.⁸ Today amethyst is relatively inexpensive. Eight out of Brazil's twenty-seven states have amethyst deposits.⁹ In the south, Rio Grande do Sul, Santa Catarina, and Parana have some of the largest amethyst deposits in the world.¹⁰ Rio Grande do Sul, in southern Brazil, produces the largest quantity of amethyst in the world.¹¹ In the north, amethyst is found in Bahia, Pará, Rodônia, and Tocantins. There are substantial differences between amethyst mining in northern and southern Brazil.¹²

Amethyst Mining in Southern and Northern Brazil

In southern Brazil, miners are primarily located in Rio Grande do Sul, Santa Catarina, and Parana.¹³

Amethyst mining in southern Brazil is much more formalized and organized than in northern Brazil where unlicensed, informal, or clandestine mines outnumber formal ones.¹⁴ Most miners in southern Brazil are members of cooperatives or organizations that handle all legal matters and licensing for the mine. These cooperatives allow miners to mine as an individual while following legal procedures.¹⁵



*Igreja (Church) do São Gabriel de Ametista do Sul*¹⁶

Cooperatives additionally support education and health/safety initiatives for miners. The largest cooperative in southern Brazil is the Cooperative of Miners in Médio Alto Uruguai (COOGAMAI).¹⁷ In the north, various bureaucratic processes to receive mining permits and the lack of resources for individual miners to obtain such permits further explained in Chapter 1.3, often prevent miners from following proper licensing procedures.¹⁸

In southern Brazil, most amethyst miners are local. Amethyst has a significant economic impact and is often a source of regional pride.¹⁹ Amethyst extraction makes up 80% of Ametista do Sul's economy.²⁰ Many tourists visit towns such as Ametista do Sul to learn about amethyst mining, eat inside an old mine, or attend amethyst mining expositions or fairs.²¹ In Ametista do Sul, 8,000 residents work for the 107 licensed mines nearby.²² Amethyst is such an important part of this town that Ametista do Sul means South Amethyst. In northern Brazil, most miners are not local.

National organizations such as the *Departamento Nacional de Produção Mineral* (DPNM), National Department of Mineral Production, that recently changed to the *Agência Nacional da Mineração* (ANM), the National Agency for Mining, is the lead oversight institutions for all mining activities within Brazil.²³

Chapter 1.2: Governance Challenges

1.2.1 State of Governance and Accountability

There are several institutions and laws in place to govern Brazil's mining industries, including the amethyst industry. In Brazil, the federal government owns mineral resources and deposits, while the land is considered private property.²⁴ Due to the fact that the federal government owns minerals, Brazil's federal government controls mining operations through a number of institutions and "a system of concessions, licences, permits and authorisations in which it has the power to grant mining titles to private holders, who must be Brazilian citizens or companies incorporated under Brazilian laws, with headquarters and management offices in the country."²⁵

The primary institutions that monitor Brazil's mining industry are the Ministry of Mining and Energy (MME), and the National Department of Mineral Production (DNPM)/National Mining Agency (ANM). The National Department of Mineral Production (DNPM) was established in 1934 for mineral exploration and mineral resources exploitation promotion and planning.²⁶ Under the Bolsonaro administration, there's been a push for more extraction with less communal input about environmental, indigenous, or human rights. On December 27, 2017, Law No. 13,575 replaced the National Department of Mineral Production (DNPM) with the National Mining Agency (ANM).²⁷ According to an environmental activist in Brazil, Congress quickly approved the law and put it into legislation without opposition.²⁸ The approval of Law No. 13,575/2017 required ANM to absorb activities previously performed by the DPNM and to execute new duties. With this transition, the ANM has struggled with operations due to structural changes and a lack of financial and human resources.²⁹

Additionally, under the Bolsonaro administration in October 2019, the Ministry of Mining and Energy (MME) allocated \$42.7 million Reais, approximately \$10.3 million USD, for additional mining inspections and hiring specialized technical advisors and civil servants for ANM to be implemented in 2020-2021.³⁰ A separate bill to increase the National Mining Agency (ANM)'s 2019 budget by \$7 million Reais, approximately \$1.7 million USD, to "reinforce inspection actions."³¹

According to Law 7,805, passed in 1989, miners are required to obtain a “*permissão de lavra garimpeira*” (PLG) or mining permit to extract any mineral in Brazil, including amethyst.³² The ANM and the Ministry of Mining and Energy (MME) approves and grants mining rights.³³ The Brazil government gives mining rights priority to the first party who applies for the mining rights, whether that be companies or an individual applying for a mining permit.³⁴ The government also issues exploration permits. Individuals with these permits are allowed to extract gems under exceptional circumstances.³⁵ If a miner extracts minerals under an exploration permit, they can be charged with a criminal offense.”³⁶ Miners also need to obtain a permit that ensures that they are not mining in either an environmentally protected area or an indigenous community.³⁷

Miner cooperatives assist individual miners in receiving mining permits. They also provide health and safety training and other opportunities for miners in the Brazilian amethyst industry and other extractive industries. There are ninety-seven Mineral Branch cooperatives throughout Brazil.³⁸

The Cooperativa dos Garimpeiros do Médio e Alto Uruguai (COOGAMAI Cooperative), located in southern Brazil, in Ametista do Sul, Rio Grande do Sul, is one of the main cooperatives for amethyst mining. COOGAMAI was founded in June 1990³⁹ and serves as a legal representative for workers and small landowners to assist them in following formal procedures to legalize the economic viability of amethyst mining.⁴⁰ COOGAMAI also established the Miner Health Fund (Fundo de Saúde do Garimpeiro) and the Miner Health Diagnostic Center (Centro de Diagnóstico de Saúde do Trabalhador Garimpeiro).⁴¹ COOGAMAI also works with a Miner Health Center (Centro de Saúde do Garimpeiro) to provide miners examinations and consultations.⁴²

COOGAMAI produces about 500 tons of amethyst geodes per month.⁴³ COOGAMAI’s President, Isaldir Antônio Sganzerla, said that current trade limits of 200 tons per emission increase obstacles for the extraction and marketing of amethyst regionally and within Ametista do Sul.⁴⁴ Sganzerla highlighted that, in this case, small miners are being excluded, while large-scale mining is being favored.⁴⁵

1.2.2 Transparency

Competition within the mining industry discourages complete transparency about mine locations from avoiding informal mine formation and international competition.⁴⁶ The Extractive Industries Transparency Initiative (EITI) “is the global standard” that promotes “the open and accountable management of oil, gas and mineral resources” through strengthening “public and corporate governance, understanding of natural resource management, and “providing the data to inform reforms for greater transparency and accountability in the extractives sector.”⁴⁷ However, Brazil is not an implementer of the Extractive Industries Transparency Initiative (EITI).⁴⁸ New mining areas are not publicly displayed due to a risk of a “gold rush” or informally setups of mines, without following legal procedures.⁴⁹

Limited information about prospecting and mining permits is available for local miners and mining cooperatives. Data about industry actors are not publicly available. News or other media sources provide information about industry actors.

The length of the bureaucratic processes impedes individuals from pursuing legal routes for licensing.⁵⁰ The licensing process limits individual citizen miners due to complicated bureaucratic permit procedures and financial constraints.⁵¹ Complete implementation of industry regulations and laws would increase amethyst pricing, and if fully implemented and followed through, the price of amethyst would increase.⁵²

Brazil is one of eight co-founders along with the U.S., United Kingdom, Mexico, Philippines, Indonesia, South Africa, and Norway of the Open Government Partnership that was founded in September 2011.⁵³ The Open Government Partnership (OGP) encourages “administration transparency, access to public information, civic participation and innovation.”⁵⁴ Governments partner with civil society and provide oversight for cooperative two-year action plans between governments and civil society.⁵⁵ Previously developed action plans from Brazil addressed topics such as increasing and improving open data health records and health services indicators and enhancing information request and disclosure of information response timeliness.⁵⁶

By the end of 2017, Brazil had completed zero OGP commitments.⁵⁷ Despite the incomplete commitments, Brazil, throughout the years, laid the open government initiatives groundwork “for more ambitious actions.”⁵⁸ The 2018-2020 Brazil National Action Plan incorporates the reparation process in Samarco, Mariana, where a tailings dam failed in 2015. The commitment will “implement instruments and actions of transparency, access to information and the development of capacities to expand and qualify the participation and public oversight on the reparation processes.”⁵⁹

A principle action for the National Mining Agency’s (ANM) 2019 agenda was to improve industry regulations and increase transparency with OECD.⁶⁰ The OECD sent three work proposals to ANM. First, administrative simplification provides a thorough review and redesign of ANM’s work processes.⁶¹ Second, peer review of the Brazilian mining sector through Legislative and Executive communication and cooperation.⁶² Third, a “peer review focused on a city or state that is heavily dependent on mining, identifying potentialities for economic diversification.”⁶³

1.2.3 Corruption Prevention

Brazil has one anti-corruption law specifically for companies within the mining industry. Federal Law No. 12,846/2013 “establishes the liability of companies for acts of corruption and other acts against the local or foreign public administration.”⁶⁴ This law prohibits “to promise, offer or give, directly or indirectly” or to provide “undue advantage to a national or foreign public official, or a third person related to them.”⁶⁵

The Brazilian Criminal Code, Law No. 2,848/40, was established on December 7, 1940, and amended most recently by Law No. 3,772/2018.⁶⁶ Similar to the Anti-corruption Law, the Criminal Code “defines the crime of active bribery in an international commercial transaction as an individual offering or promising undue advantage to a foreign public official or to a third party to influence him or her to perform, hide or delay an official act related to an international commercial transaction”.⁶⁷ Although “only individuals can be held criminally liable for bribery in Brazil.”⁶⁸ “Individuals and legal entities can be held liable for bribery of public officials in Brazil. Private bribery is not criminalised under Brazilian legislation.”⁶⁹

Brazil joined the “inter-governmental body” Financial Action Task Force (FAFT) in 2000.⁷⁰ Brazil throughout their membership “significantly enhanced its ability to prosecute money laundering (ML) offences by implementing a system of Specialised Federal Courts which bring together federal prosecutors and judges specialised and with experience in handling cases involving ML and other financial crimes”.⁷¹ Despite their significant role in implementing FAFT goals, the number of criminalized terrorist funding sentences and convictions is low in Brazil.⁷²

1.2.4 Industry Regulation

Although the Mining Code outlines compliance requirements and illegal mining, the complicated bureaucratic process and no tax breaks or incentives for those “engaged in mining activities” discourages penalty enforcement within the mining industry.⁷³ Brazil adopted the Towards Sustainable Mining (TSM) Initiative in September 2019, which “requires mining companies to annually assess their facilities' performance across eight important areas, including tailings management.”⁷⁴

1.2.5 Presence of Criminal Non-State Actors and Organizations

Brazil is a member of the Financial Action Task Force of Latin America (GAFILAT). GAFILAT implements FAFT Recommendations’ “comprehensive global strategy to combat money laundering and terrorist”.⁷⁵

Major financial sources for crime in Brazil include corruption, “drug trafficking, weapons trafficking, organized crime, smuggling and embezzlement of governmental money”.⁷⁶ However, little of the corruption and crime is related to amethyst mining. Few cases of illicit drugs being exchanged for precious stones have been detected.⁷⁷ However, it was indicated during the on-site visit that it is not common, as the profit margins for precious stones being sold on the open market are relatively low because most of the precious stone trade conducted in Brazil is carried out on the wholesale export market and the retail market is residual.⁷⁸

Chapter 1.3: Economic Challenges

1.3.1 Industry Employment

Brazil extracts around one hundred different gems and employs thousands of artisanal and large-scale miners.⁷⁹ Many of Brazil's gem mines are clandestine or illegal mines, which makes it difficult to calculate how many gems are produced in Brazil.⁸⁰ According to the National Department of Mineral Production (DNPM), in 2005, Brazil's gem production was valued at \$47 million USD, and its gem exports were valued between \$1.35 and \$1.68 million USD.⁸¹ In 2005, the gem exports total was at least 2.7 times higher than the official gem production value.⁸²

Amethyst miners typically work in one of five different ways: as independent artisanal miners, in a family economy, as employees of larger extractive companies, under a private partnership, or as members of a mining cooperative.⁸³

According to a gem expert, Brazilian amethyst miners, make, on average, between \$100 USD - \$200 USD per month.⁸⁵

Informal, small-scale miners tend to have

lower educational levels compared to larger-scale miners, making it difficult for them to find other jobs. Additionally, many small-scale miners come from mining families where they are expected to work in the mines, especially in towns in southern Brazil where communities such as Ametista do Sul focus solely on amethyst mining.⁸⁶



*Amethyst miner extracting geodes*⁸⁴

Brazil has attempted to formalize the workforce by encouraging miners to join cooperatives specific to amethyst mining, such as COOGAMAI. These cooperatives help workers obtain *Permissão Lavra Garimpeiro* (PLG) Mining Permits, which can otherwise be difficult to obtain on an individual basis due to complicated procedures.⁸⁷

1.3.2 Fiscal Sustainability

Gems in Brazil are heavily taxed. In 2004, Brazil had the highest mining taxes in the world (53%) that averaged more than three times higher than the world average (15%).⁸⁸ The largest domestic taxes on amethyst are the Annual Hectare Fee (TAH) which permit holders to pay to the National Mining Agency (ANM) and the Financial Compensation on Revenue from Exploitation of Mineral Resources, *Compensação Financeira pela Exploração de Recursos*, (CFEM).⁸⁹ In 2017, the federal government passed Law 13540, increasing the CFEM tax rates.⁹⁰ Generally, any revenue from mineral activity is subject to the CFEM and paid directly to the federal government. The government then distributes the revenue between itself (12%), the state (23%), and the municipality where the mineral project is located (65%).⁹¹ However, little tax is paid on amethyst production. Thus, there are little public benefits and minimal government investment in the amethyst mining communities.⁹²

According to the Brazilian Mining Association (IBRAM), between 2014 and 2018, Brazil planned to invest about \$54 billion in its extractive industries. This is a 16% decrease from the previous five-year period. Most of these investments were in Minas Gerais (41%), Para (22%), and Mato Grosso do Sul (10%), all of which have amethyst mines.⁹³

1.3.3 Beneficiation

In 2011, China was the leading partner in Brazil's gem commerce⁹⁴. In 2013, Brazil exported 60% by weight, or 25% by value, of its output to China.⁹⁵ However, increasing trade with China decreased Brazil's domestic gemstone cutting and polishing industry because China wanted unpolished and uncut amethyst, so cutting and polishing could be done in China instead of Brazil.⁹⁶ This harms local economies, particularly in Brazil's northeastern state Minas Gerais.⁹⁷

The data obtained in the mining concessions show that amethyst mines in Brazil are distributed regionally with 4% in the north, 8% in the midwest, 13% in the northeast, 21% in the south, and 54% in the southeast.⁹⁸ However, calculating the number of small enterprises is a complex task due to many individuals operating in the informal sector, combined with frequent abandonment of mining activities that skew statistics.⁹⁹

Brazil belongs to several international trade associations, the most common is the Mercado Común del Cono Sur (MERCOSUR), a trade association that promotes free trade amongst member countries including Argentina, Bolivia, Brazil, Paraguay, Uruguay, and Venezuela. In 2015, MERCOSUR received about 11% of Brazil's exports and supplied about 8% of Brazil's imports.¹⁰⁰ Various urban centers host the country's main gem fairs or expositions, which are smaller venues compared to other international shows. In addition to these international expositions, hundreds of individuals travel around the country and acquire rough material to sell later in urban areas.¹⁰¹ The widespread adoption of modern technology, such as the internet and digital cameras, has revolutionized traditional methods of trading over the past decade, making intermediaries somewhat obsolete.¹⁰²

1.3.4 Smuggling and the Informal Economy

According to a gemologist expert, around 20% of the amethyst mining industry is formal.¹⁰³ Since most of the activities are informal, most miners work under informal contract arrangements, leaving them without any benefits like social security or retirement plans. Health and life insurance are not relevant in small mines.¹⁰⁴ The lack of organization among miners and the rest of the production chain hinders their capacity to overcome the obstacles to getting organized and formalizing their activities, which could increase their productivity through technological improvements.

However, new administration changes could shift focus to these areas, as the smuggling that occurs are within state borders to avoid taxes, license procedures through bribes leading to corruption. With administration changes also comes the challenge of governing and keeping track of these informal mining areas. While formal estimates of amethyst reserves are currently not available, Brazilian gem experts have estimated that significant quantities of amethyst will be available for many years to come, also indicating the potential for more informal mines to appear.¹⁰⁵

1.3.5 Non-State Actor and Terrorist Funding

Amethyst and citrine mining has little to no involvement with funding non-state actors and terrorist groups. Smuggling does occur from state to state borders to avoid high taxation, and informal mines avoid regulations and taxation processes.¹⁰⁶ Criminal organizations can use bombs meant

for mining for dangerous uses. However, involvement with terrorism rarely involves amethyst and citrine.¹⁰⁷

1.3.6 Supply Chain

Per the 2014 estimates of the Central Intelligence Agency (CIA), the nominal GDP of Brazil was \$2.24 trillion.¹⁰⁸ Brazil is a well-diversified middle-income economy, with developed and large mining, manufacturing, and service sectors.¹⁰⁹ The country's service, industry, and agriculture sectors contribute 70.4%, 23.8%, and 5.8%, respectively, to the total GDP as per CIA 2014 estimates. Most of the country's industries are in its southern and southeastern regions. Generally, any revenue from mineral activity is subject to the CFEM.¹¹⁰ The mineral activity revenue is paid to the federal government and distributed among the federal government (12%), the state (23%), and the municipality where the mineral project is located (65%).¹¹¹ However, little tax is paid gem production, as this activity takes place mostly informally.

Methodology

Open-pit mining is most common, although other methods are also used. Most of the mining is done with picks, shovels, buckets, jackhammers, and occasionally small amounts of dynamite. Vertical shafts and horizontal tunnels are excavated to follow the veins of amethyst and are reinforced with timbering taken from the surrounding forest. Electricity and ventilation systems are installed in mines as money is provided.¹¹²



*Amethyst Miners in tunnels*¹¹³

Washing and Sorting

Geodes are extracted locally in open pits as well as in small underground pits (10 to 30 m) open into the altered volcanic rock. Large volumes of rock, soil, and regolith are removed using tractors, drilling machines, and sometimes explosives, to reach the mineralized level of the rock. The

removal of the geodes along the ground or the pit slopes is made by manual collecting using tools such as mattock, spade, chisel, and hammer.¹¹⁴

In this region, large amethyst geodes are extracted from the fresh massive basalt in horizontal underground pits (100 to 200 m) whose roof is supported by columns of the prospected rock (Figure 6). In most of the mine, fronts are possible to see the characteristic profile of this mineralized lava flow.¹¹⁵

The horizontal pits are open in the basalt, using drilling machines, explosives, and manual tools such as spade, chisel, and hammer. After detonation, the miners evaluate the geodes that outcrop the mine walls. With a hammer and chisel, the miners open a small hole in the geode and look inside with a small lamp to see its interior.¹¹⁶ An



*Gem processing and gemstones workshop in Brazil. A – Polishing agate geodes and agate plates. B – Dyeing agate geodes and plates. C – Exposition of polished agate plates. D – Geodes with amethyst.*¹¹⁸

evaluation is made of the mineral species, the size, and color of the crystals and the size of the geode itself. If the miner decides to take out the geode, they will begin to peel it out of the rock using a hammer or chisel.¹¹⁷

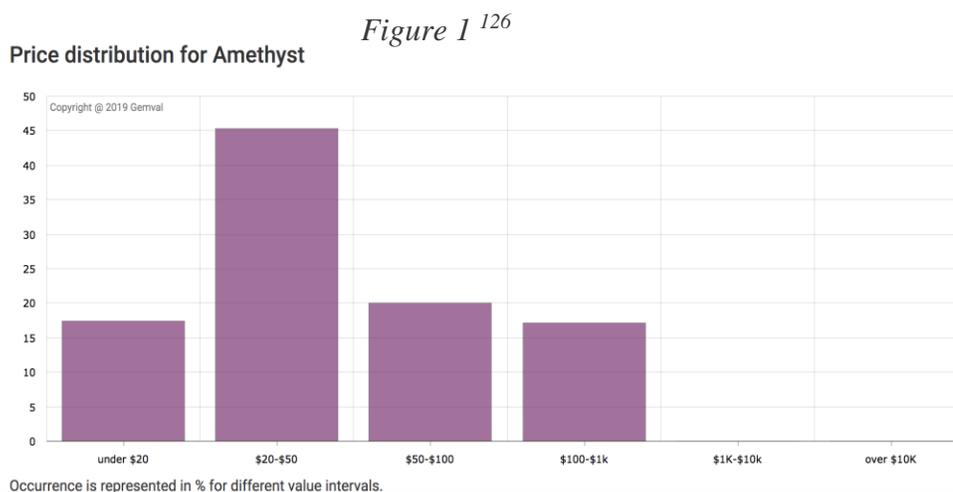
Security

The illegal mining industry in Brazil is consistent, and policies regarding the security of mines have rarely changed. There is also a lack of interest from consumers to find out where amethyst

and citrine originate from. Much of the interest consider the price range of the gems.¹¹⁹ This allows the clandestine industry to continue to exist, as the government agenda does not have a strong focus on combating clandestine mining. NGOs have a ripe opportunity to improve the education of labor supply chain knowledge to the local individuals.¹²⁰

Market System

Most of the amethyst is sold as rough gemstones.¹²¹ It is difficult for foreign investors to contribute to the amethyst mining process.¹²² Foreign investors in Brazil receive the same legal treatment as local investors in most economic sectors; however, there are restrictions in the health, mass media, telecommunications, aerospace, rural property, maritime, and air transport sectors.¹²³ The Brazilian Congress is considering legislation to liberalize restrictions on foreign ownership of rural property and air carriers.¹²⁴ Foreign investors also have concerns over poor existing infrastructure, relatively bureaucratic labor laws, and complex tax and regulatory requirements, all as part of the extra costs of doing business in Brazil.¹²⁵ Figure 1 shows the average amethyst market price represented at different intervals. The majority of the market selling process for amethyst occurs from either independent buyers that take place at trade shows. Trade shows are a highlight of the Brazilian amethyst community and often serve as the epicenter for its buying and tourism.



Chapter 1.4: Environmental Challenges

1.4.1 Environmental Sustainability

Since amethyst mining does not use any toxic materials or chemicals, the environmental impacts should be relatively simple to control. However, as amethyst miners tend to work informally, the state has little control over their activities.¹²⁷ Miners often cut down or burn a forest to gain access to gems. Amethyst mines sometimes are abandoned and are often not properly inspected, which can also cause accidents, as people and animals can fall into the holes.¹²⁸

Debris from the mines and the miners' waste also contaminate the soil and streams, which can kill the vegetation and wildlife.¹²⁹ This problem was common in several sites, including in prominent amethyst mining communities such as Goiás, Minas Gerais, and Bahia.¹³⁰ Furthermore, waste is often abandoned improperly on land would otherwise be used for agriculture.¹³¹ Additionally, detonations cause major problems as they may compromise local air quality and damage flora, soil, and water resources.¹³²

1.4.2 Environmental Protections

Each state in Brazil has its legislation on environmental licensing of amethyst mines.¹³³ There are over 500 amethyst mines, but 150 remain in operation.¹³⁴ ANM (former DNPM) officials argue that they have limited capacity to control and need support from the states, especially the environmental agencies who can enforce protections. Aid from cooperatives such as COOGAMAI allows them to aid and search for a legal alternative to operationalize this demand. Moreover, according to AGASPLA (Association of Miners of Pedra Lavrada), other actions have been taken concerning the improvement of the municipality's infrastructure, such as the construction of electrical substations. Over the past thirty years, Brazil's Human Development Index (HDI) has been steadily improving, with 0.56 still low by the UN, a consequence of climate adversity and the exploitation of the city's natural and human resources.¹³⁵

ANM and other foreign environmental companies have also made several positive efforts in environmental protection. For example, a group is working on trying to remotely monitor abandoned mines that may pose some social or environmental risk. According to Luiz Henrique

Rezende of Dam Safety Division of ANM in Minas Gerais, “the tool has the potential to shed light on unknown points, going back to the past on structures with no history of displacement tracking records, as well as future periodic monitoring of uncharacterized structures, which tend to stabilize after closure.”¹³⁶



Brazilian miners extracting amethyst ¹³⁸

Environmental concerns in Brazil should be characterized with high priority, as stated in Article 225, “Everyone has the

right to an ecologically balanced environment, good for the common use of the people and essential to a healthy quality of life. The Government and the community are obliged to defend and preserve it for present and future generations.”¹³⁷

Chapter 1.5: Health Challenges

1.5.1 Human Health

Health risks within Brazil’s amethyst mining industry differ based on individual miners. Miners in both the formal mines in southern Brazil and the more informal mines in northern Brazil tend not to use proper equipment because miners purchase their equipment.¹³⁹

According to one gemstone expert, this creates a challenge to correct.¹⁴⁰ Individual owners,

miners, and cooperatives could invest in proper equipment, but this is not likely to

happen soon, as the industry is focused on individual profit. While the lack of safety equipment is concerning, no gem expert stated that “one is abusing the miners as it is their personal choice not to follow safety procedures.”¹⁴¹



Brazilian amethyst miners in Sento Se, Bahia ¹⁴²

Injury and death are common in informal mines due to poor tunnel systems.¹⁴³ Brazilian news articles reported several deaths in the informal mining area in 2017 - 2019 in Sento Sé, Bahia, due to tunnel collapses.¹⁴⁴ Lighting usually exists in formal tunnels in southern Brazil; however, it does not usually exist in informal tunnels, which is a vast problem and security risk for miners.¹⁴⁵ Additionally, many informal mines do not have proper ventilation and are at a greater risk of collapsing since most informal miners are not formally trained.¹⁴⁶ In one journalist's report, a miner stated that they often hide stories about mining injuries and death not to attract oversight and risk the mine being closed.¹⁴⁷

Chronic health problems, like silicosis and pneumoconiosis, are common in both formal and informal mines. Silicosis occurs when miners inhale mineral dust containing silica. It is a chronic and deadly illness. Pneumoconiosis is an “inflammatory reaction, fibrosis, and respiratory failure” due to the inhalation of “pathogenic mineral dust.”¹⁴⁸ Miners also risk exposure to extreme temperatures, excessive noise, and radiation.¹⁴⁹

There are labor laws concerning the health and safety of miners in Brazil.¹⁵⁰ Regulatory Rule No. 22, which is related to Occupational Health and Safety in Mining, issued by the Ministry of Labor and Employment, and Ordinance No. 237/2001, issued by the DNPM (currently known as ANM), “establishes provisions for the protection of workers, workplace organization, emergency operations and the need for training.”¹⁵¹ These standards are for all extractive industries in Brazil, including the mining of gems such as amethyst.¹⁵³ Several health organizations and government departments have conducted safety trainings in southern Brazil where amethyst mining is prominent; however, such trainings have not been reported in northern Brazil. In southern Brazil, the State Secretary of Health's (SES) office gave a total of 680 safety kits to miners in Ametista do Sul, which included protective glasses, boots, hats, and masks. Also, in Ametista do Sul, cooperatives have partnered with health centers for miners to offer exams and advise miners about various health concerns



*COOGAMAI, Brazil's largest amethyst cooperative*¹⁵²

related to working in the mines.¹⁵⁴ Miners can attend local health centers, but in remote areas in northern Brazil, health centers are not easily accessible.¹⁵⁵

1.5.2 Food Security

There is little evidence suggesting that amethyst mining is affecting food security on a large scale in Brazil. There is evidence, however, that many farmers leave their farms after hearing about informal amethyst mines in northern Brazil.¹⁵⁶ Many farmers see amethyst mining as more profitable than farming, especially in northern Brazil.¹⁵⁷

1.5.3 Water Security

While water security has been a large issue in Brazil due to the risks of other large scale extractive industries and the destruction of important dams such as the Belo Monte Dam in Pará, amethyst, in particular, does not prove to be a huge risk for water security.¹⁵⁸ Amethyst mining does not use a lot of water, but it still contributes to local water pollution due to improper sewage and waste disposal especially in informal mining areas.¹⁵⁹ Additionally, stagnant water left in open mine pits attracts mosquitos, especially in northern areas of Brazil where mosquitos are much more common. As mosquitos are attracted to stagnant water, mining areas are placed at a higher risk for diseases such as dengue and Zika.

Chapter 1.6: Human Rights Challenges

1.6.1 Workers' Rights

Amethyst is often an individualized operation. While many reports have stated, human rights abuses exist in other extractive industries, hardly any reports have been submitted to either regional or international human rights organizations related to violations within amethyst mining. No established reports have been submitted related to amethyst mining to the Inter-American Court, the Inter-American Commission, Human Rights Watch, Amnesty International, or International Labor Organization regarding amethyst mining in Brazil. Within each state, human rights offices, and human rights organizations such as Conectas, do not have public reports available related to amethyst mining.

Workers' rights in mining industries in Brazil have always been a concern due to poor working conditions, low pay, few if any health benefits, and long working hours.¹⁶⁰ There are laws in place to ensure the mining industry respects workers' rights, such as a mining minimum age law that forbids workers under the age of 18 to work inside mines. Many of these laws are not enforced in amethyst mines.¹⁶¹ For example, under the Brazilian mining code, all miners are limited to working eight hours a day in Southern Brazil.¹⁶² However, in northern Brazil, because amethyst mining is such an individualized business, miners can work as long as they want to work without regulation.¹⁶³ It is important to note that the miners are choosing to stay in the mines and work beyond that legal limit. According to multiple interviews amethyst mining experts in Brazil, no one forces the miners to work long hours. One interviewee reported that "[amethyst] miners are constantly abused, if not 100% of the time. This is not done by third parties, to clarify. [the miners] abuse themselves as they are there for their profit. No one is making them work in unsafe conditions or long hours except themselves."¹⁶⁴ The high proportion of illegal or clandestine amethyst mines makes it difficult to organize strikes. As one interviewee mentioned: "if the mine is illegal, who are the miners going to strike to?"¹⁶⁵

1.6.2 Indigenous and Minority Rights

Some human rights organizations have called attention to policies made by current Brazilian President Jair Bolsonaro in his attempt to increase extractive industries for economic gain and disregarding the rights of specifically indigenous groups.¹⁶⁶

While in Brazil, the risk of violation of indigenous groups' rights is exceptionally high in extractive industries, especially in northern Brazil where extractive industries are entering the Amazon region, multiple interviewees agreed that this is not the case for the amethyst mining industry.¹⁶⁷ ¹⁶⁸ Brazil does have national laws in place to ensure mining does not affect indigenous communities; as previously reported, the creation of a mining permit area depends on the prior license of Ibama (Brazilian Institute of Environment and Renewable Natural Resources) and cannot take place on indigenous lands.¹⁶⁹ Formal amethyst mines should not take place on indigenous lands; the question is then if informal mines that are clandestine and not under government regulations are affecting indigenous communities. Amethyst mining is not prominent in the Amazon region; one interviewee reported, in any case, if amethyst mining affects indigenous

populations, it would be due to informal mines in Bahia, Para, as well as states such as Tocontins and Rondonia.¹⁷⁰ Another interviewee pointed out that there have been multiple recent government reports in 2019 encouraging extractive industries to pursue projects, including those related to amethyst mining, in the state of Rondonia.¹⁷¹ If these mining projects grow into larger informal mines, there is a risk that it could affect indigenous groups in the area and also potentially encourage the involvement of criminal organizations that are common in the border region between Bolivia and Brazil that is known as a hotspot for drug-trafficking routes.¹⁷²

1.6.3 Women's Rights / Freedom from Violence

Women are not able to participate in the amethyst mining industry in Brazil equally to men. While women do work within the industry, they do not work directly within the mines.¹⁷³ According to various interviewees, women do not work in tunnels in both northern and southern Brazil and in formal as well as informal mines.¹⁷⁴ Women do, however, participate in clerical or administrative tasks related to legal amethyst mining. In the case of informal mines, women often pick up smaller amethyst stone “scraps” that cannot be sold as a large geode or cut into a gem for jewelry and instead collect these scraps for artisanal purposes.¹⁷⁶



Brazilian women in Sento Se, Bahia holding amethyst stone ‘scraps’¹⁷⁵

Multiple interviewees expressed concern that a reason why women do not participate in the actual mining of amethyst within the tunnels due to the likelihood or high risk of being victims of sexual violence.¹⁷⁷ In southern Brazil, the largest cooperative in the amethyst industry - COOGAMAI, encourages and supports women working in amethyst mines. COOGAMAI President Isaldir Antonio Sganzerla pointed out that the inclusion of women in the industry follows the cooperative's values, supporting its members in their mining ventures, boosting job and income

generation, ensuring the quality of life for many families, not only directly in the extraction of crystal, but also related activities such as tourism, for example.¹⁷⁸

Women do not receive the same economic benefits, such as wages from the amethyst mining industry equal to men. Since the amethyst mining industry in Brazil is individualized, workers make the highest wages in both formal and informal mines when they dig out a large amethyst geode.¹⁷⁹ Since women do not work directly in the tunnels and instead participate in lower-wage positions, they do not receive the same economic benefits as men.

Another interviewee reported that there are also higher cases of domestic violence around amethyst mining towns, especially in towns that developed solely because of informal mines such as in Sento Sé, Bahia, in northern Brazil.¹⁸⁰ Sento Sé had a drastic population increase due to the discovery of amethyst in the region, bringing interested miners and their families to the area from all over the country.¹⁸¹ Since the sector grew at such a quick rate, no police were present in the area, and health centers were not easily accessible.¹⁸² One interviewee reported that many women reported an increase in domestic violence in the informal mining area as well as a less secure sense of community.¹⁸³

While human trafficking is not a reported issue related to amethyst mining, all interviewees reported that prostitution was likely in amethyst mining communities, especially informal communities.¹⁸⁴ Multiple interviewees stated that forced prostitution did not exist in amethyst mining communities.¹⁸⁵ When areas experienced a gold rush of sorts with people migrating from all over the country in hopes of finding amethyst and wealth - these informal mines would also often attract a high number of prostitutes to the area. Most of these clearer cases of violence against women and security issues related to amethyst mining happened in areas where clandestine mines would pop up and attract a large number of people from throughout the country.¹⁸⁶

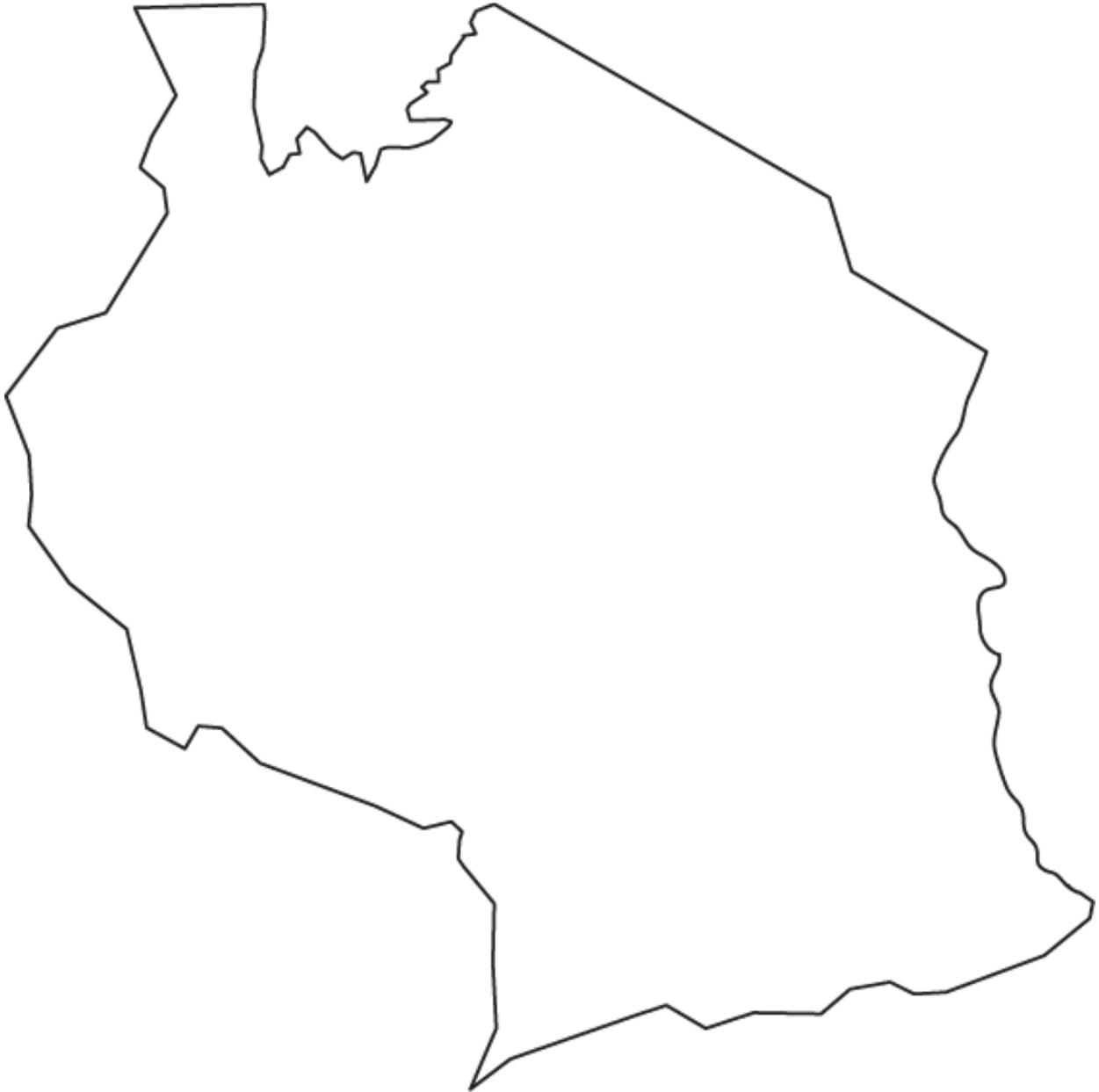
1.6.4 Children's Rights

Children are not subject to forced labor in the amethyst mining industry in Brazil. In southern Brazil, interviewees stated it was highly unlikely to find a minor under the age of the legal mining age limit of 18 years old to be working in one of the mines or tunnels.¹⁸⁷ There are national laws

in place to prevent child labor, but the question is, are these laws implemented in practice, especially in extremely rural mining communities. In northern Brazil, within formal mines, child labor is also not a risk. Interviewees stated that there might be some rare cases in northern Brazil in informal mines where youth are supporting the industry picking up smaller amethyst stones that cannot be sold and are later used for artisanal purposes.¹⁸⁸ Interviewees who have visited informal mines in northern Brazil reported that they did not see any youth working directly in the mining tunnels.¹⁸⁹

Children are also not commonly denied education or have health risks threatened by the amethyst mining industry. In southern Brazil, the amethyst mining industry in many of these smaller communities has encouraged education opportunities for youth and miners alike, as well as pushed for higher quality health services for the community.¹⁹⁰ In the north, the same is true for areas surrounding formal mines; however, informal mines are likely located in extremely rural areas where accessible education and health services do not exist.¹⁹¹

Chapter 2: Tanzania



Chapter 2.1: Historical and Cultural Background

Tanzanite is a transparent deep blue to violent colored gemstone and one of the rarest gems in the world. It is a type of zoisite. In 1968, Tiffany & Company named the stone Tanzanite (after Tanzania) as they were afraid that zoisite sounded too similar to suicide.^{192,193}



*Tanzanite*¹⁹⁴

Tanzanite is currently only found in one place on earth. The mine is in a 12 square mile area south of Mount Kilimanjaro, in the highlands of Mererani, east of the city of Arusha. The fact that tanzanite is only found here creates a particular set of advantages and challenges for the Tanzanite industry.

Tanzanite was discovered in 1967, transforming the small town of Mererani into a major mining town seemingly overnight. In 1971, the government nationalized the industry, and in 1990, they split the area into four Blocks (A, B, C, and D). The government leased Blocks A and C to large-scale operators, evicting all small-scale miners in the process. The government reserved Blocks B and D for local, small-scale miners. The African Gemstone Mining Ltd (or AfGem), a South African company, purchased the largest stake in the Blocks A and C in 1996. At the turn of the twenty-first century, tanzanite had become one of the most popular colored gems in the US. However, sales stopped virtually overnight in 2001, when a Wall Street Journal article alleged that tanzanite funded Al-Qaeda in the September 11th terrorist attacks.¹⁹⁵ Tanzanite had also been reportedly connected to the 1998 Al-Qaeda bombing of the U.S. embassies in Kenya and Tanzania.



Merlani tanzanite mines in front of Mt. Kilimanjaro
196

These attacks prompted Tanzanian and American government officials and industry leaders to meet and agree to the Tucson Tanzanite Protocol. The protocols sought to codify tanzanite trade rules and emphasized cracking down on illegal smuggling and terrorist financing.

In 2003, AfGem renamed itself TanzaniteOne in an attempt to restore tanzanite's image, the Tanzanian government also increased security around the Tanzanite mining zone and established a new governing bureaucracy over the industry. Additionally, the USA PATRIOT Act established new criteria for all large-scale gemstone industries to follow to avoid the potential of terrorist financing. Tanzanite One has since adhered to these criteria, adding further structure to the industry.¹⁹⁷

Since the early 2000s, the Tanzanian government has gone through several reforms. In 2010, the government passed a Mining Act, which established new “primary mining licenses” for small-scale mining operators. These new licenses cost less than \$100,000 and last for 5-7 years. They are easier to attain than the existing regular or special licenses and are accompanied by environmental and societal impact provisions overseen by the government.¹⁹⁸

Around the same time, the government began banning the export of rough tanzanite larger than one carat. This ban was intended to support the domestic trade of the mineral and to prop up local cutting and polishing industries, as traders shipped raw tanzanite to India, where there was a more established cutting and polishing industry. However, the government did not enforce this ban sufficiently, and tanzanite smuggling remained a problem.

In December 2013, Richland Resources, who owned TanzaniteOne at the time, signed a 10-year joint venture (JV) agreement with the Tanzanian government through the State Mining

Corporation (STAMICO). In the agreement, the STAMICO required 50% ownership of TanzaniteOne.

In 2017, the government banned the export of all unprocessed Tanzanite ores, issued an additional 1% tax on exported products, and required the government to own a 16% stake in all large-scale mining projects. Research indicates that these reforms worried international investors.¹⁹⁹

Additionally, in 2017, the government started building a wall around the entire tanzanite mining compound. This wall increases security and governmental control by limiting entry to the mine and requiring government issued identifications for all mine employees.



Despite the incremental reforms, some *Wall around the tanzanite mine*²⁰⁰ government policies, such as the export ban, have harmed the tanzanite industry, as Tanzania does not have enough trained polishers and cutters. In 2019, TanzaniteOne shut down its operations after facing mounting financial difficulties. Large-scale mining is at a standstill, yet small-scale mining still takes/ place.²⁰¹

Chapter 2.2: Governance Challenges

2.2.1 State of Governance and Accountability

The Tanzanian government is a hybrid regime, rated “partly free” by Freedom House as it has multi-party elections but a strong, single-party dominant political scene.²⁰² Therefore, the state of governance remains fraught.²⁰³ However, the state’s focus on the mining industry has yielded positive results in the past.

There are formal institutions that monitor Tanzania’s mining industry. The Commissioner of Minerals and the Zonal Mining Officers provide official administration.²⁰⁴ Despite the presence of such advanced formal institutions, transparency remains low, and the smuggling of ore remains a

major concern.²⁰⁵ The smuggling of raw tanzanite severely undercuts potential government revenue (more analysis in Section 3). Government officials hold violators accountable when apprehended, but it has proven difficult to reign in the smuggling routes.²⁰⁶

The fact that there is one tanzanite mine has helped the government regulate the industry: all mining, cutting, polishing, is done on-site.²⁰⁷ Additionally, the 2017 wall is effective in this instance because it surrounds the entire mining industry.²⁰⁸ Additionally, as a single large-scale operator of tanzanite mining, TanzaniteOne, which also makes it easier for the government to oversee the formal industry. However, it is harder for the government to regulate the small-scale miners, as the sheer number of licenses and miners prove difficult to manage comprehensively.²⁰⁹ Informal institutions, NGOs, and civil societies also play a role in and around the tanzanite industry. The International Labor Organization (ILO) monitors the industry²¹⁰, as well as international nonprofits such as PACT and local civil society groups such as the Tanzanian Women Miner's Association (TWMA).²¹¹ Most of the informal institutions work with small-scale miners, and the Tanzanian government has historically had a mostly hands-off approach to their work.²¹²

2.2.2 Transparency

Generally, data on industry actors are not easily accessible. Most tanzanite miners work in small-scale mines, which generally lack the capability to record data. Government permits and licenses for small-scale mine are readily accessible. While the issuing processes are not entirely transparent, it is relatively easy to acquire a license to mine tanzanite with sufficient capital.²¹³ The Tanzanian government has made licensing easier with each iteration of reforms.²¹⁴

Tanzania has implemented the Extractive Industries Transparency Initiative (EITI) to legitimize the industry to the global market.²¹⁵

2.2.3 Corruption Prevention

Corruption permeates Tanzanian society. Transparency International rates Tanzania at a 36/100 in their Corruption Perceptions Index, and Freedom House rates government anti-corruption efforts at a 2/4.²¹⁶²¹⁷ Recent efforts have focused on petty corruption under the Prevention and Combating of Corruption Bureau (PCCB). There are specific anti-corruption laws in Tanzania.

International organizations, such as TanzaniteOne, are required to sign an anti-corruption pledge.²¹⁸ There are current efforts to reduce corruption, although government officials face no pressure to disclose personal finances, which may prove an obstacle in efforts to counter macro-corruption. On a micro-level, rent-seeking continues to have a presence in the industry.²¹⁹

2.2.4 Industry Regulation

The Tanzanian government has focused public resources and developed specific policies for the tanzanite industry to increase the opportunity for revenue.

The 2010 and 2017 reforms made it easier for miners to obtain a mining license and nominally improved environmental and labor regulations.²²⁰

Despite the new regulations and reforms, environmental standards and labor safety standards,

are not evenly enforced.²²² The regulations are much more effective for TanzaniteOne, where government regulators hold environmental and labor safety as a top concern.²²³



*A Maasai man inspects tanzanite*²²¹

Unfortunately, these new regulations came with a cost. In 2017, investors started fleeing TanzaniteOne after burdensome demands of government control slowed the growth of the tanzanite industry in the country.²²⁴ The Tanzanian government lifted the export ban in 2019, but the consequences persist. With the decline of TanzaniteOne, the future of the tanzanite industry is up in the air.

2.2.5 Presence of Criminal Non-State Actors and Organizations

International criminal cartels and terrorist organizations exploit loot-able or extractable resources as a financing strategy. However, because of the proximity of the Tanzanian government to the tanzanite industry sites, as well as a keen interest by foreign investors and international monitors, there is no evidence of international terrorist or international criminal involvement in the tanzanite

trade. Other than petty corruption, persistent smuggling rings, and political malfeasance, national/local criminal activity remains at a minimum.

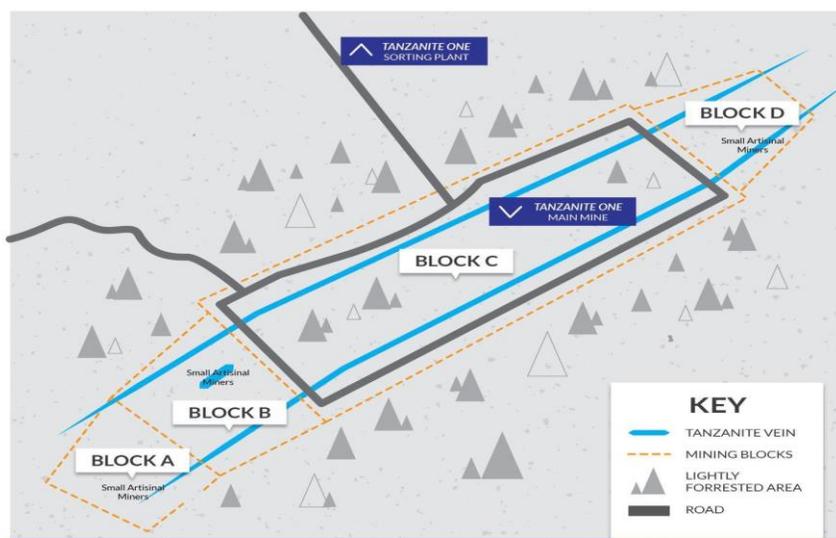
Chapter 2.3: Economic Challenges

2.3.1 Industry Employment

The exact number of people involved in the tanzanite industry is unknown. As of 2016, TanzaniteOne employs over 650 staff members.²²⁵ Artisanal and small-scale mines employ over a million people in Tanzania, but the number of artisanal tanzanite miners is unknown.²²⁶ According to a gem expert, 90% of tanzanite miners are artisanal miners. Artisanal and small-scale mining companies are well organized in Tanzania, and the miners tend to organize themselves in three ways:²²⁷

1. Micro-mining, where three to ten people form a group and share the license,
2. Local landowner funding, where the local landowner or shopkeeper funds the mine and hires miners who usually pay one-third of their revenue to the sponsor and
3. Company funding, where companies in the jewelry industry fund artisanal miners.

Large-scale, small-scale, and artisanal tanzanite miners all experience income instability. Artisanal and small-scale miners are paid when they find gems. Their incomes can vary significantly, and many can work for years before finding a lucrative gem.²²⁹ Until recently, TanzaniteOne provided



*In 1990, the Tanzania government divided the mining area into four blocks. The government awarded Block C, the largest and most mineral rich block, to TanzaniteOne, the only large-scale mining corporation. They gave block A to Kilimanjaro Mining Ltd, a medium scale mining company, and Blocks B and D to artisanal miners.*²²⁸

a reliable income. However, in 2016, TanzaniteOne laid off roughly half of its staff (600 workers), and recent reports indicate that the company is no longer operational.²³⁰

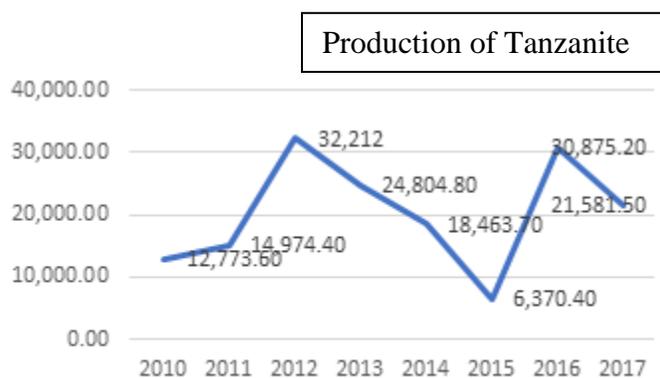
While the income from tanzanite is unpredictable, the tanzanite industry provides crucial job opportunities to low-income communities. Most miners are from low-income families and have a basic education, which limits their ability to find other work.²³¹ The table below shows the education level of artisanal and small-scale workers in the tanzanite mining industry.

Table 1. Level of Employees' Education level

Education	Miners	Brokers	Dealers/Processors
No formal education	7%	3%	0%
Primary education	46%	74%	21%
Secondary education	31%	21%	39%
Certificates/Diploma	10%	0%	33%
University degree	6%	3%	6%
Total	100%	100%	100%

2.3.2 Fiscal Sustainability

The future of the tanzanite industry is uncertain. As the graph shows, tanzanite production has fluctuated significantly in the last ten years.



Additionally, there are differing opinions on how much tanzanite is still available

to mine. In 2018, the Tanzanian government reported that there are more than 1,760 million tons of tanzanite remaining in the mine, enough for another twenty-five years.²³² However, according to TanzaniteOne, mining could end before 2030 because the miners lack the correct technology to reach the deeper gems.

Yet, another uncertainty is the price of tanzanite. At the end of the twentieth century, tanzanite cost \$200 per carat, but by the beginning of the twenty-first century, tanzanite cost between \$600 and \$800 per carat.²³³ Today, the prices still vary significantly year to year. In 2014, tanzanite cost between \$400 to \$500 per carat.²³⁴ In 2018, tanzanite cost between \$650-\$750 per carat.²³⁵

The Tanzanian government's high tax rate also impacts tanzanite's fiscal sustainability. The Natural Resource Governance Institute (NRGI) estimates that Tanzania is the highest taxed mining sector in the world (74%). Tax evasion has been a significant problem with large scale mining companies in Tanzania. Recently, the Tanzania government has been collecting tax more effectively from large scale mining companies. In 2018, TanzaniteOne agreed to pay compensation and overdue taxes to the government. The Tanzanian government still struggles to collect taxes and royalties from artisanal miners.

2.3.3 Beneficiation

Tanzanite accounts for a small but increasing portion of Tanzania's national revenue. From 2010 to 2015, Tanzania's mining sector grew by 10.2%.²³⁶ Additionally, the mining sector's contribution to GDP growth's growth increased from 3.3% in 2011 to 8.8% in 2017.²³⁷ Although TanzaniteOne makes up 0.35% of government revenue, the rareness of tanzanite has also attracted tourists and created a new tanzanite tourism industry.²³⁸



*TanzaniteOne miners*²³⁹

The government has tried to increase its revenue from the tanzanite industry. The tanzanite trade earns \$500 million globally annually.²⁴⁰ Even though Tanzania is the only source of tanzanite in the world, Tanzania only receives 4.15% of the global export value.²⁴¹ In an attempt to increase revenue, the government passed the Mining Act of 2010, requiring all cutting processes to be done in Tanzania. Research conducted by the Bank of Tanzania in 2016 suggests that the processing activities failed to contribute to employment and revenue as expected due to the unpredictable supply of rough tanzanite, lack of financial resources,

poor tanzanite processing technology, and skills, and an unreliable market for cut and polished tanzanite.²⁴² In 2017, the government built a wall around the tanzanite mining area. Data on budget and resource revenue of tanzanite after 2017 are not available.

Although the wall improved the smuggling situation, the tanzanite export ban hurt the TanzaniteOne, which has since closed. Therefore, tanzanite's contribution to government revenue remains low even though the smuggling problem has improved.

Tanzanite mining has benefited the local community. TanzaniteOne, in cooperation with the Tanzanite Foundation, has implemented community projects around the mines. The Tanzanite Foundation is a non-profit that educates the public and promotes tanzanite. There are no government-funded education or training programs for value-adding activities, but NGOs like the Tanzanite Foundation fill that gap. The Tanzanite Foundation's community projects are often well-received.²⁴³ For example, their Massai Ladies Project teaches women to create their jewelry collection. TanzaniteOne also has a clean water initiative, and it funded a local police station.

2.3.4 Smuggling and the Informal Economy

In 2017, a parliamentary committee investigated tanzanite mining and reported that there was rampant tanzanite smuggling costing Tanzania \$2.7 million in lost revenue every year.²⁴⁴ The parliamentary committee's investigation also found that Tanzania received 5.2 % of revenues from the global tanzanite trade over the past decade.²⁴⁵ Although Tanzania is the only source of tanzanite in the world, rough tanzanite is often smuggled into neighboring Kenya and exported to India for cutting. Kenya and India generate more revenue from exporting tanzanite than Tanzania. Globally, the tanzanite trade is worth \$500 million a year, yet the export revenue of tanzanite in Tanzania is \$20.75 million.²⁴⁶

Both artisanal miners, large-scale tanzanite miners, and government officials are involved in smuggling. A smuggling report from ENACT, an NGO working in the region, states that there are three levels of smuggling. The first level is when smugglers to bribe the police to gain access to the mining field where they can buy tanzanite. The second level includes forging mining licenses

and exporting permits. The third level involves moving smuggled tanzanite through border points by bribing security personnel.²⁴⁷

The Tanzania government has tried to stop smuggling out of the mining area and out of the country. Despite the 2010 export ban, in 2015, Tanzania's Minister of Energy and Minerals Minister noted that "larger stones of tanzanite have continued to be smuggled outside the country and found in major gem shows in Tucson, Bangkok and Hong Kong."²⁴⁸ In 2017, President Magufuli built a wall with cameras and checkpoints completely around the tanzanite mining area.

However, all our interviewees stated that smuggling is still likely occurring. We could not find any quantitative data to support their claims.

2.3.5 Non-State Actor and Terrorist Funding

We could not find any evidence linking terrorist activities or organized crime to the tanzanite mining industry. In the aftermath of 9/11, the Wall Street Journal published an article stating that al Qaeda used tanzanite to raise money for terrorist activities, including 9/11 and a previous al Qaeda embassy bombing.²⁴⁹ The sale of tanzanite in North America stopped immediately.²⁵⁰ Three months later, in February 2002, the US State Department reported that there was no link between tanzanite mining and terrorist activities.²⁵¹ To reopen and rebuild the confidence of the tanzanite industry, Tanzania government and the American Gem Trade Association, along with the other major industry stakeholders, drafted the Tucson Tanzanite Protocol in 2003 to "institute a practical and effective means to eliminate concerns about the tanzanite trade, its alleged connection to funding terrorism."²⁵² Since then, we could not find any reports connecting of tanzanite with terrorist activities.²⁵³

2.3.6 Supply Chain

Methodology

Tanzanite was discovered in 1967. Between 1967 to 1972, an estimated two million carats of gem-quality tanzanite were extracted by open-pit mining. Soon the open-pit mining gave way to underground mining, and now all tanzanite mines go deep underground in tunnels with shafts. The

mining methods vary from large scale companies to small scale companies due to the level of financial capacity and the size of mines.

There are two tanzanite mining sectors in Merelani: TanzaniteOne and other small-scale mining companies. TanzaniteOne is the only large-scale mining company in Merelani and is the dominant firm in the industry. TanzaniteOne not only has the exclusive right to the best tanzanite resources but also is responsible for grading and certifying all tanzanite, including those mined by small-scale mining companies.²⁵⁴ The financial capacity and the level of mining technology of TanzaniteOne is incomparable to other small-scale mining companies in the area.

Regarding small-scale mining companies, local retail dealers or jewelry companies can get mining permits in blocks A, B, and D and hire their miners. Some miners can also obtain one permit and work together as a group.²⁵⁵ In this paper, we refer to all of them as small-scale mining companies. The small-scale mining permits allow them to operate at lands that are 25 meters by 25 meters large.²⁵⁶ Because of the limited size of the land, almost all small mines are vertical mines that go straight down to the ore body.²⁵⁷ These small mines mostly use simple methods and basic air supply systems.²⁵⁸ The small-scale miners do not typically use mechanized equipment and cannot dig as deep as TanzaniteOne mines.

Washing and sorting

To promote value-adding activities within the state and to retain the value of tanzanite,²⁵⁹ in 2010, the Tanzania government banned the export of rough tanzanite weighing more than one gram.²⁶⁰ Mining companies must conduct all cutting and polishing activities in Tanzania. However, Tanzania lacks high skilled cutters and experts in processing gems.²⁶¹ The following table shows who has is involved at each level of the tanzanite production process:²⁶²

Table 2. Actors at each level of the tanzanite process

	Actors
Rough Stone	Miners, Brokers, Dealers, Retailers, TanzaniteOne

Cut Stone	Big Brokers, Dealers, Retailers, TanzaniteOne
Jewelry	Retailers, TanzaniteOne

TanzaniteOne operates all tanzanite related activities on-site with advanced equipment, from mining, sorting, cutting, and processing to retail. TanzaniteOne sorts and grades rough tanzanite both manually and with an automated optical sorting system. It uses a Dense Media Separator that can operate 10,000 tons per month.²⁶³ Most of the actors in the industry can conduct the washing and sorting of the rough tanzanite. Only big brokers have small workshops for cutting.²⁶⁴

Security

There is no evidence of criminal organizations or terrorist groups along the supply chain of tanzanite. Smuggling and clashes between small-scale miners and TanzaniteOne are two major security problems. We covered the smuggling issue in the economy section and the violence issue in the human rights section.

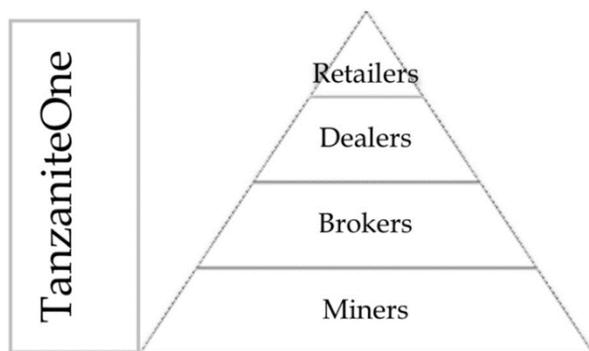
Thefts from both employees of TanzaniteOne and artisanal miners are an ongoing problem for TanzaniteOne. In 2002, TanzaniteOne security shot at small-scale miners who entered block C underground and threatened the security with knives.²⁶⁵ In December 2006, the Manyara regional police commander allowed TanzaniteOne to use ‘reasonable force’ to protect its property from artisanal miners. This announcement gave TanzaniteOne the power to use air guns and live bullets to deal with artisanal miners entering block C underground.²⁶⁶

Before 2017, a large amount of rough tanzanite was smuggled to Kenya for processing and then to India for cutting. The government built the wall around the mine. But there are no data on smuggling after 2017.

Market System

There are five types of actors in the tanzanite industry: TanzaniteOne, miners, brokers, dealers, and retailers. TanzaniteOne is the only actor in the formal industry, and it operates everything on-site, from mining, sorting, polishing to selling. Artisanal miners also sell rough tanzanite to

TanzaniteOne for sorting and further processing. TanzaniteOne established a non-profit organization Tanzanite Foundation in 2003 to promote tanzanite worldwide and advocate its ethical mining strategy.²⁶⁷ Therefore, TanzaniteOne also has an impact on the marketing of tanzanite. The figure below shows the relationship between the informal and the formal industry.



Arusha city and Merelani are the two tanzanite trade centers for the informal tanzanite industry. Miners go to Arusha to sell their stones, and brokers, dealers, and retailers in Arusha also come to Merelani to

buy rough tanzanite. Small scale miners can sell their rough tanzanite to large-scale miners, local brokers, and local dealers. Buyers in the market prefer to buy rough tanzanite directly from the miners because the miners have limited information about the market price and are usually in a desperate situation.²⁶⁸ It is hard to estimate the number of brokers in Arusha because most brokers are not registered, and they enter and leave the industry constantly.²⁶⁹

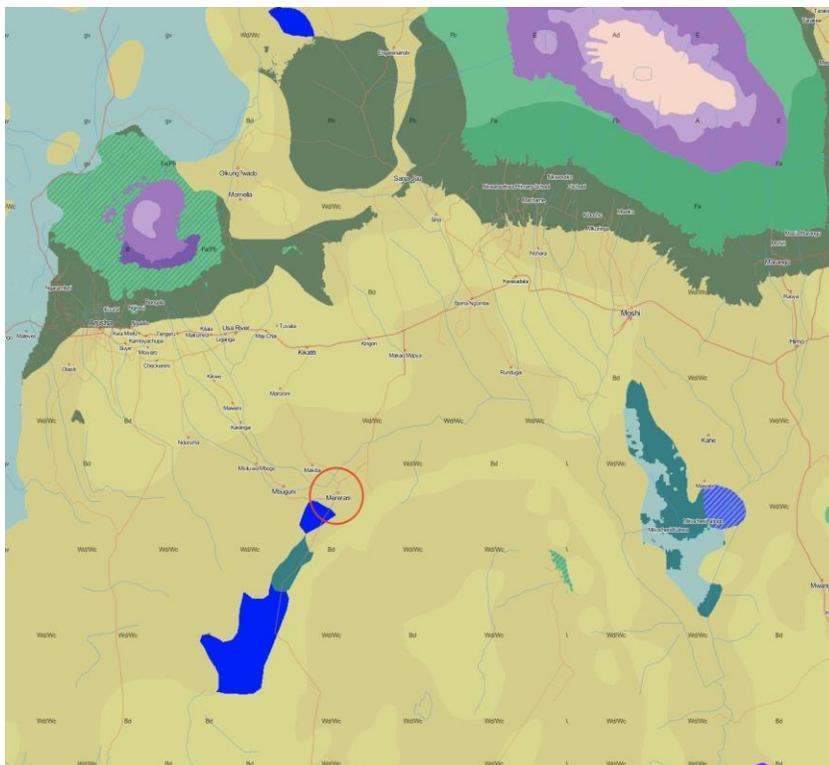
There are about 20-40 registered dealers in the tanzanite industry; they are in direct competition with retailers. Dealers do not sell their stones to retailers, and they only trade with foreign buyers. Retailers usually own mines and buy rough tanzanite from its miners.²⁷⁰

India, the U. S., and China are the major actors in the tanzanite market. Jaipur in India is the biggest cutting and polishing center for tanzanite in the world before the export ban.²⁷¹ The United States is the biggest market for tanzanite, where approximately 75% of tanzanite is sold.²⁷² China has also been showing increasing interest in tanzanite in recent years.²⁷³ To ensure the ethical route to the tanzanite market, TanzaniteOne has agreements with 12 sight holders. These 12 sight holders are gemstone houses and jewelry manufacturers who focus on tanzanite. They oversee the further retail and wholesale of tanzanite around the world. These sight holder companies are also from Jaipur India, Hong Kong, and New York.²⁷⁴

Chapter 2.4: Environmental Challenges

2.4.1 Environmental Sustainability

The vegetation type in the Mererani area is grassland. Specifically, a combination of Acacia-Commiphora deciduous wooded grassland and Combretum wooded grassland. The city does not have a high level of biodiversity, and because the tanzanite mining area is relatively small, 2 km by 4 km, the mining industry has likely not caused severe deforestation or desertification.²⁷⁵



*Vegetation Map of Merelani*²⁷⁶

Air pollution is significant in

Merelani. Most of the air pollution in the mining area originated from underground blasting, which emits dust, hydrocarbons, and poisonous gases into the atmosphere. According to the research conducted by Mbowe, Yabu, and Lugobi in 2016, 70% of miners used non-electrical explosives, about 27% used electrical detonators. Non-electrical detonators tend to be safer than electrical detonators.²⁷⁷ Regardless, excessive use of detonators can damage rock structures, increase the risk of land degradation, air pollution, and release poisonous gas,²⁷⁸ including carbon monoxide, carbon dioxide, Nitric oxide, Nitrogen dioxide, and Sulfur dioxide. According to the WHO Guidelines for Indoor Air quality,²⁷⁹ the air pollution level in Merelani mines is high above the standard.²⁸⁰

2.4.2 Environmental Protections

The Tanzanian government introduced the Environment Management Act in 2014.²⁸¹ This act addresses water, soil, air, and waste pollution in Tanzania, and urges the National Environment Management Council to prescribe measurement criteria. In the Environmental Consideration for Sustainable Industrialization in Tanzania's 2017 report, the government mentioned that mining damages the landscape, but there are no criteria to assess the mining's overall environmental impact.

There are environmental protections for large scale mines. According to the Tanzania Mineral Audit Agency's annual report, there were over 100 major environmental restorations on large scale mines from 2010 to 2015. The government allocated \$244,000 USD to TanzaniteOne in 2015 for environmental restoration²⁸². In 2017, the Ministry of Minerals replaced the Tanzania Mineral Audit Agency with the Mining Commission.²⁸³ We were not able to find data measuring the effectiveness of the project.

We were also unable to find substantial data on the environmental conditions in the tanzanite mining area, which indicates a general lack of monitoring pollution levels in and around the mines. The Tanzanian government requires an Environmental Management Plan (EMP) for both small-scale and large-scale mining groups to obtain a mining permit. However, there is a lack of environmental regulation on the ground, especially for artisanal and small-scale miners. According to a gems expert, environmental protection is not the government's priority.²⁸⁴ Local institutions fail to manage the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) properly.²⁸⁵ Without regulation and proper mining technology, there is a huge risk of land degradation in the small-scale mining area.²⁸⁶ Miners fail to manage the waste excavated during mining and miners.²⁸⁷ Also, the unorganized shafts result in land degradation, which then causes mine disasters, such as flood and collapse of the mine.²⁸⁸

Chapter 2.5: Health Challenges

2.5.1 Human Health



*Tanzanite miners in a barrel, without protective gears*²⁹⁶

Tanzania has one of the highest rates of mining injuries in the world.²⁸⁹ Tanzanite underground shafts are more than 100 meters deep, and the miners often work in very harsh conditions. These conditions, coupled with almost non-existent health care services, lead to acute and chronic health problems. The majority of miners work without shoes, gloves, safety belts, helmets, or adequate lighting, all of which increase the likelihood of injury.²⁹⁰ Between 2009 and 2012, 98.7% of miners seen at a local health center did not use protective gear at work.²⁹¹ Common sources of injuries in tanzanite mines include explosions, mine collapse, falling

rocks, fires, falls, noise, and floods.²⁹² Research conducted by the University of Dar es Salaam found that tanzanite mines have a high level of dust (28.4 mg/m³)²⁹³, which has been associated with respiratory ailments such as silicosis. Many mines also rely on compressors to supply oxygen to the miners, which can have devastating effects if they fail. In 2002, forty-eight tanzanite miners died when their compressor stopped working.²⁹⁴ The mines' poor ventilation can also trap deadly gases. A 2005 research article from the University of Dar es Salaam found that between 1996 and 2005, 40% of all deaths in the tanzanite mines were caused by poor ventilation.²⁹⁵

Artisanal and small-scale miners are at much greater health risk compared to large scale miners as the small-scale mines are largely unregulated.²⁹⁷ Until 2017, the majority of small-scale miners worked under other people's licenses, which made it difficult for the government to regulate the industry and ensure workers' safety.²⁹⁸ Additionally, small-scale miners are not formal sector

employees and are not covered under the government's Occupational Safety and Health (OSH) laws.²⁹⁹ In 2017, the government passed new legislation to increase the regulation of small-scale mines across Tanzania. At the time of this report, the research team was not able to find data to determine if these laws have improved worker safety. There are a few recent reports of representatives from the Occupational Health and Safety agency visiting artisanal and small-scale tanzanite mines; however, many mine owners believe that the government is more interested in collecting taxes than the health and safety of the miners.³⁰⁰

The amount of resources varies between the small-scale mines in blocks B and D.³⁰¹ The most basic small-scale mines are holes in the ground with a rope.³⁰² Some small-scale mines have more advanced technologies, but overall, the small-scale miners tend to have fewer resources and less mining knowledge compared to



*Artisanal tanzanite mine*³⁰⁷

large-scale miners.³⁰³ The small-scale miners typically learn how to mine from one other.³⁰⁴ Most small-scale miners were never taught how to properly reinforce tunnels, stack their waste, or safely use dynamite, which can lead to substandard practices and increase the risk of tunnel collapse.³⁰⁵ In 1998, at least two hundred tanzanite miners died when their mine collapsed during a flood.³⁰⁶

In contrast, the large-scale tanzanite mines are, in theory, regulated by the Tanzanian government. As formal sector employees, the large-scale miners are covered by Tanzania's health and safety laws. These laws require that those miners receive medical examinations before, during, and after their employment, are restricted to eight-hour workdays and entitled to injury compensation. The 2008 Worker's Compensation Act pays formal sector employees who have sustained injuries or died as a result of their mining.³⁰⁸ However, our research indicated that large-scale tanzanite miners

do not typically receive these services and, like small-scale and artisanal miners, are required to pay for their health care.

Also, the large-scale mines are more mechanized than the small-scale and artisanal miners. They have more resources, including engineers, who implement safety measures to mitigate health risks.³⁰⁹ During the first ten years that AfGem (now TanzaniteOne) owned the large-scale tanzanite mine, there was one accidental death in the mine. In contrast, hundreds of small-scale miners were killed during this same period.³¹⁰



*TanzaniteOne miners*³¹¹

In both large-scale and small-scale mines, dust is one of the biggest chronic health risks.³¹² Originally, tanzanite was easily found on the earth's surface. Today, miners use jackhammers and dynamite to reach depths of more than a hundred meters, which creates significant amount dust.³¹³ Prolonged exposure to silica and quartz in the dust can cause lung cancer or a deadly condition called Silicosis.³¹⁴ Silicosis is initially asymptomatic but can rapidly progress and become fatal in less than five years.³¹⁵ The silica dust coats an individual's lungs and slowly asphyxiates them. Silicosis weakens immune systems and increases susceptibility to both Tuberculosis (TB) and Human Immunodeficiency Virus (HIV).³¹⁶ Mererani has one of the highest rates of HIV and TB in Tanzania.³¹⁷

There are other health risks associated with explosives, including noise and vibrations that can dislodge other rocks. Government regulations require that only licensed operators use explosives; however, this is not enforced. TanzaniteOne typically uses explosives at the end of the day, after all, its employees have left. However, the small-scale and artisanal miners often work at night and can be injured by the vibrations caused by blasts from the nearby TanzaniteOne's mine.³¹⁸

Besides workplace injuries, other illnesses can result from the lack of running water and adequate sanitation facilities in the area. Water is shipped in from other areas in Tanzania and sold to the miners. A public health non-profit found that this water is frequently sourced from rivers and rainwater and is often contaminated. We could not find any data linking the shipped water or unsanitary conditions at the Tanzanite mines with illnesses such as malaria or typhoid; however, this has happened at other mining sites in Tanzania.³¹⁹

2.5.2 Food Security

Tanzania has a significant food security problem. Tanzania ranks 95th out of 117 countries in the 2018 Global Food Security Index (GFSI), indicating that Tanzania has a serious hunger level.³²⁰ According to the UNDP's 2018 Human Development Index, 34.5% of children in Tanzania under the age of five are malnourished.³²¹

Overall, mining impacts Tanzania's food security in two key ways: the first is that mines destroy farmland, and the second is that farmers leave the farming industry for the more lucrative mining industry. Mererani was not an agricultural area before tanzanite was discovered. The land is very rocky and has too much soda ash to grow food.³²² Thus, the tanzanite mine did not destroy farmland; however, many tanzanite miners are former farmers. In 2004, roughly 50% of the miners in Mererani were either former farmers or retired civil servants.³²³ The net impact of tanzanite mining on farming is unclear. Although people may have left farming to mine for tanzanite, many farmers have mixed livelihoods and will mine during the dry season.³²⁴ Also, tanzanite miners can go months or years without finding high-value tanzanite and, therefore, may turn to a variety of professions, including farming, to supplement their income.³²⁵

2.5.3 Water Security

Tanzania has a significant water scarcity problem, and the area around the tanzanite mines is experiencing a severe water shortage. Several organizations, including the tanzanite foundation, have drilled water wells near the mines, but our interviewees suggested that most of these wells are not operational.³²⁶ One of our interviewees suggested that the people selling the water to the locals do not want non-profits coming in and providing free water.³²⁷

Tanzanite mining does not use a lot of water, but it still contributes to local water pollution.³²⁸ Many artisanal miners do not properly discard their waste rock and leave their waste rock in piles, which can contaminate the already unclean river water.³²⁹

Chapter 2.6: Human Rights Challenges

2.6.1 Workers' Rights

The international community has been concerned about worker's rights in Tanzania's extractive industries for years. Most concerns have focused on the high rates of child labor, but there are other workers' rights concerns in the tanzanite industry, including non-payment of salaries.

Regarding child labor, Tanzanian law prohibits anyone under the age of eighteen from working in the mines.³³⁰ However, as will be discussed below, this legislation has not been effective. Historically, most artisanal and small-scale miners worked under other people's mining leases, making it harder for the government to regulate the industry.³³¹ A Primary Mining License (PML) holder could have multiple people working in their mines under their license.³³² In mid-2017, the Merelani regional commissioner required all mining operators, including small-scale miners, to issue unique contracts.³³³

The Merelani regional commissioner also required that all mine operators pay workers regular salaries. Previously, small-scale miners were paid for what they produced and could sometimes go years without earning any income. However, our research indicates that some miners prefer this to a regular salary because there is a chance that they could find a valuable piece of tanzanite and make a large sum of money.

Large-scale miners have also experienced income problems. In 2018, the Tanzanian government sued TanzaniteOne for non-payment of salaries, and in 2019, the government ordered that TanzaniteOne stop mining because it had not paid over 700 workers for the past twenty-two months.³³⁴³³⁵

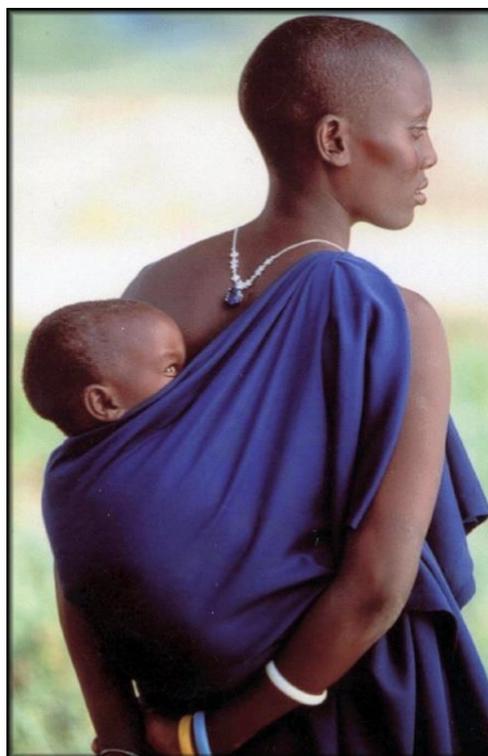
Many miners belong to mining associations. These associations educate miners on health, safety, the industry, and taxes; and advocate for the miners in the government.³³⁶ For example, many mining associations were involved in advocating for The Mining Act in 2010.³³⁷ Any primary mining license holder can join the association. As most artisanal miners do not hold a primary mining license, they are unable to join associations.

2.6.2. Indigenous and Minority Rights

The Maasai tribe has inhabited the areas surrounding the tanzanite mine since the seventeenth century.³³⁸ The Maasai people play a central role in tanzanite folklore.

A Maasai man is credited with discovering tanzanite in 1967.³³⁹ Since then, jewelry companies have used both the Maasai's image and traditional practices to market

the gemstone.³⁴⁰ For example, a US jewelry store states on its website that "Maasai belief holds that the color blue is both sacred and spiritual and according to folklore...Maasai chiefs began giving this gem to their wives when a new baby was born."³⁴¹



*An undated tanzanite advertisement where a Maasai woman with a baby is wearing a tanzanite necklace.*³⁴²

The Maasai people are traditionally semi-nomadic pastoralists and have traditional, not legal claims to the land. There is a thirty-year land dispute between the Maasai and Tanzanian government regarding land rights.³⁴³ The Tanzanian government sold traditional Maasai land to many groups, including mining companies.³⁴⁴ Furthermore, the miners who come from outside the village also live on the Maasai's land. Tanzanite mining does not directly interfere with traditional practices, but the Maasai are losing their traditional pastoralist skills, choosing instead to work in the tanzanite industry.³⁴⁵

Maasai men traditionally do not work in the underground mines, and rather, they dominate the tanzanite trade in Mererani.³⁴⁶ They typically work as middlemen, buying the gems directly from

the miners and selling them to other larger organizations.³⁴⁷ The Maasai, who live close to the tanzanite mines, have also benefited from some of the Tanzanite Foundation's community programs including schools, roads, and microfinancing projects.³⁴⁸

2.6.3 Women's Rights

Articles 12 and 13 in Tanzania's constitution guarantees gender equality and supports women's full political and social participation. However, gender equality remains a significant problem in Tanzania.³⁴⁹ The 2018 UN Development Programme Gender Inequality Index identifies Tanzania as a low human development country and ranks Tanzania 154 out of 189 countries. Women do not benefit as much from tanzanite mining as men.³⁵⁰ Before 2005, women were not allowed in the underground mines because the mine owners thought it would be too dangerous.³⁵¹ In 2004, fifteen women created the Tanzanite Women Miners Development Union.³⁵² These women-owned mines but were unable to mine in them.³⁵³ They successfully petitioned the government to allow women to mine underground. Since then, the Tanzanite Women Miners have continued to work on women's empowerment and started tanzanite cutting training programs for women.³⁵⁴

In 2017, UN women published an article about Pili Hussein, a woman who dressed as a man so she could mine in the tanzanite mines in the 1980s.³⁵⁵ Hussein started mining after escaping an abusive relationship.³⁵⁶ According to a tanzanite expert, many women, especially women in abusive relationships and widows, turn to tanzanite mining as a way to make money quickly.³⁵⁷ Today, Hussein owns a mine with over seventy employees and mentors young women.³⁵⁸³⁵⁹

Women are still underrepresented in the tanzanite mining industry. A 2019 report by the Institute for Human Rights and Business indicates that women make up 18% to 20% percent of the entire tanzanite industry, and 5% of underground miners.³⁶⁰ Many women miners sift through TanzaniteOne's waste rock, looking for tiny tanzanite pieces.³⁶¹ These tiny pieces of tanzanite do not sell for a high price. Many miners perceive sorting through waste rock as dangerous and believe that the men who do so are thieves.³⁶²

Even when women can mine underground and find decent size pieces of tanzanite, they still do not earn as much as men. Women tend to be less networked, have less knowledge of prices and industry, and tend not to be able to travel as far to find a fair price for their gems.³⁶³

2.6.4. Children's Rights

Until recently, child labor was a major problem in the Tanzanite mines.³⁶⁴ A 2006 report by The New Humanitarian report found that there more than 4,000 children under the age of fourteen years old working in the tanzanite mines.³⁶⁵

According to Tanzanian Law, it is illegal to employ anyone younger than fourteen in light work, and anyone below eighteen in hazardous work such as mining, In 2004 the Tanzanian National Assembly passed The Employment and Labour Relations Act, and in 2009 they passed The Law of the Child Act.³⁶⁶ Both of these laws prohibit mine owners from employing anyone under the age of eighteen.³⁶⁷ While research indicates that child labor decreased in Tanzania after the government passed the law until 2017, there remained a substantial amount of child labor in tanzanite mines.³⁶⁸ A 2014 BBC story highlighted the widespread use of child labor in tanzanite mines.

Child labor in the tanzanite mines persisted for several reasons. The primary reason for child labor is the widespread poverty in Mererani. Roughly 30% of the people living near the tanzanite mines live on less than \$1 a day.³⁶⁹ Many children start mining so they could provide for themselves and their families. Additionally, children are valuable in mines because they could fit into smaller spaces more easily than adults.³⁷⁰ In September 2017, the government started building a wall around the perimeter of the mines. Our interviewees are optimistic that the wall has ended child labor as children are not able to get the identification needed to get past the checkpoints.³⁷¹ All of our interviewees no longer considered child labor a problem in the tanzanite mines. We could not find any data on child labor in tanzanite mines post 2017 to substantiate these claims.

2.6.5. Freedom from Violence

Tanzanite mining has not been officially tied to terrorist organizations, but it is connected to local violence. Conflicts between large-scale and small-scale miners are common in and around the

tanzanite mines. Between 1967 and 1990, tanzanite was primarily mined by local artisanal and small-scale miners. In 1990, the Tanzanian government forcibly evicted all artisanal and small-scale miners and gave a foreign mining company access to the mineral-rich area. While a majority of TanzaniteOne miners are Tanzanian, they are not from the local area. TanzaniteOne has gone on record saying that they do not hire local miners because they pose an increased risk of smuggling. Furthermore, the TanzaniteOne miners and local artisanal miners live in different areas and rarely interact, which breeds hostility.

The tanzanite mining area is very small. It is common for the tunnels to cross into other people's land, which can lead to conflict. In July 2017, a small-scale miner was killed after his tunnel connected with one of TanzaniteOne's tunnels.³⁷²

There are also conflicts related to land rights. The Tanzanian government owns all rights to subsurface minerals. Mining, in combination with increasing wildlife tourism and commercial farming in the area, has decreased pastoralists' grazing areas.³⁷³ Under the 1999 Village Land Act, individuals have little power to object to losing the land of any size to mining companies if the government determines it is in the national interest.³⁷⁴ The 1998 Mining Act allows the Commissioner of Minerals to settle all disputes; however, the Commissioner of Minerals often does not have a record of other resources on the land (including health clinics and schools), so conflicts frequently occur.³⁷⁵ Despite these conflicts and the deadly health risks, there is little evidence of labor trafficking. As far as we can determine, all the miners are choosing to mine.

In 2008, the Tanzania National Assembly passed the Anti-Trafficking in Persons Act, which prohibits all forms of trafficking.³⁷⁶ According to a 2018 US State Department Report, Tanzania is a "source, transit, and destination country" for sex and labor trafficked individuals.³⁷⁷ The International Organization for Migration (IOM) also found that between 2008 and 2013, there was an increase in child trafficking for commercial sexual exploitation along the Tanzania-Kenya border, where the tanzanite mines are located.³⁷⁸ There is some data linking sex trafficking to tanzanite as there are numerous brothels in the neighboring town.

Chapter 3: Methodology, Framework, and Measurement

This report utilizes the Jewelry Development Impact Index (JDII) created by the Minerals, Materials, and Society Program at the University of Delaware. The index analyzes a gem's impact on its source community and country using five of the seven United Nations Indicators of Human Security and the risks related to governance, economics, environment, health, and human rights.

Each indicator includes between three and five sub-indicators. For example, the section on health challenges analyzes the impact of mining on human health, food security, and water security. The research team scored the sub-indicators using a set of questions developed by practitioners from the University of Delaware. Scores were determined based on extensive desk research and interviews with subject matter experts, including: academics, government officials, journalists, legal experts, think-tanks, and NGO personnel. Responses were scored on a 1- 7 Likert scale (*see Annex A*).

The scale ranges from one, representing the most unfavorable condition, to seven, representing the most favorable condition (see Table 3). On this scale, a higher score indicates that the industry is not creating a large human security risk. A lower score indicates that the industry is creating a large human security risk.

Table 3. Methodology Scoring Key

0	Not Applicable	Not Applicable
1	Never	Constant Risk
2	Rarely	Very High Risk
3	Occasionally	High Risk
4	Average	Moderate Risk
5	Frequently	Low Risk
6	Very Frequently	Very Low Risk
7	Always	Little to No Risk

A major change from previous years is reversing the scale for 30 out of the 124 JDII questions since many of the questions were asked in a way that a high score would indicate poor performance in that area when instead, it should have indicated a strong performance or little to no risk. For 30 questions, the majority of which were in the environment and governance sections, a score of 7 indicates little to no risk.¹ To further explain this change in methodology, Question 1 (Q1) represents most questions in the scale where a high score indicates a strong performance and a lower risk. Question 2 (Q2) is the opposite where a high score indicates poor performance and constant risk. For example:

Q1: Is there a presence of formal institutions to monitor the industry? If yes, how effective are the institutions?

Yes, the institution is very effective = 7

(A score of 7 would indicate a lower risk on the original scale)

Q2: (reversed question): Does the mining of gems cause deforestation?

Yes, the mining of the gem always causes deforestation = 7,

(A score of 7 would also indicate a lower risk on the original scale. Causing deforestation puts the country at greater risk and poor performance in this indicator.

We reversed this score because deforestation does increase risk; therefore, the new reversed score is 1.)

A score of 7 must indicate a low risk for all questions, so the scores accurately reflect the risk level. Additionally, a few questions had a corresponding follow-up question, thus skewing country average results. For example:

Q1: Are there specific anti-corruption laws for the industry?

Q2: Are anti-corruption laws enforced concerning the industry?

In this case, there are two questions about anti-corruption laws out of five on corruption.

¹ See Annex C for an explanation of all reversed questions.

It is also important to note that no answers were recorded as a simple “yes” or “no”; rather, all questions were scaled to analyze effectiveness. For example, for some questions such as “*Q1: Are there specific anti-corruption laws for the industry?*” a yes would indicate a score of 7 or little to no risk; however, even if anti-corruption laws are in place, they do not ensure that laws are being observed. A substantial risk of corruption could exist despite laws being on the books and scaling to analyze effectiveness on all indicators allowed for more accurate representations of each human security risk in each industry.

This report is also the first time the JDII project analyzed gems according to a seven-point Likert scale. There are two differences between the previous system and this one:

1. In our scoring system, a higher score means better performance or lower risk. Whereas in the previous system, a higher score meant a higher risk.
2. We use 1-7, and the previous reports used 0-5. In our two-country comparison, we transformed the previous score into the 1-7 scoring system. The transformation equation is $\text{New score} = -6/5 * \text{previous score} + 7$.

Table 4. Previous Methodology Scoring Key

0	Always or Yes	No-Risk
1	Almost Always	Very Low Risk
2	Usually	Low Risk
3	Sometimes	Moderate Risk
4	Almost Never	High Risk
5	Never or No	Very High Risk

Chapter 4: Research Gap/Gap Analysis

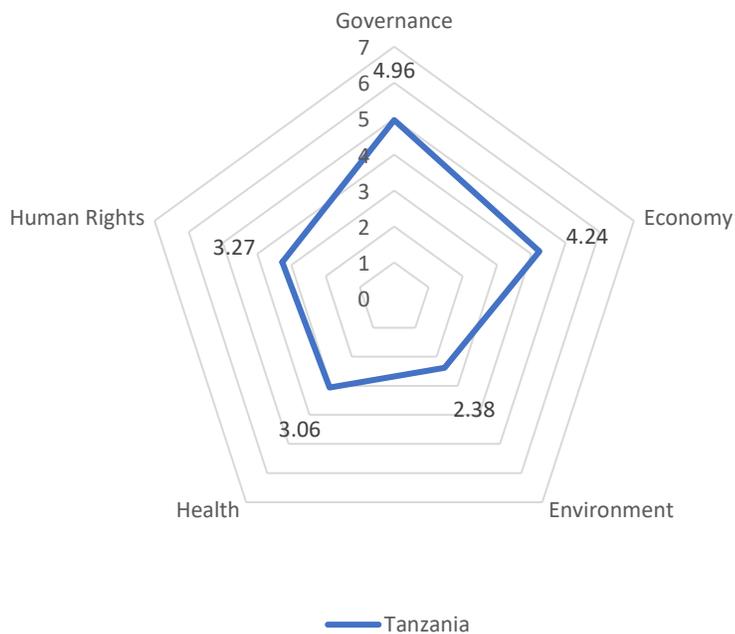
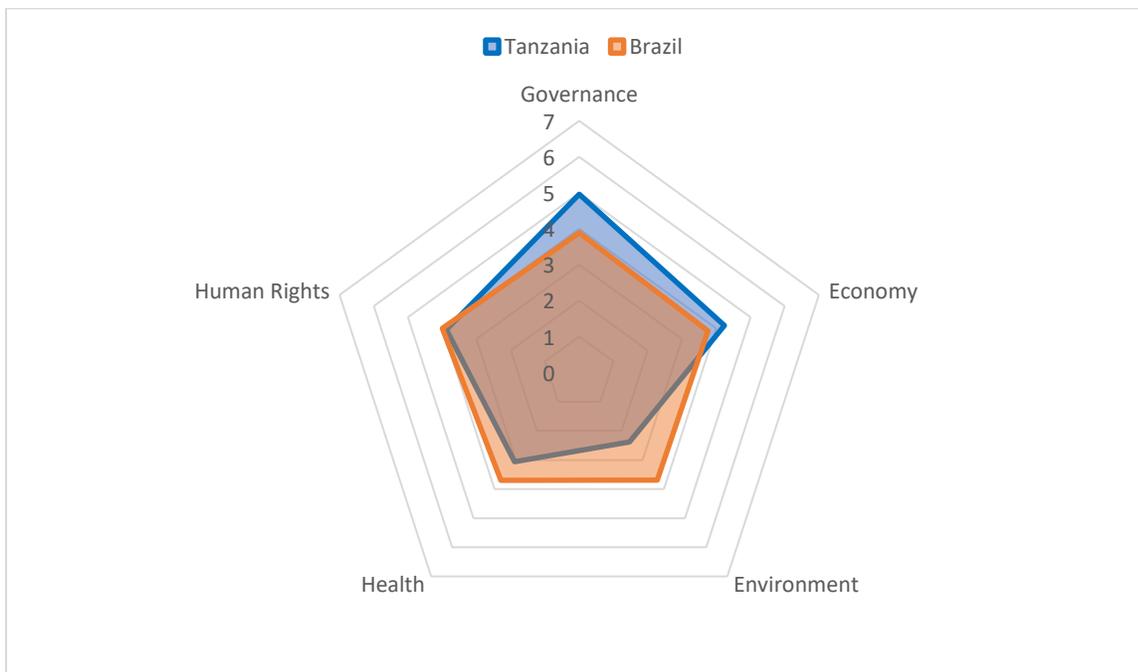
There are significant gaps in available information related to amethyst and citrine mining in Brazil and tanzanite mining in Tanzania. One of the largest gaps is the lack of available quantitative data on both the amethyst/ citrine and tanzanite industries, much of the research for this report was gathered from interviews

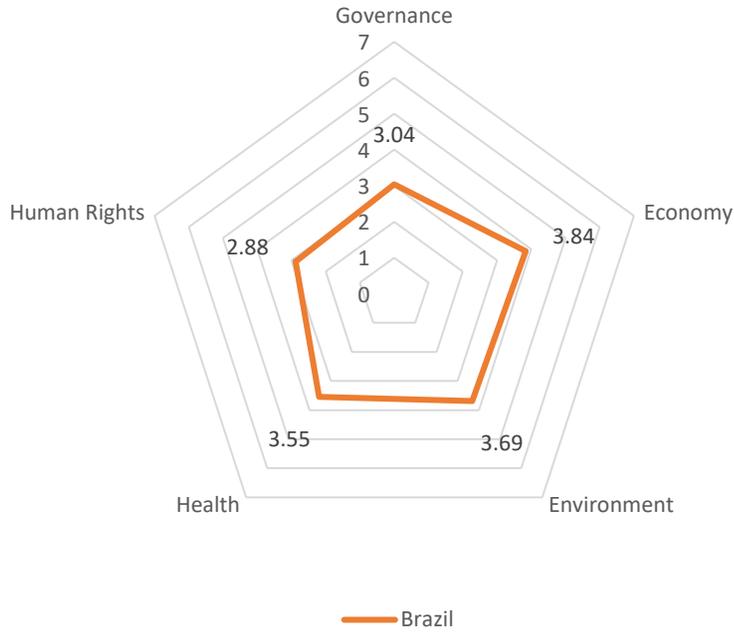
Most research gaps existed due to the lack of available data. Most data available was overgeneralized to reflect all mining industries in each country as opposed to focusing specifically on the amethyst/citrine and tanzanite industries. Additionally, information that did concentrate specifically on amethyst and tanzanite did not necessarily focus on all the human security risk indicators. Both Brazil and Tanzania are actively mining other gems and minerals that may have higher human security risks. At times, the international community overlooks the impact of these smaller extractive industries. Likewise, the effects of smaller industries - such as amethyst, citrine, and tanzanite - might have a marginal effect when compared to much larger industries such as diamonds or gold.

Most of the available research on amethyst and citrine mining in Brazil focuses on technological advancements, and most of the quantitative studies were conducted in the 1970s and 1980s. Published information about the amethyst and citrine mining industries is outdated as policies, and human security risks have changed over the past 40 to 50 years. Additionally, the informal nature of the northern Brazilian mining industries made it difficult to find accurate information. To fill the information gap, the research team conducted semi-structured interviews with local gemstone experts, academics, journalists, and geologists in northern and southern Brazil.

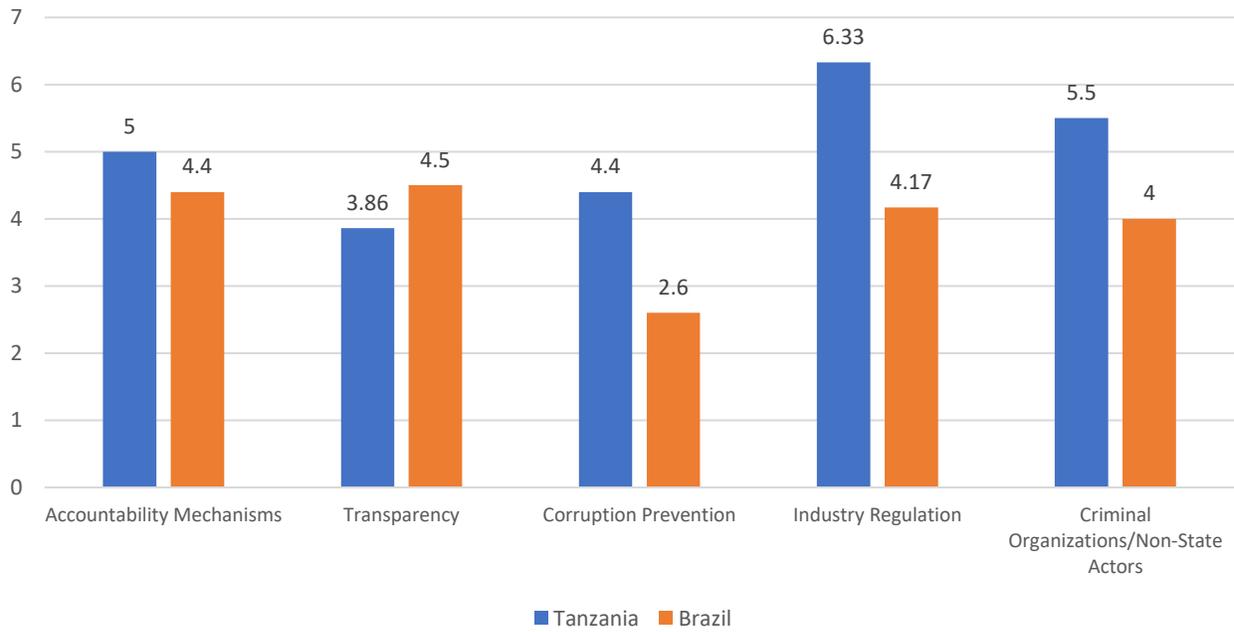
In addition to the dearth of data, the tanzanite research team encountered contradictory statements from interviewees. This report intends to show all perspectives and responses to provide a full summary of the impacts of the tanzanite industry. Also, there have been substantial changes in both Tanzania and the tanzanite industry since 2015. We found limited research reflecting these changes. For example, in 2017, the Tanzanian government built a wall around the tanzanite mine. Our interviewees suggested that the wall eliminated child labor, but we were unable to find any recent studies to substantiate these claims.

Chapter 5: Two-Country Comparison





Governance Score



The JDII indicator scores for governance vary from similar to vastly different. In total, Brazil scored a 3.04, and Tanzania scored a 4.96 out of 7, which puts Tanzania generally facing lower risk to governance than Brazil.

Brazil received a higher risk (risk score: 4.4) for accountability mechanisms because of the desperate nature of the industry and the sheer difference in size, especially with two separate regions (north and south) with different industrial governance settings. This is compared to Tanzania's tanzanite industry (risk score: 5), which is confined to a small 12-square mile area that is easier for the state to manage.

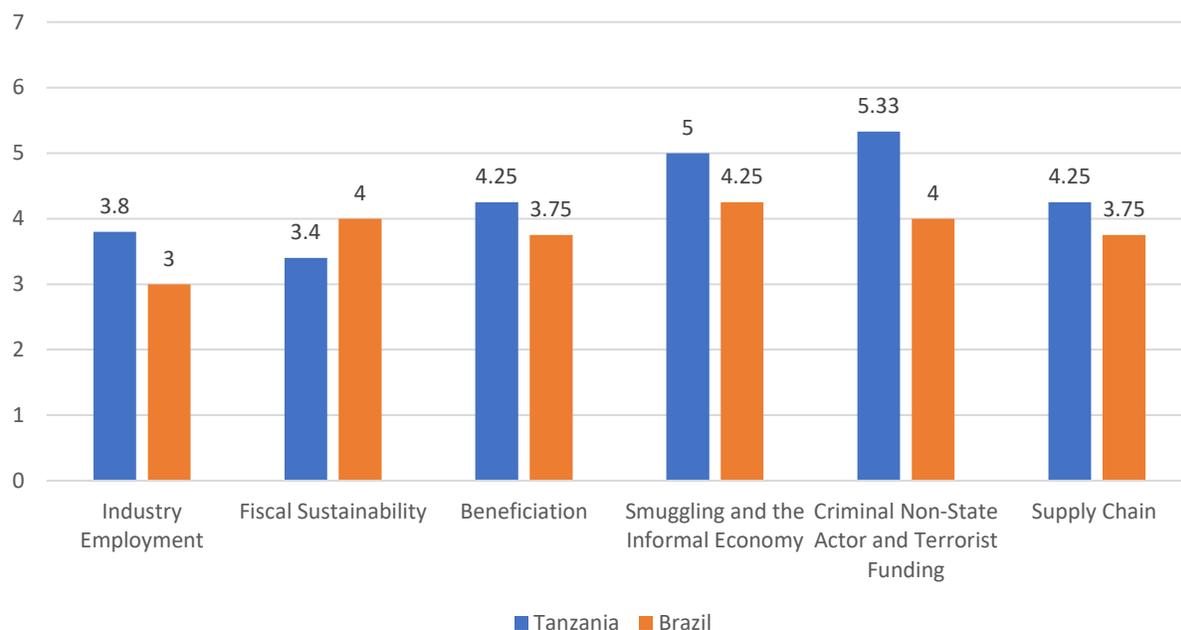
For transparency, Brazil holds a lower risk score of 4.5 compared to Tanzania's 3.86. This is largely because of the difference in bureaucratic and democratic development in both countries: Brazil has more accountability mechanisms for the state, while Tanzania is still considered in a lower stage of democratization.

For corruption, Brazil received a much higher risk score (2.6) compared to Tanzania (4.4). This is the case because of two main reasons: 1) Brazil has loose anti-corruption laws in the gemstone industry, and none focused solely on amethyst, and 2) similarly to the accountability score, Tanzania has a greater ability to police corruption since the tanzanite industry is so tightly geographically concentrated.

The industry regulation scores show a similar deficit in risk as corruption, with Brazil at a medium risk of 4.17 and Tanzania at a very low risk of 6.33. Again, the differences are due to the geographically limited nature of the tanzanite industry and the ease in which the state can regulate.

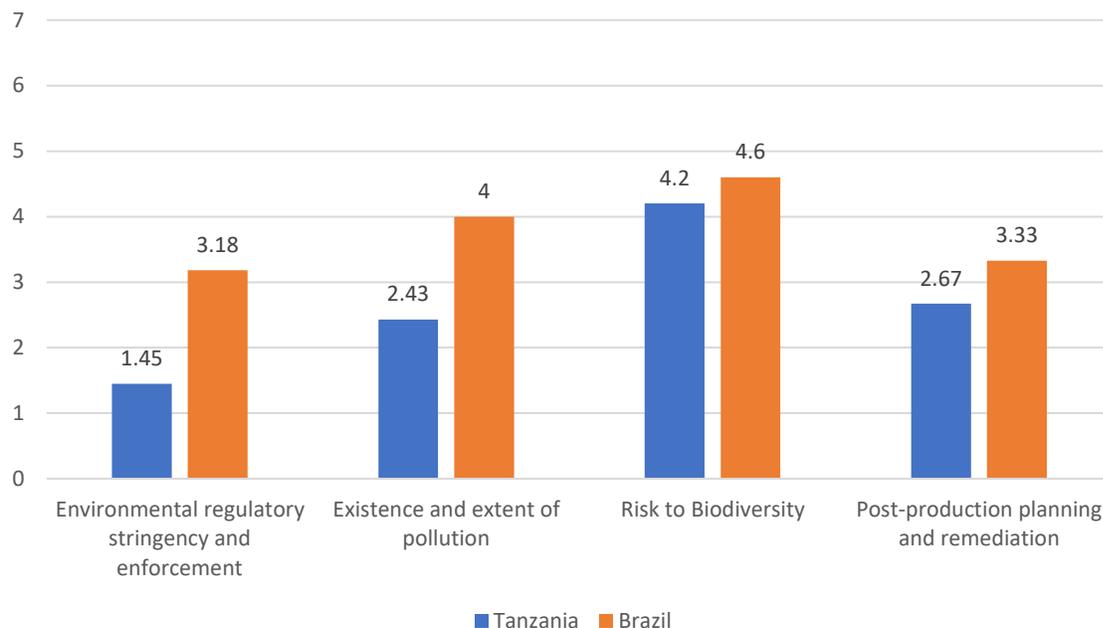
The criminal/non-state actor risk scores hold Tanzania scoring at a low 5.5 and Brazil scoring at a medium 4. However, these scores might betray the nature of crime/etc. In the respective industries: amethyst is an inexpensive gem, and so criminality is reduced to petty crimes in comparison to larger operations around more valuable stones, and tanzanite is so tightly controlled geographically that smuggling is the only significant crime around that industry.

Economy Score



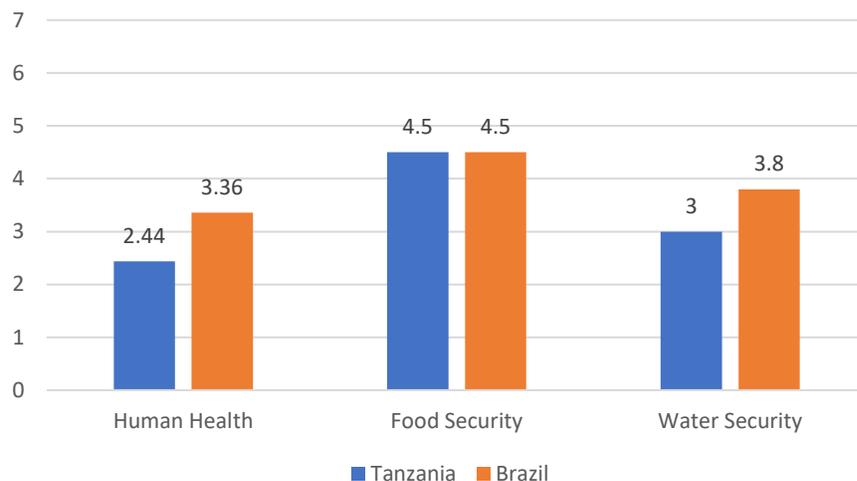
The JDII indicator scores for economics vary significantly based on the country. In total, Brazil scored a 3.84, and Tanzania scored a 4.24 out of 7, which puts both countries within low to moderate risk. Brazil received a higher risk for industrial employment because of the informal nature of the industry, which scored a 3 and Tanzania a 3.8. For fiscal sustainability, Tanzania scored a 3.4, and Brazil scored a 4. Tanzania's higher risk is due to the fluctuation of the tanzanite production in recent years and the operating problem with TanzaniteOne. For beneficiation, Tanzania scored 4.25, marginally higher since the government is introducing all value-added activities back to the country, where Brazil scored a 3.75. Smuggling and the Informal Economy are at a higher risk for Brazil because of the bureaucratic mining license process and heavy tax system, where Brazil scored a 4.25, and Tanzania scored a 5. The Tanzanian government has implemented export regulations and security checks around the mining area to prevent smuggling. Both Brazil and Tanzania lack terrorist presence. However, Brazil scored a higher risk in criminal non-state actor and terrorist involvement due to the organized informal industry, where Brazil scored a 4, and Tanzania scored a 5.33. Brazil and Tanzania both scored a 4.25 in supply chain management, as most of the market heavily coexists with cooperatives, such as TanzaniteOne and COOGAMAI.

Environment Score



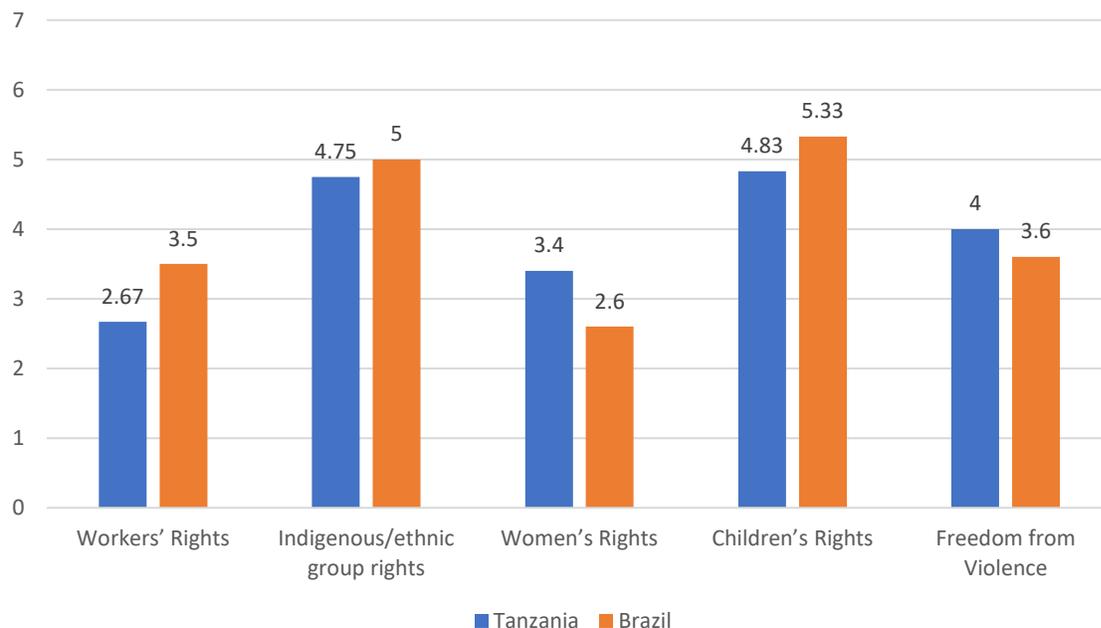
The JDII indicator scores for the environment vary significantly based on the country. In total, Brazil scored a 3.69, and Tanzania scored a 2.38 out of 7, which puts both countries within high to very high risk. Tanzania received a higher risk for environmental regulatory stringency because of the lack of enforcement of environmental laws in the industry, scoring a 1.45 and 3.18 for Brazil. For the existence of pollution, Tanzania scored a higher risk of 2.43, and Brazil scored a 4. The high risk of pollution is due to the lack of enforcement of environmental regulations within Tanzanite mining in Tanzania. Tanzania also scored a medium risk in biodiversity and high risk in post-production planning and remediation with scores of 4.20 and 2.67, respectively, and Brazil scores of 4.60 and 3.33. Brazil's risk to the environment is higher when considering other mining operations of minerals, apart from amethyst.

Health Score



The JDII indicator scores for health vary slightly based on the country. In total, Brazil scored a 3.55, and Tanzania scored 3.06 out of 7, which puts both countries within the high risk. Brazil scored higher on both human health and water security. Both countries scored the same for food security, as the jewelry industries' only notable impact on food security is that farmers start mining. We scored Brazil slightly higher for human health because of Tanzania's high rated of injury and fatalities and the lack of sanitation facilities near the mines. Additionally, neither tanzanite nor amethyst mining requires significant amounts of water, but the improperly discarded waste rock does contribute to water pollution in both cases. The difference is that our research indicates that the Tanzanite mining area in Tanzania is facing a greater water scarcity problem compared to the many amethyst mining areas in Brazil.

Human Rights



Overall regarding risk to human rights, Brazil scored 2.88 out of 7, and Tanzania scored 3.27 out of 7 which puts both countries within high to very high risk. Brazil received a higher score or has less risk of impact for workers' rights due to the individual nature of amethyst mining scoring 3.6, whereas, in Tanzania, all workers are under one specific mine scoring a total of 2.67. Regarding indigenous/ethnic group rights, Brazil scored a 5, and Tanzania scored a 4.75; in Brazil, some informal mines have the potential to affect indigenous communities.

Regarding women's rights, Brazil scored 2.6, and Tanzania scored 3.4 – women in Brazil cannot usually participate in the amethyst mining industry, whereas in Tanzania, the industry is making reforms and is much more open to women mining. Regarding children's rights, Brazil scored 5.33 and Tanzania scored 4.53; children are not commonly found in the mining process of either industry. Regarding Freedom from violence Tanzania's risk with a score of 4 is higher than Brazil's score of 3.6; overall, an average risk to both countries. Both industries were around the average range for human rights risks.

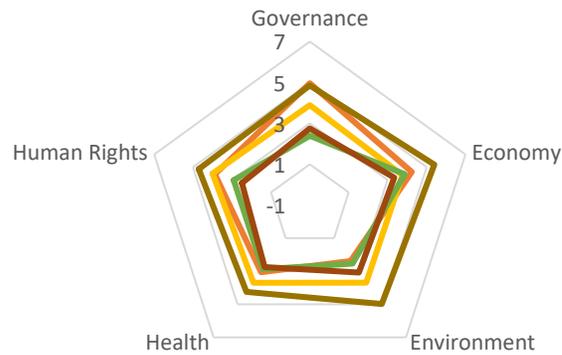
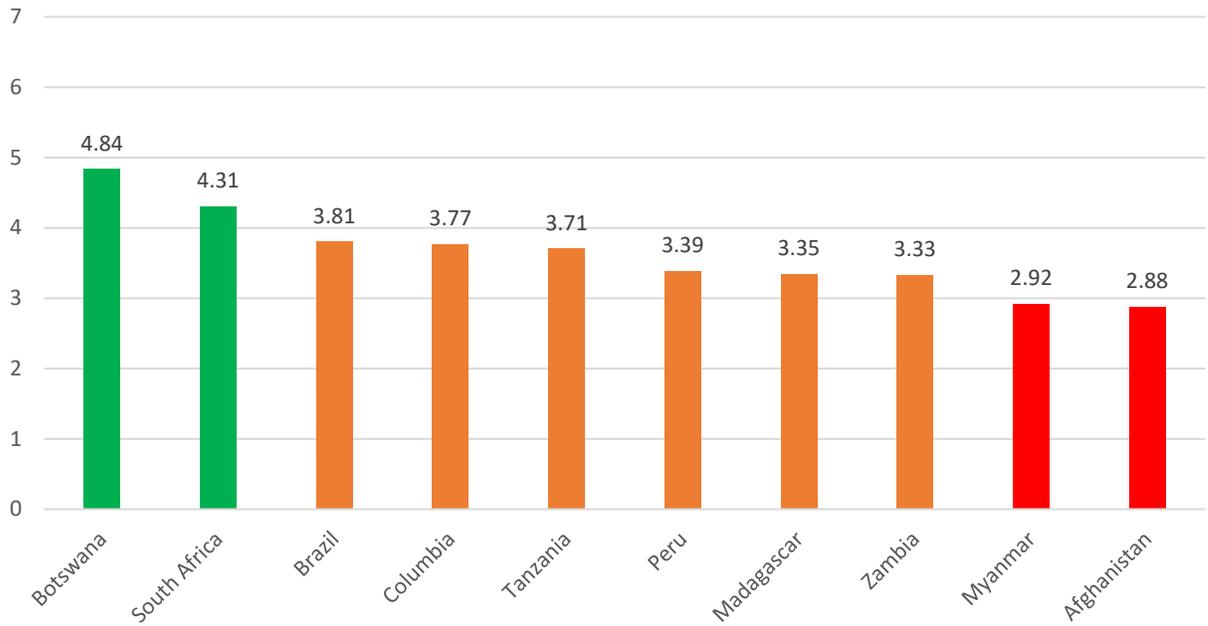
Chapter 6: Ten Country Comparison

This report is the fifth in a series of projects aiming to develop an accurate and useful tool to analyze the jewelry industry's impact on developing countries. As such, it is important to scale this iteration to the previous reports. The JDII methodology has changed substantially over the last four projects. This limits some of our cross-project analysis and validity of previous scores, as some of the scores have been adapted three times to fit three different scoring systems. We translated all eight previous scores into our updated methodology using the scores from the previous countries. Additionally, we reversed scores several scores so that a seven indicated a low risk for all questions. We do not believe that other research teams did this, so some of the sub-indicator scores may be inaccurate. We did not conduct independent research on any of the previous countries. Notwithstanding these restrictions, the graphs show the scalability of our current methodology to compare different sized mining industries in different.

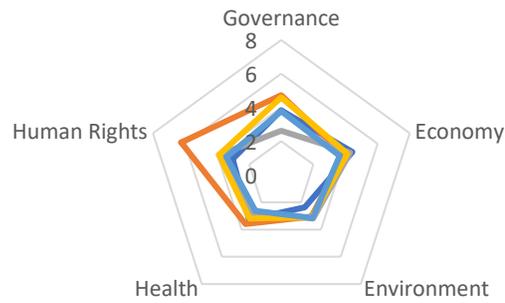
Scoring Bar Graph Key

	Strong	> 5
	Moderate	4-5
	Weak	3-4
	Very Weak	<3

Ten Country Comparison Total Scores



— Tanzania — Brazil — Myanmar — Afghanistan — Botswana



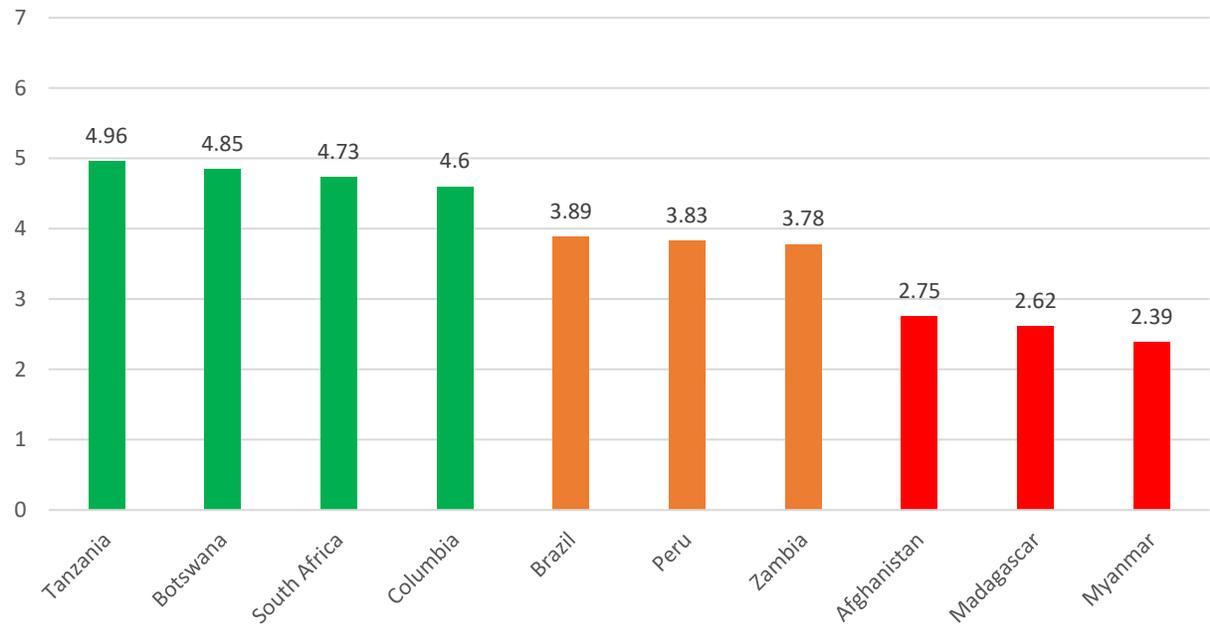
— Peru — South Africa — Madagascar — Columbia — Zambia

Ten Country Comparison by Sub-Indicator

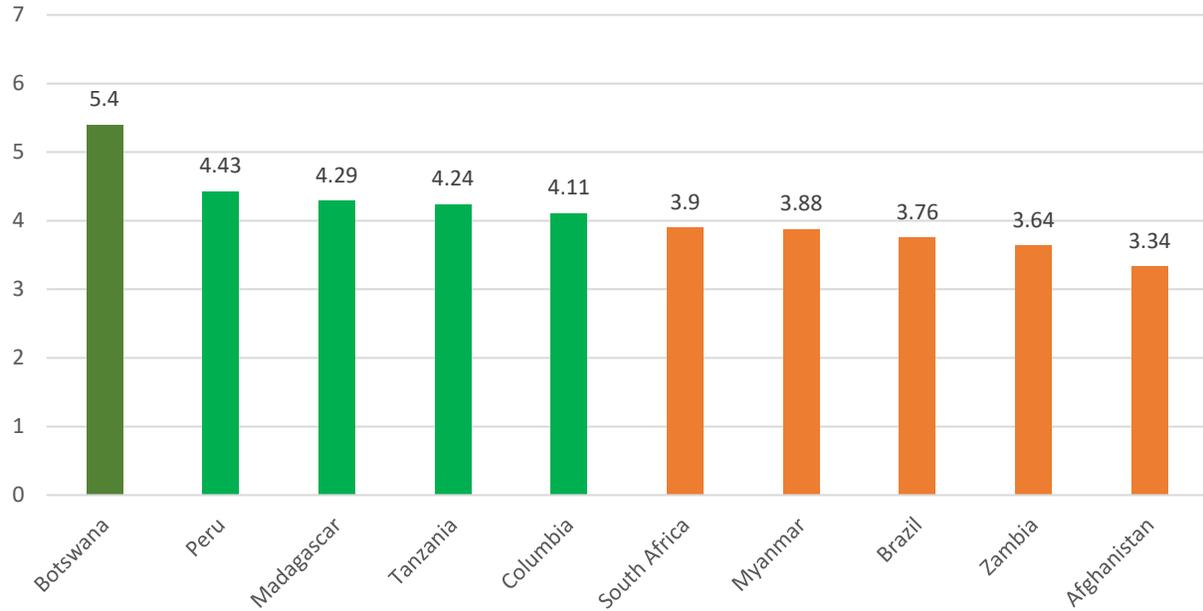
Scoring Bar Graph Key

	Strong	> 5
	Moderate	4-5
	Weak	3-4
	Very Weak	<3

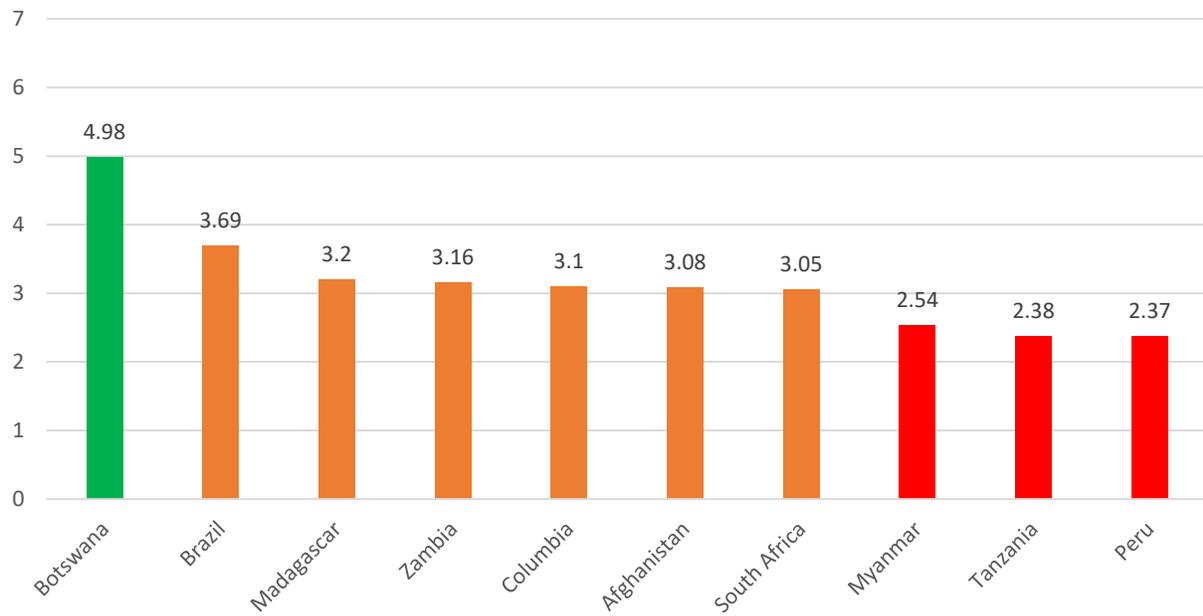
Governance



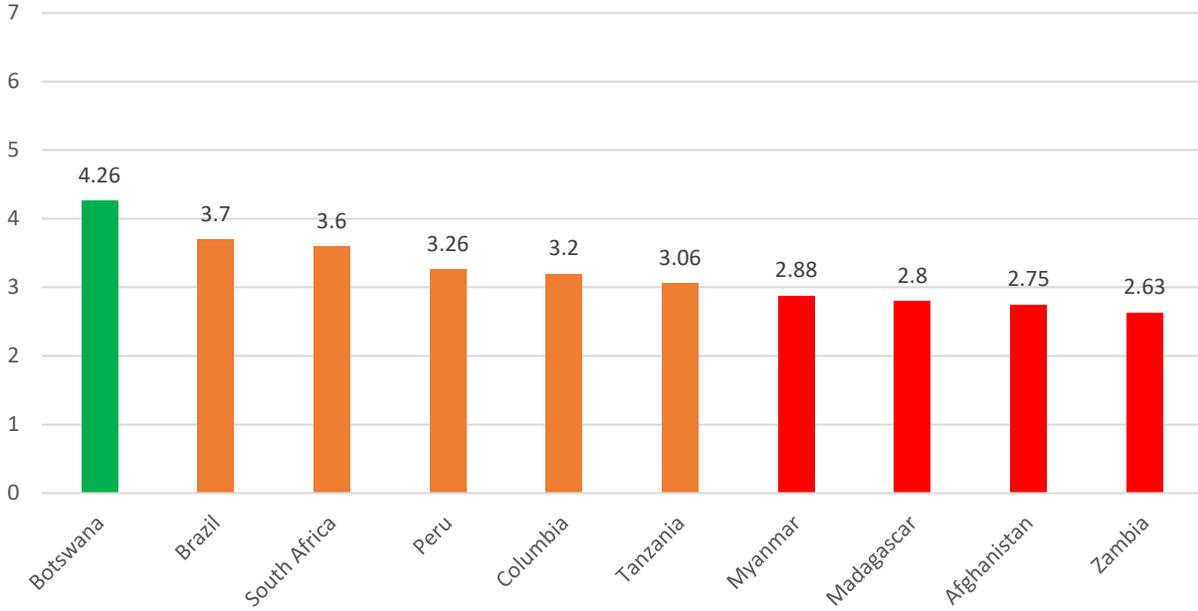
Economy



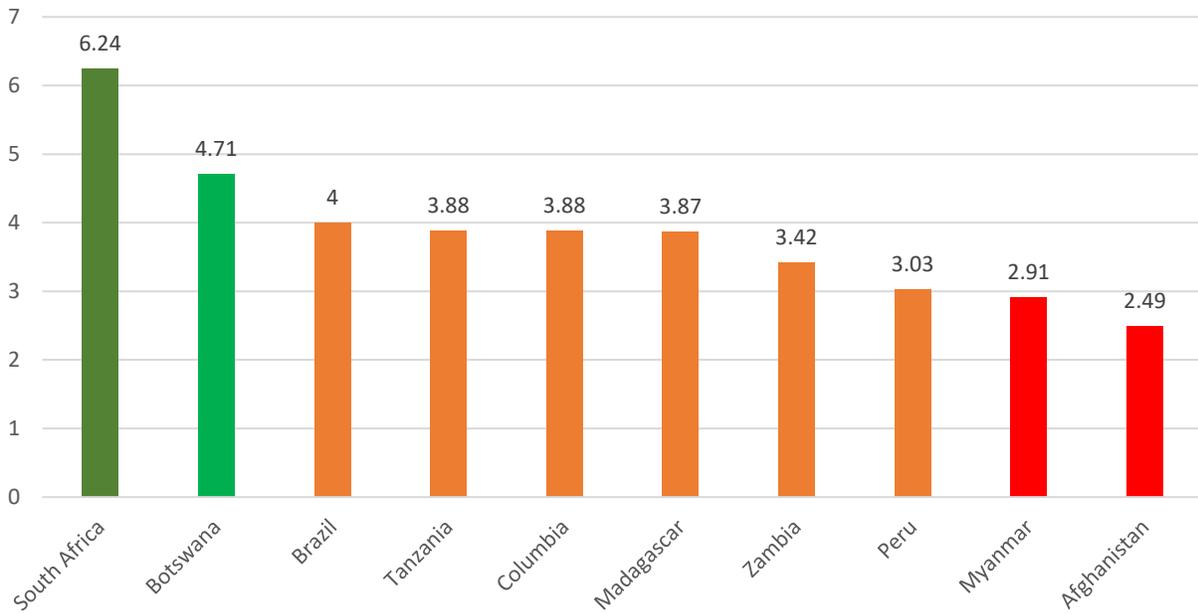
Environment



Health



Human Rights



Ten Country Comparison, 1-7 Scoring System

Scoring Index

Score		
0	Not Applicable	Not Applicable
1	Never/No	Very High Risk
2	Rarely	High risk
3	Occasionally	Moderate Risk
4	Average	Average
5	Frequently	Low Risk
6	Very Frequently	Very Low Risk
7	Always/Yes	No-Risk

	Tanzania	Brazil	Myanmar	Afghanistan	Botswana	Peru	South Africa	Madagascar	Columbia	Zambia
Governance										
Accountability										
Mechanisms	5.00	3.00	3.10	4.60	5.56	3.16	4.60	3.40	4.84	3.60
Transparency	3.86	3.86	4.40	3.75	2.68	5.50	5.56	1.00	5.67	4.60
Corruption										
Prevention	4.40	2.60	1.00	1.00	2.60	3.40	5.80	2.80	4.30	4.00
Industry										
Regulation	6.33	2.83	2.44	3.40	6.40	6.10	3.70	3.40	5.60	4.20
Criminal										
Organizations/Non-State Actors	5.50	2.00	1.00	1.00	7.00	1.00	4.00	2.50	2.50	2.50
Total	4.96	3.04	2.39	2.75	4.85	3.83	4.73	2.62	4.60	3.78

Ten Country Comparison in 1-7 scoring system

	Tanzania	Brazil	Myanmar	Afghanistan	Botswana	Peru	South Africa	Madagascar	Columbia	Zambia
Governance										
Accountability Mechanisms	5.00	3.00	3.10	4.60	5.56	3.16	4.60	3.40	4.84	3.60
Transparency	3.86	3.86	4.40	3.75	2.68	5.50	5.56	1.00	5.67	4.60
Corruption Prevention	4.40	2.60	1.00	1.00	2.60	3.40	5.80	2.80	4.30	4.00
Industry Regulation	6.33	2.83	2.44	3.40	6.40	6.10	3.70	3.40	5.60	4.20
Criminal Organizations/Non-State Actors	5.50	2.00	1.00	1.00	7.00	1.00	4.00	2.50	2.50	2.50
Total	4.96	3.04	2.39	2.75	4.85	3.83	4.73	2.62	4.60	3.78
Economy										
Industry Employment	3.80	3.00	6.60	6.70	7.00	5.08	7.00	5.08	3.10	5.20
Fiscal Sustainability	3.40	4.00	4.20	1.80	3.16	4.60	4.36	3.64	5.56	2.68
Beneficiation	4.25	3.75	3.51	1.60	4.60	5.50	3.40	4.60	4.00	2.80
Smuggling and the Informal Economy	5.00	4.25	3.40	4.55	6.70	4.60	3.70	4.00	5.80	3.40
Criminal Non-State Actor and Terrorist Funding	5.33	4.00	3.40	2.60	7.00	3.40	1.00	5.00	1.80	5.80
Supply Chain	4.25	4.25	2.20	2.80	4.00	3.40	4.00	3.40	5.50	2.80
Total	4.24	3.84	3.88	3.34	5.40	4.43	3.90	4.29	4.11	3.64
Environment										
Environmental regulatory stringency and enforcement	1.45	3.18	3.05	3.23	5.00	3.05	2.60	2.80	3.92	3.75
Existence and extent of pollution	2.43	4.00	2.03	3.23	4.95	1.85	3.60	4.40	2.88	2.03
Risk to Biodiversity	4.20	4.60	2.44	3.64	5.00	1.96	2.20	2.20	3.40	2.68
Post-production planning and remediation	2.67	3.33	2.60	2.20	5.00	2.60	3.80	3.40	2.20	4.20
Total	2.38	3.69	2.54	3.08	4.98	2.37	3.05	3.20	3.10	3.16
Health										

Human Health	2.44	2.64	1.77	1.77	5.40	4.92	4.00	3.70	3.51	3.51
Food Security	4.50	4.00	4.20	2.60	3.60	2.40	2.80	2.50	3.40	2.20
	Tanzania	Brazil	Myanmar	Afghanistan	Botswana	Peru	South Africa	Madagascar	Columbia	Zambia
Water Security	3.00	5.20	2.68	3.88	3.80	2.44	4.00	2.20	2.68	2.20
Total	3.06	3.55	2.88	2.75	4.26	3.26	3.60	2.80	3.20	2.63
Human Rights										
Workers' Rights	2.67	2.50	3.60	3.60	4.60	3.60	6.40	1.60	4.60	2.80
Indigenous/ethnic group rights	3.25	2.00	NR	1.60	2.80	6.70	4.90	3.40	3.40	4.60
Women's Rights	3.80	3.00	2.44	1.48	4.60	1.72	5.56	3.40	2.68	2.92
Children's Rights	3.50	2.83	3.40	2.20	6.70	3.64	6.52	5.32	5.08	4.12
Freedom from Violence	3.20	4.00	NR	2.68	6.04	3.40	6.04	4.12	3.64	2.68
Total	3.27	2.88	2.91	2.49	4.71	3.03	6.24	3.87	3.88	3.42
Total country score	3.58	3.40	2.92	2.88	4.84	3.39	4.31	3.35	3.77	3.33

Chapter 7: Recommendations for Future JDII Development

This project intends to develop an accurate and useful tool to analyze the jewelry industry's impact on developing countries. As such, we recommend that future JDII projects consider implementing four changes.

Our first recommendation is that future teams research gems that have a significant impact on the country's overall economy. In Brazil, amethyst and citrine are relatively inexpensive stones. The governance or economic risks from the amethyst industry are outweighed by risks from larger mining industries, notably gold. In Tanzania, the mining and processing of tanzanite only occur in a small geographical area, and so the environmental and health footprint of such an industry is smaller compared to larger extractive industries (e.g., gold or diamonds). Since tanzanite and amethyst and citrine are drastically different in scale, relevance, and value than other extractive industries in their country, we believe that a study of different gems would have yielded more comprehensive and impactful results.

Additionally, we recommend that future teams continue to use our updated seven-point scale with the reversed questions. However, future teams should reverse the scale, as explained in the methodology section.

Finally, we recommend that future teams change some of the questions, so they are all scored on the same Likert scale. Currently, the scoring guide uses three seven-point Likert scales: "Never" to "Always," "Constant Risk" to "No Risk," and "Worst" to "Great." Simplifying the question styles to a single Likert scale could reduce confusion and benefit future analysts and clients. This would mean changing the wording of many of the questions, as well as choosing a single measurement of the three listed above.

Conclusion

This report presented the findings in the fifth series of the Jewelry Development Impact Index (JDII) that analyzed amethyst's production impact in Brazil and tanzanite's production impact in Tanzania on human security risks such as governance, economy, environment, health, and human rights. This report, in combination with the four previous reports, contributes to a uniform measurement tool to assess the impact of the jewelry industry on local human security and development. According to the methodology employed, Brazil's overall score of 3.4 and Tanzania's overall score of 3.58 suggest that amethyst and tanzanite industries highly to moderately impact human security and human development in the countries.

The highest human security risk in Brazil is human rights, which scored 2.88 out of 7. More specifically, the women who are systemically excluded from underground mining due to a high rate of sexual violence in the mines. Brazil's lowest risk to human security is an environment, which scored 3.69 out of 7. The amethyst and citrine industries in Brazil in formal contexts do not create a large environmental impact compared to other damaging extractive industries in Brazil.

All of Brazil's human security risk scores were between 2.88 and 3.69 out of a 7, less than one point from each other in a moderate risk range. We believe the scores are clustered together because these scores represent an average of two very different industries: the formal amethyst industry in southern Brazil in towns such as Ametista do Sul as well as the clandestine informal industry that is apparent in northern Brazil in areas such as Sento Se, Bahia. There are over 500 amethyst mines in Brazil, 107 of which exist just in Ametista do Sul, and there are significant regional differences. This report averaged higher risk practices in northern Brazil and lower risk practices in southern Brazil to come up with a country average. While the industry has a low risk in established areas such as Ametista do Sul in southern Brazil, as more amethyst deposits are discovered in Brazil, the situation is likely to continue changing regarding high-risk areas.

The highest human security risk in Tanzania is environmental, which scored 2.38 out of 7 due to weak environmental regulations. The lowest human security risk is governmental, which scored 4.49 out of 7. As tanzanite is only mined in one relatively small area, it is better able to regulate

this industry. We believe that other mining industries in Tanzania would have lower governance scores than tanzanite. Tanzanite's future impact on human security remains uncertain. The lack of relevant recent data makes it difficult for us to analyze the effectiveness of recent policy changes. These policies could reduce the industries' impact on human security; however, alternatively, they may not create lasting change.

We built upon the previous group's mythologies and proposed several changes. Our most significant change is that we made reversed scored several questions so that a score of seven corresponds to a lower risk across all our questions. This significantly changed several sub-indicator scores.

We used both interviews and literature to score the countries as accurately as possible. Two researchers are fluent in Portuguese and were able to communicate directly with contacts in Brazil. However, we were not able to spend any time in either Brazil or Tanzania conducting research. Scores will need to be updated as more data becomes available because the mining situations of Amethyst in Brazil and tanzanite in Tanzania will continue to change in both countries.

Annex A: Two-Country Comparison Index (with Revised Scores)

Revised Scores Results

Governance	Tanzania	Brazil
Accountability Mechanisms	5.00	3.00
Transparency	3.86	3.86
Corruption Prevention	4.40	2.60
Industry Regulation	6.33	2.83
Criminal Organizations/Non-State Actors	5.50	2.00
Total Score	4.96	3.04
Economy	Tanzania	Brazil
Industry Employment	3.80	3.00
Fiscal Sustainability	3.40	4.00
Beneficiation	4.25	3.75
Smuggling and the Informal Economy	5.00	4.25
Criminal Non-State Actor and Terrorist Funding	5.33	4.00
Supply Chain	4.25	4.25
Total Score	4.24	3.84
Environment	Tanzania	Brazil
Environmental regulatory stringency and enforcement	1.45	3.18
Existence and extent of pollution	2.43	4.00
Risk to Biodiversity	4.20	4.60
Post-production planning and remediation	2.67	3.33
Total Score	2.38	3.69
Health	Tanzania	Brazil
Human Health	2.44	2.64
Food Security	4.50	4.00
Water Security	3.00	5.20
Total Score	3.06	3.55
Human Rights	Tanzania	Brazil
Workers' Rights	2.67	2.50
Indigenous/ethnic group rights	3.25	2.00
Women's Rights	3.80	3.00
Children's Rights	3.50	2.83
Freedom from Violence	3.20	4.00
Total Score	3.27	2.88
Country Score	3.58	3.40

Revised Scores Results

Governance	Tanzania	Brazil
Accountability Mechanisms	5.00	3.00
Transparency	3.86	3.86
Corruption Prevention	5.20	1.40
Industry Regulation	6.33	2.83
Criminal Organizations/Non-State Actors	5.50	2.00
Total Score	5.11	2.81
Economy	Tanzania	Brazil
Industry Employment	3.80	3.00
Fiscal Sustainability	3.40	4.00
Beneficiation	4.25	3.75
Smuggling and the Informal Economy	5.00	4.25
Criminal Non-State Actor and Terrorist Funding	5.33	4.00
Supply Chain	5.25	4.25
Total Score	4.40	3.84
Environment	Tanzania	Brazil
Environmental regulatory stringency and enforcement	1.45	3.18
Existence and extent of pollution	3.00	4.29
Risk to Biodiversity	2.60	3.80
Post-production planning and remediation	2.67	3.33
Total Score	2.23	3.62
Health	Tanzania	Brazil
Human Health	3.33	2.45
Food Security	2.00	3.25
Water Security	3.00	4.80
Total Score	2.94	4.00
Human Rights	Tanzania	Brazil
Workers' Rights	2.67	2.50
Indigenous/ethnic group rights	3.25	2.00
Women's Rights	3.80	3.00
Children's Rights	3.50	2.83
Freedom from Violence	3.20	4.00
Total Score	3.27	2.88
Country Score	3.59	3.43

Annex B: Questions used for Scoring Results

scores of the bolded questions were reversed.

0= Not Applicable, (Not applicable)

1=Never (None)

2=Rarely (Very rare)

3= Occasionally (Rare)

4= Average

5=Frequently (Few)

6=Very Frequently (Some)

7= Always (Many)

Risks to Governance

Questions on Accountability Mechanisms

- Is there presence of formal institutions to monitor the industry? (0, 1-7)
- If yes, how effective are the institutions? (0, 1-7)
- Are violators of the rule of law in regards to the industry held accountable? (0, 1-7)
- Are the locations of industry actors, such as mining companies, etc., physically accessible to the government? (0, 1-7)
- Is there confidence that the government holds industry actors accountable? (0, 1-7)
- Are there informal institutions that monitor the industry on a micro-level? (0, 1-7)

Questions on Transparency

- Is data about industry actors easily accessible and publicly available? (0, 1-7)
- Is the government a participant member of the Open Government Partnership? (0, 1-7)
- Are there any civil society actors focused on industry issues present? (0, 1-7)
- Is information about the issuing of prospecting and mining permits open and available to the public? (Y/N)
- Does the government have a framework to ensure the traceability of the mined resources?(0, 1-7)
- Are whistleblowers in the industry protected under the law? (0, 1-7)
- Is the country an implementer of the Extractive Industries Transparency Initiative (EITI)? (0, 1-7)
- Are any of OECD due diligence guidelines followed? (0, 1-7)
 - Responsible Business Conduct (human rights, environment, corruption, and government)
 - OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas

Questions on Corruption Prevention

- Are there specific anti-corruption laws for the industry? (0, 1-7)
- Are anti-corruption laws enforced in relation to the industry? (0, 1-7)
- Do government officials publicly disclose their finances? (0, 1-7)
- Does rent-seeking have a presence in the industry? (0, 1-7)
- Is there existence of written or formal anti-corruption programs that prohibit bribery in business practices and transactions? (0, 1-7)

Questions on Industry Regulation

- Is there active government body or structure that establishes industry regulations? (0, 1-7)
- Does the government enforce industry regulations? (0, 1-7)

- Are there penalties for violating industry regulations? (0, 1-7)
- Are industry actors incentivized, either in terms of financial returns or threat of prosecution, to abide by industry regulations? (0, 1-7)
- Is the process of obtaining permits or licenses related to the industry accessible? (0, 1-7)
- Is the process of obtaining permits or licenses related to the industry timely? (0, 1-7)

Questions on Criminal Organizations/Non-State Actors

- Is the illegal industry free of international criminal organizations? (0, 1-7)
- Is the illegal industry free of terrorist organizations? (0, 1-7)
- Is the illegal industry free of national or local criminal organizations? (0, 1-7)
- Is the industry free of illegal or criminal government involvement? (0, 1-7)

Risks to Economy

Questions on Industry Employment

- What is the availability of the formalized industries? (0, 1-7)
- Is the potential income for most workers in the industry equal to or higher than the country average? (0, 1-7)
- Do companies in the industry hire the majority (more than 60%) of their employees locally, i.e., employees are citizens of the country? (0, 1-7)
- Does the work offered in this industry provide a reliable income? (0, 1-7)
- Does the country's labor force have the capacity (education/skills) to take up other, service-sector jobs (i.e. marketing, oversight, etc.) - in addition to primary/extractive/mining activities? (0, 1-7).

Questions on Fiscal Sustainability

- Does the government effectively collect taxes and royalties on the industry? (0, 1-7)
- Does the government reinvest revenue earned from the industry back into communities most affected by the industry? (0, 1-7)
- Has foreign direct investment in this industry generally been rising or stable in the last five years? (0, 1-7)
- Has global demand for the precious mineral or gem generally been rising or stable in the last five years? (0, 1-7)
- Is there enough of the natural resource left to ensure production for at least another decade? (0, 1-7)

Questions on Beneficiation

- Does the industry in the country include any higher value adding activities, e.g., refinement, manufacturing, stone cutting, jewelry crafting, etc., other than mining? (0, 1-7)
- Have there been any attempts by the government to create a national beneficiation strategy in this country? (0, 1-7)
- Have there been any attempts by the business sector to create beneficiation in this country? (0, 1-7)
- Is the country's labor force perceived as having the right skill sets and education levels necessary to pursue higher value adding activities than mining and refinement? (0, 1-7)

Questions on Smuggling and the Informal Economy

- What percent of the total industry is formal? Formal means that industry companies operate as legally recognized as businesses.

- 0= 100% of the industry is formal.
- 1=90-90.99% of the industry is formal.
- 2=70-89.99% of the industry is formal.
- 3=50-69.99% of the industry is formal.
- 4=20-49.99% of the industry is formal.
- 5=0-19.99% of the industry is formal.

- What is the availability of regulations in place to prevent illegal exports? (0, 1-7)
- Does the government tend to actively prevent illegal exports and smuggling? (0, 1-7)
- Is the precious mineral or gem easy for regulatory export agents to identify in its raw form? (Y/N)

Criminal Non-State Actor and Terrorist Funding

- How organized is the informal industry? (0, 1-7)
- Is the informal industry free of terrorist involvement? (0, 1-7)
- Is the informal industry free of criminal organizations'? (0, 1-7)

Questions on Supply Chain – integrating specific supply chain questions into economy and governance scores

- Do LSM companies ever work together to set industry standards in terms of ethical emerald extraction? (0, 1-7).
- **How significant is the illegal smuggling of commodities.? (0, 1-7)**
- What is the availability of local or international NGOs active in the country to ensure transparency and accountability in the supply chain process? (0, 1-7)
- Do mining cooperatives have influence on the value chain? (0, 1-7)
(mining cooperatives may exist outside formal corporations or government licensing but add to value chain)

Risk to the Environment

Questions on Environmental regulatory stringency and enforcement

- Does the process to receive a permit to prospect or mine include environmental concerns, including interference with the area's biodiversity, pollution, remediation, etc.? (0, 1-7)
- Does the government have the capacity to enforce environmental protections? (0, 1-7)
- Are there environmental reserves which are protected from ANY mining activity? (0, 1-7)
- Are the protected areas free of mining by mining companies or informal industry actors? (0, 1-7)
- Is the government enforcing regulations to limit or remediate air pollution? (0, 1-7)
- Is the government enforcing regulations to limit or remediate water pollution? (0, 1-7)
- Is the government enforcing regulations to limit or remediate soil pollution? (0, 1-7)
- Is there enough recycling of raw materials in the product making process? (0, 1-7)
- Are there initiatives to reduce electricity consumption of the burn-out process? (0, 1-7)
- Are there initiatives to reduce electricity consumption in the mining process? (0, 1-7)
- Are there initiatives to reduce fuel consumption of the mining and product manufacturing process? (0, 1-7)

Questions on existence and extent of pollution

- **Are activities regarding mining or refining of the gem cause air pollution? (0, 1-7)**

- **Does mining or refining of the gem cause water pollution? (0, 1-7)**
- Are there regulations in place to limit or remediate air pollution? (0, 1-7)
- Are there regulations in place to limit or remediate water pollution? (0, 1-7)
- **Does mining or refining of the gem cause soil pollution? (0, 1-7)**
- Are there regulations in place to limit or remediate soil pollution? (0, 1-7)
- How effective is the enforcement mechanism? (0, 1-7)

Questions on Risk to Biodiversity

- **Does mining of gems cause deforestation? (0, 1-7)**
- If mining causes deforestation, are reforestation initiatives in place? (0, 1-7)
- **To what extent does mining of gems contribute to the country's overall deforestation? (0, 1-7)**
- **Does mining of precious gems cause erosion? (0, 1-7)**
- **Does mining take place in areas designated as highly biodiverse? (0, 1-7)**

Questions on post-production planning and remediation

- Are there regulations to ensure environmental remediation after a mine closes?(0, 1-7)
- Does the government ensure and enforce remediation? (0, 1-7)
- Is money set aside for remediation of closed mines appropriately distributed i.e., all the money collected for remediation from the mining company is used for remediation of the specified mine area? (0, 1-7)

Risks to Health

Questions on Human Health

- Are safety measures taken by mining companies to provide protective equipment and training for miners? (0, 1-7)
- **If not, how widespread is the lack of safety measures in place for miners? (0, 1-7)**
- Is the government contributing to the healthcare facilities to combat diseases? (0, 1-7)
- Are mining companies contributing to healthcare facilities to combat diseases? (0, 1-7)
- **Do mining activities cause bodily harm or fatality? (0, 1-7)**
- What is the availability of relevant health and safety act? (0, 1-7)
- Are mining companies held accountable for the health and safety of their workers? (0, 1-7)
- Do mine workers have health compensation provided by their employer? (0, 1-7)
- What level of access do miners have to sanitation facilities? (0, 1-7)
- Are there initiatives regarding reduction on mercury? (0, 1-7)
- Are there initiatives regarding arsenic? (0, 1-7)

Questions on Food Security

- **Are arable lands, i.e., lands previously used to grow crops, now being used for mining? (0, 1-7)**
0%, 1-20%, 20.1-40%, 40.1-60%, 60.1-80%, 80.1-100%
- After a mine is closed, is the community able to use the land for farming? (0, 1-7)
- **Are workers in the country's agricultural labor force leaving agriculture to work in the industry? (0, 1-7)**
0%, 1-20%, 20.1-40%, 40.1-60%, 60.1-80%, 80.1-100%
- **Has mining had an impact on the availability of food for the population? (0, 1-7)**

0%, 1-20%, 20.1-40%, 40.1-60%, 60.1-80%, 80.1-100%

Questions on Water Security

- **Is water security a problem for the country? (0, 1-7)**
- **Has the mining industry had an impact on the availability of clean water? (0, 1-7)**
0%, 1-20%, 20.1-40%, 40.1-60%, 60.1-80%, 80.1-100%
- Is the industry reusing, using, or purchasing gray water instead of using potable water for mining, refinement, and or manufacturing? (0, 1-7)
- Do workers in the industry have access to clean drinking water in their workplace and in their respective living accommodations? (0, 1-7)
- Does the industry require water for refinement and/or mining? (0, 1-7)

Risks to Human Rights

Questions on Workers' Rights

- Is there a minimum working age in the industry? (0, 1-7)
- Is there a limit of working hours in the industry? (0, 1-7)
- Are workers unionized and/or have they organized strikes collectively?(0, 1-7)
- Does the government provide compensation and resettlement package as prescribed in the law to individuals/families affected by mining? (0, 1-7)
- Do workers have any access to social protections i.e. social insurance, assistance, safety nets? (0, 1-7)
- Do the workers have legal protections from the government? (0, 1-7)

Questions on Indigenous/ethnic group rights

- Is indigenous and/or ethnic groups' ability to maintain and practice their culture negatively affected and or inhibited by the presence or operations of the industry? (0, 1-7)
- **Are certain ethnic and/or indigenous groups excluded from participating in the industry? (0, 1-7)**
- **Are indigenous and/or ethnic groups being displaced from their land by the industry? (0, 1-7)**
- **Are indigenous and/or ethnic groups barred from employment in this industry, formally and informally? (0, 1-7)**

Questions on Women's Rights

- Are women able to participate in this industry equally to men? (0, 1-7)
- Do women receive economic benefits from this industry equal to men, e.g., in terms of wages or resettlement compensations?(0, 1-7)
- Are women free from violence in association with the industry? (0, 1-7)
- Are women able to profit from the industry independently of men? (0, 1-7)
- **Are women/girls sexually exploited in direct or indirect connection, e.g., concentrated presence of miners in mining towns, with the industry?(0, 1-7)**

Questions on Children's Rights

- **Are children subject to forced labor in the industry?(0, 1-7)**
- **Are children denied education because of this industry? (0, 1-7)**
- **Are children's health or mental well-being threatened in some way because of this industry? (0, 1-7)**
- Does the government have laws to protect children's rights in general and or specific to the industry? (0, 1-7)

- Are children's physical rights violated because of the industry? (including harmful practices based on tradition, culture, religion, or superstition) (0, 1-7)
- Are children sexually exploited in direct or indirect connection to the industry? (0, 1-7)

Questions on Freedom from Violence

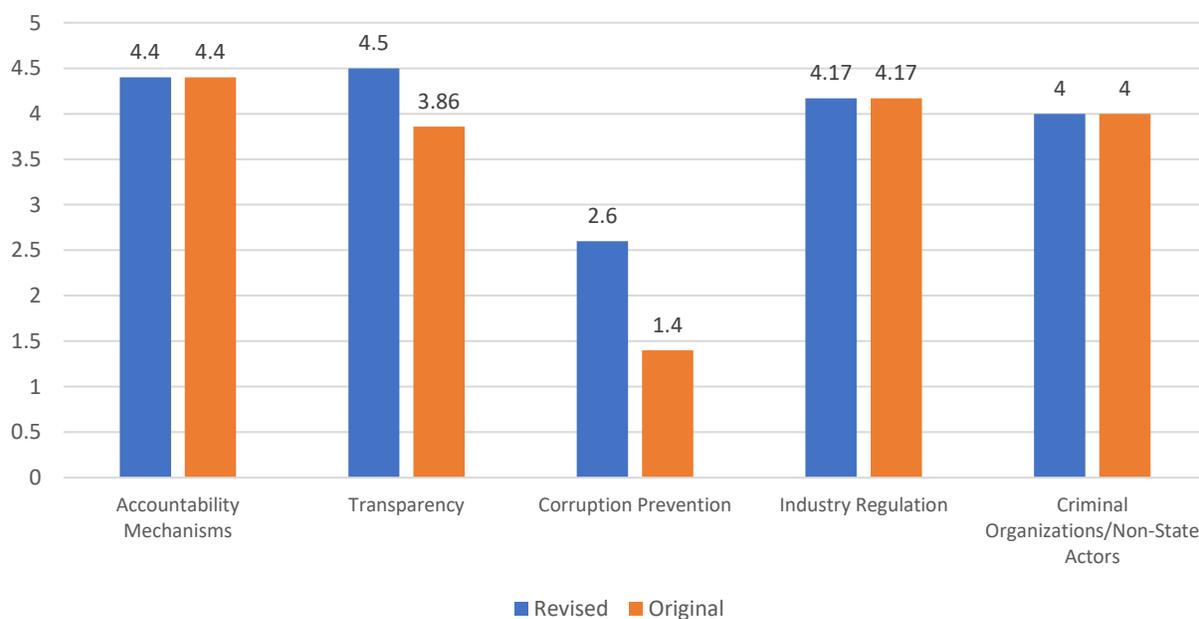
- Has violence/conflict emerged as the result of the industry, e.g., from worker protests, illegal mining, etc.? (0, 1-7)
- Has human trafficking increased as the result of this industry? (0, 1-7)
- Has domestic violence increased as the result of this industry, e.g., as a result of male miner's behavior at home and with "hot money"? (0, 1-7)
- Do communities in or around industry mining sites feel less secure? (0, 1-7)
- Does the government actively intervene to prevent or mitigate violence resulting from the presence of the industry? (0, 1-7)

Annex C: Impact of Reversing Question Scores

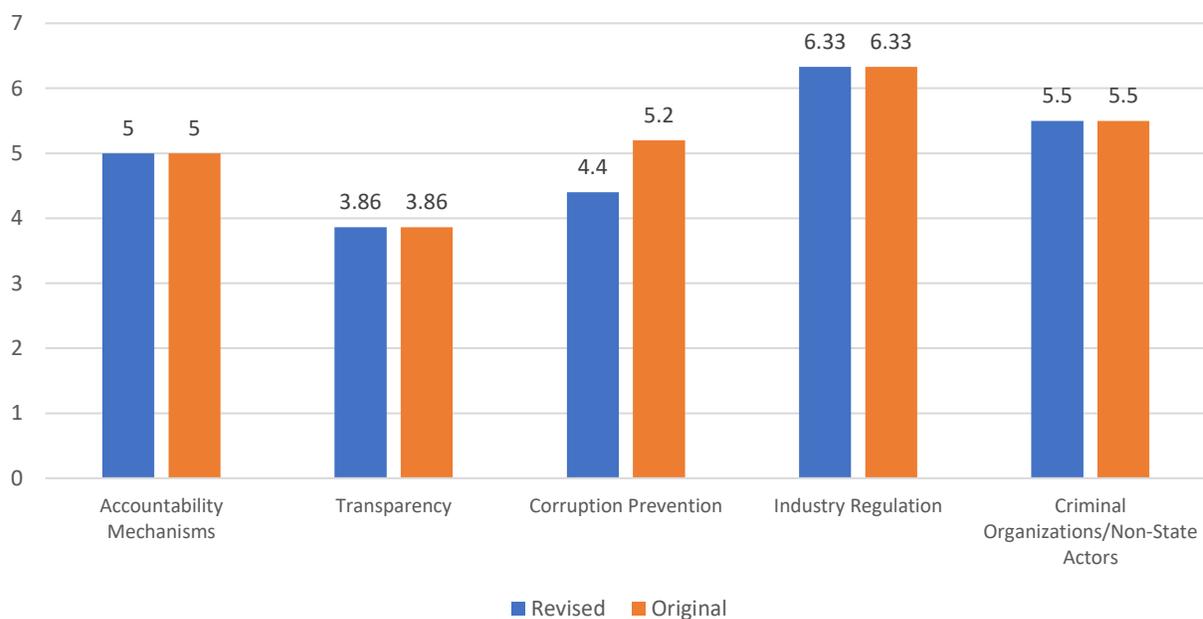
These graphs show the impact of the reversed scores of the bolded questions above.

- The higher the score =, the better the situation

Governance Scores Tanzania

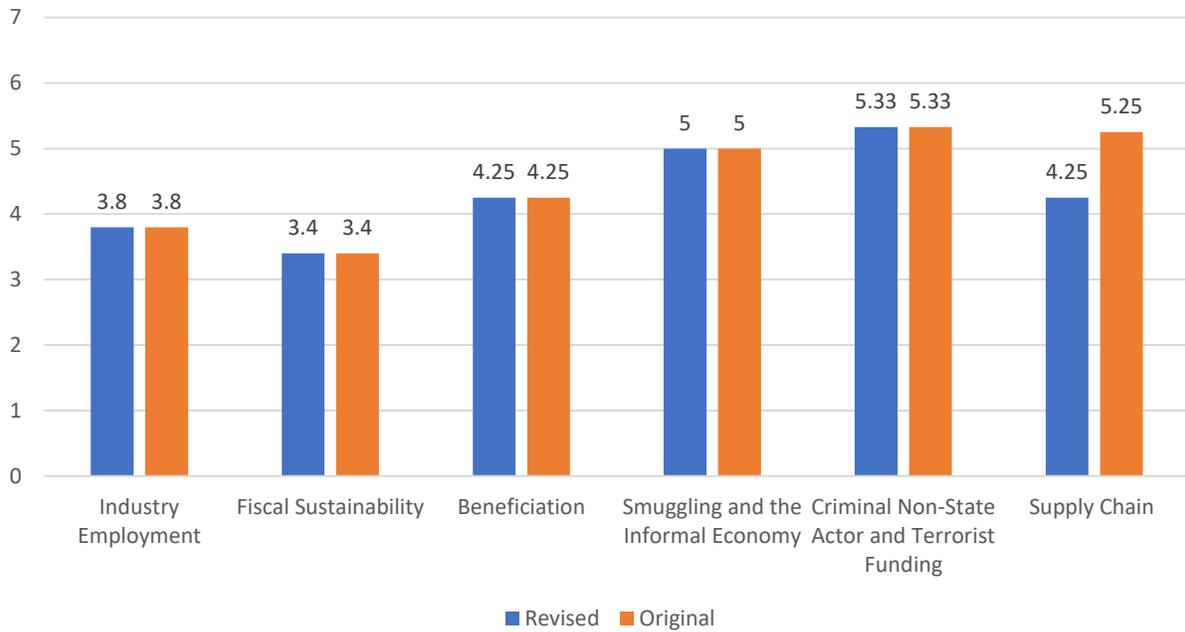


Brazil

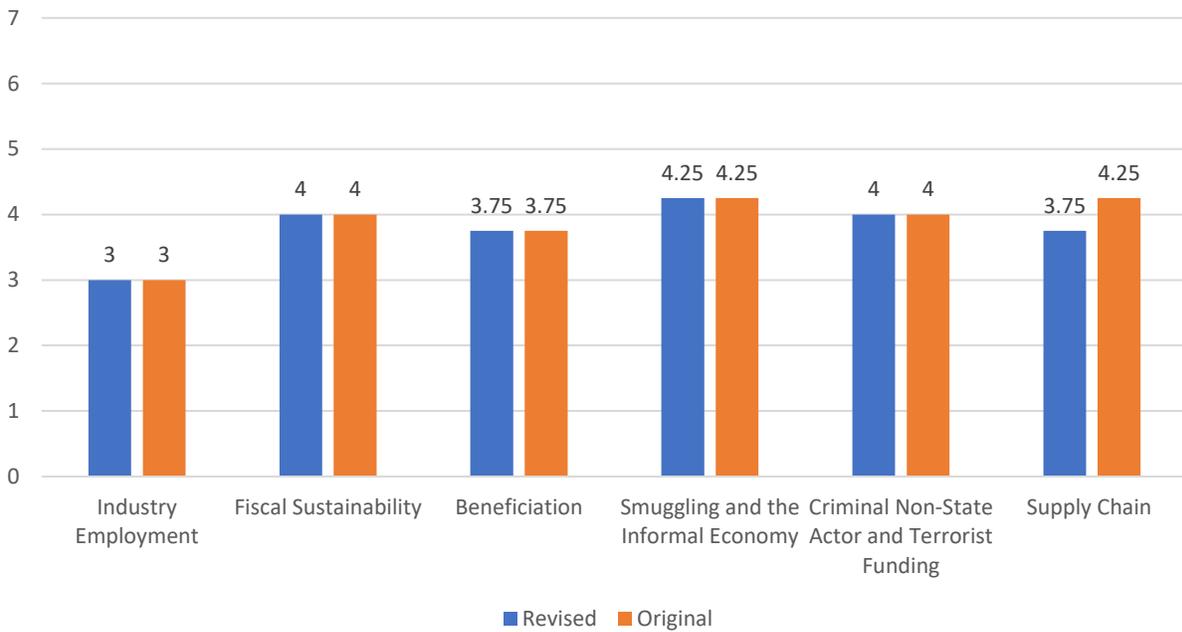


Economy Scores

Tanzania

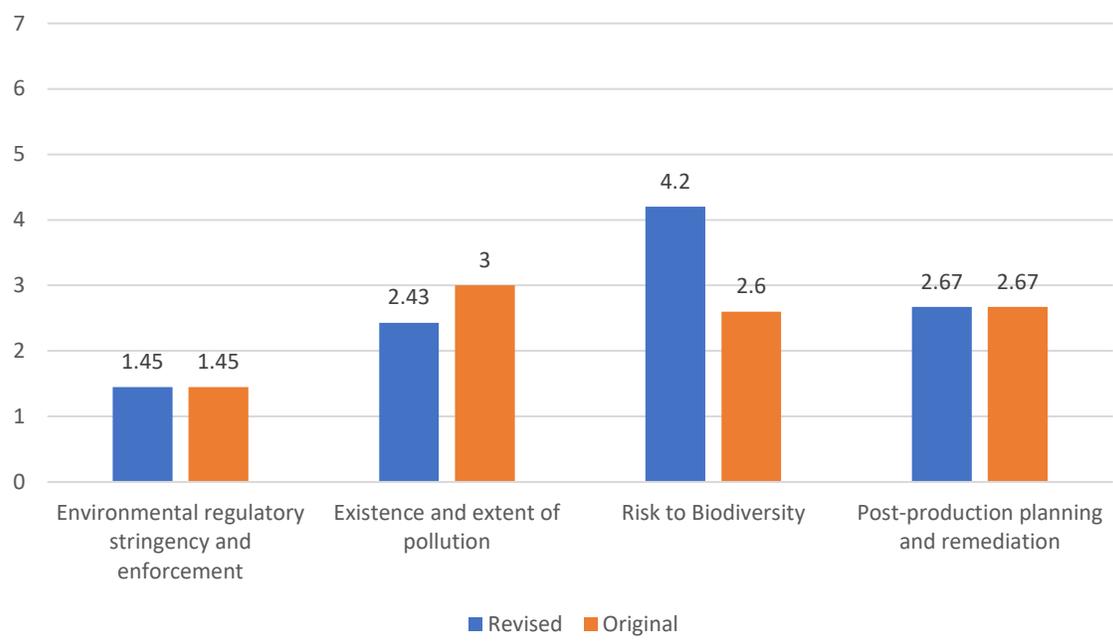


Brazil

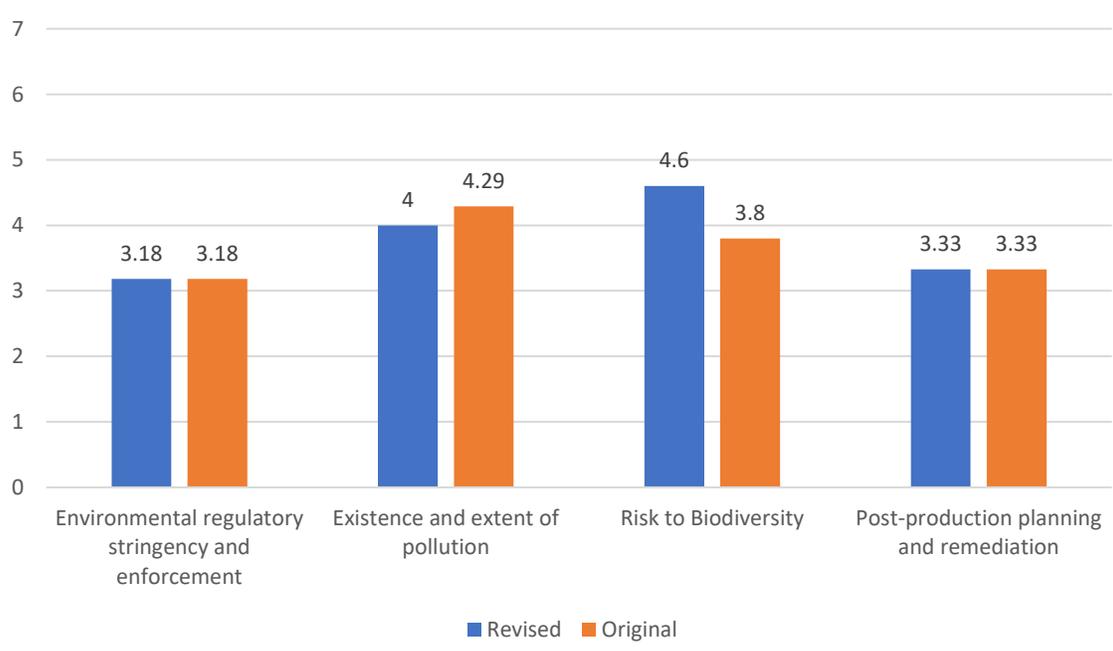


Environment Scores

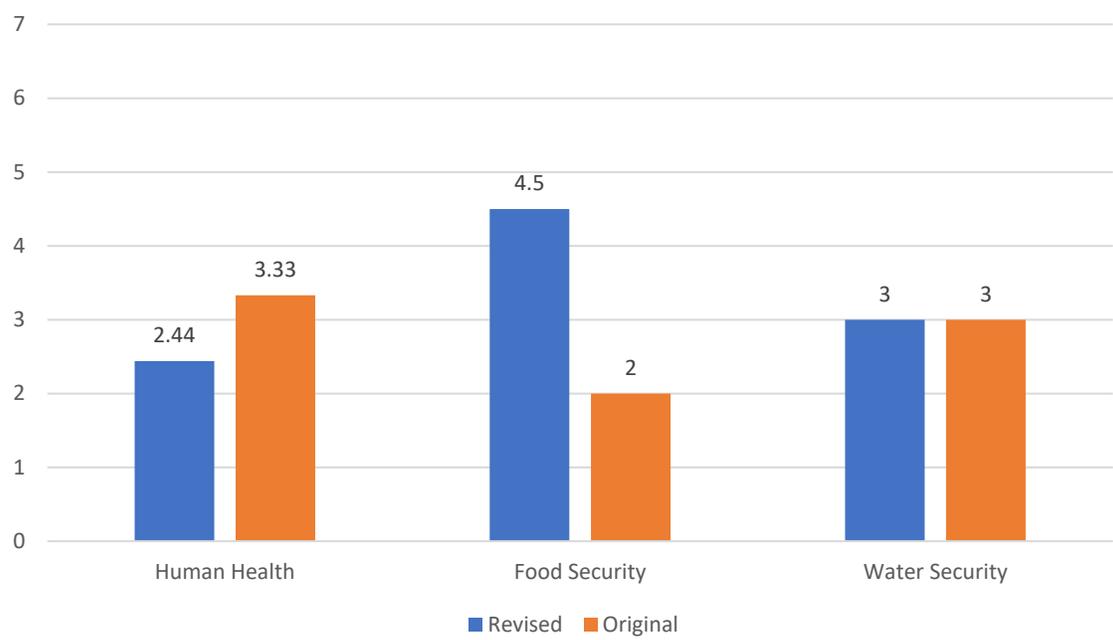
Tanzania



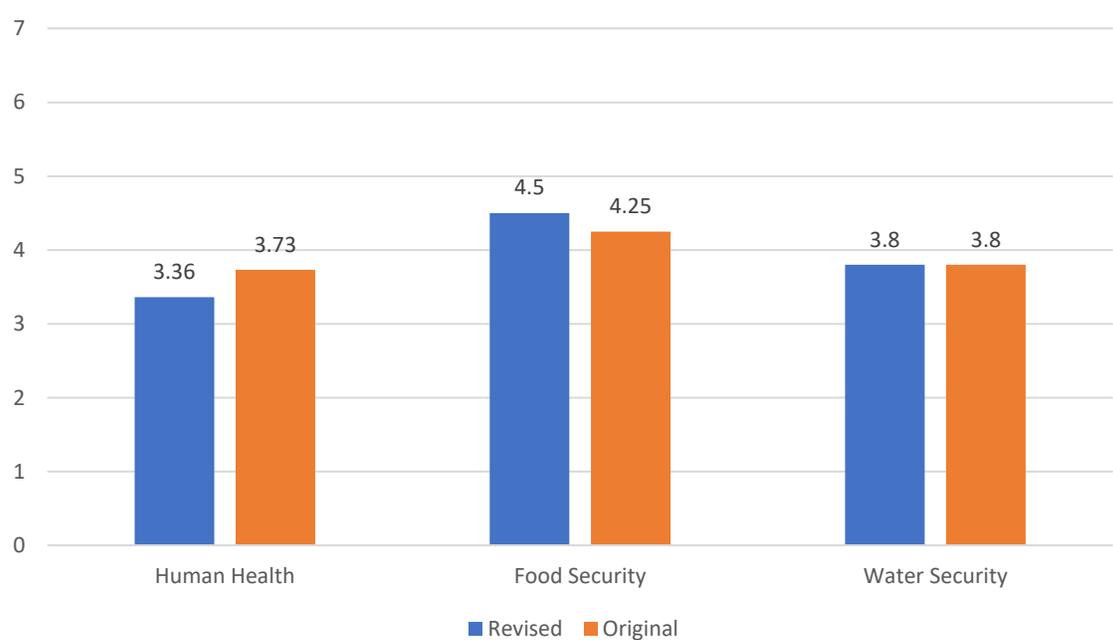
Brazil



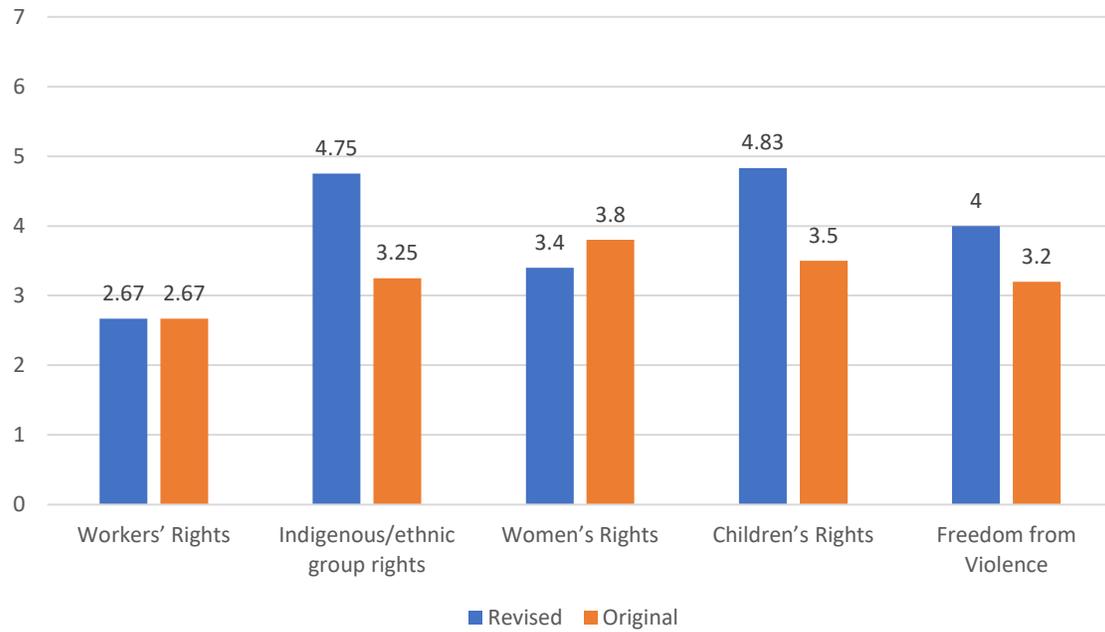
Health Scores Tanzania



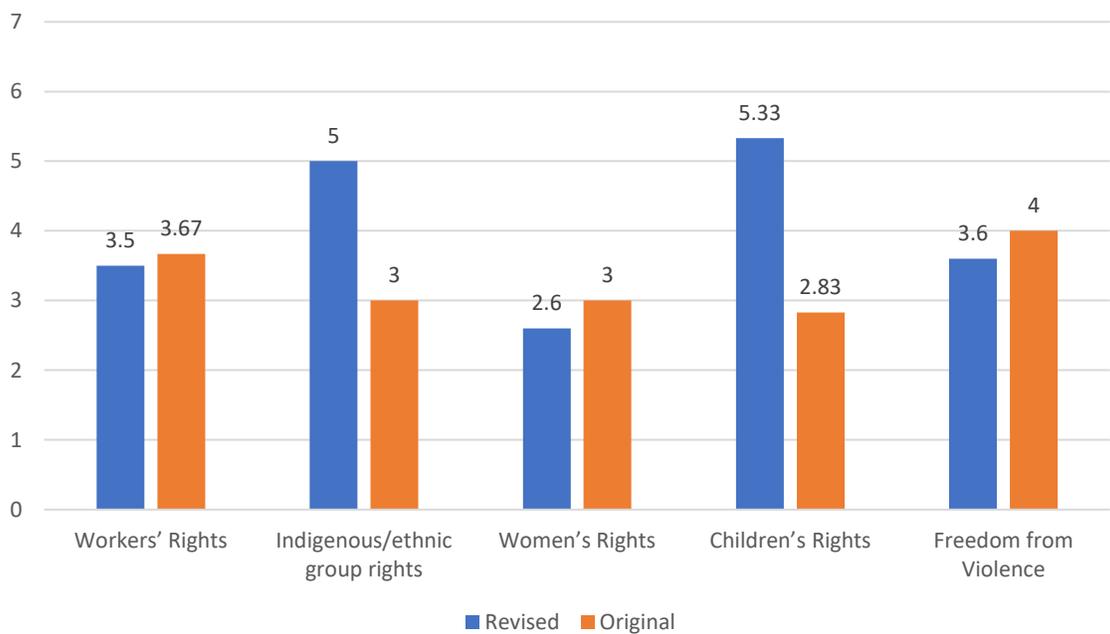
Brazil



Human Rights Tanzania

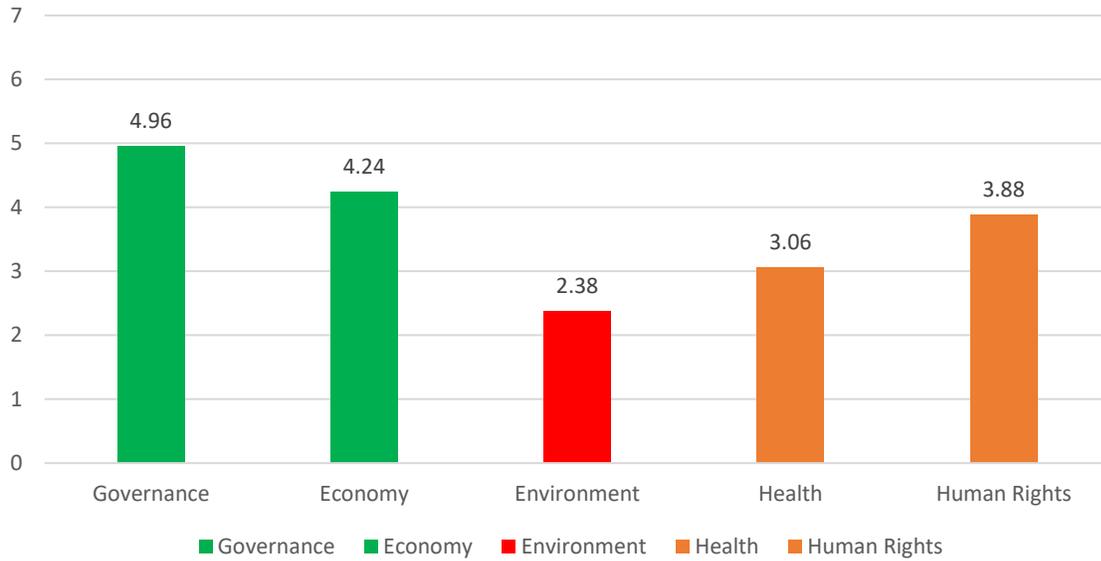


Brazil

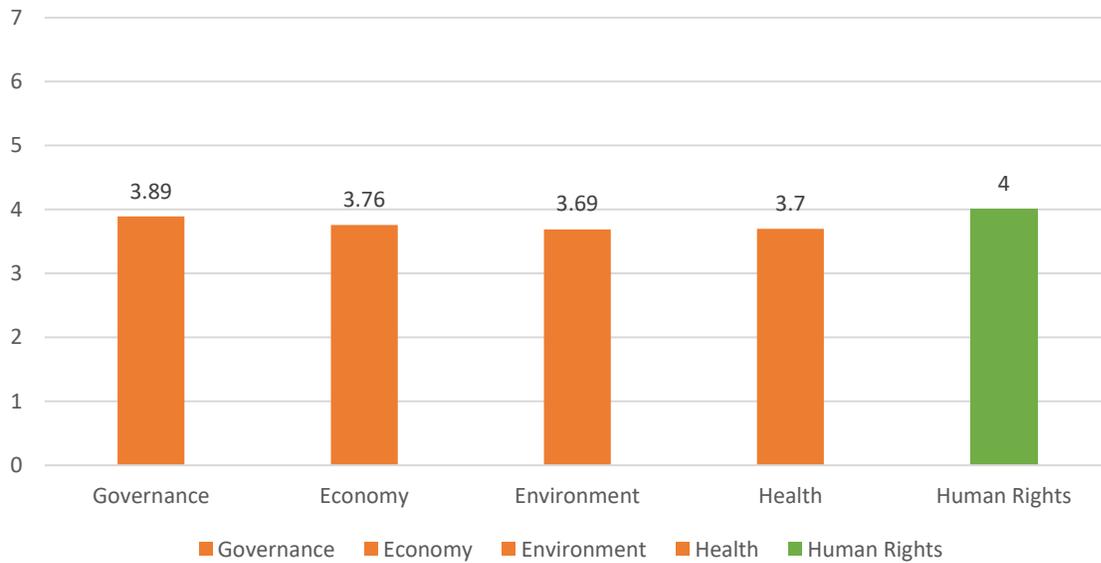


Annex D: Drivers of Risk – Brazil, and Tanzania

Tanzania Jewelry Development Impact Index



Brazil Jewelry Development Impact Index



Low risk
 moderate risk
 very high risk

-
- ¹ Epstein, D. S. (1988). Amethyst Mining in Brazil. *Gems & Gemology*, 24(4), 214–228. doi: 10.5741/gems.24.4.214
- ² Epstein, D. S. (1988). Amethyst Mining in Brazil. *Gems & Gemology*, 24(4), 214–228. doi: 10.5741/gems.24.4.214
- ³ Venegeroles, A. (2017). Milagre em Sento Se. Retrieved from <http://foco.atarde.uol.com.br/sentose/>.
- ⁴ JDII- Brazil Interview A (October 2, 2019), [Telephone], Washington, D.C. - Minas Gerais, Brazil.
- ⁵ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ⁶ Epstein, D. S. (1988). Amethyst Mining in Brazil. *Gems & Gemology*, 24(4), 214–228. doi: 10.5741/gems.24.4.214
- ⁷ Epstein, D. S. (1988). Amethyst Mining in Brazil. *Gems & Gemology*, 24(4), 214–228. doi: 10.5741/gems.24.4.214.
- ⁸ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ⁹ Epstein, D. S. (1988). Amethyst Mining in Brazil. *Gems & Gemology*, 24(4), 214–228. doi: 10.5741/gems.24.4.214
- ¹⁰ Epstein, D. S. (1988). Amethyst Mining in Brazil. *Gems & Gemology*, 24(4), 214–228. doi: 10.5741/gems.24.4.214
- ¹¹ Epstein, D. S. (1988). Amethyst Mining in Brazil. *Gems & Gemology*, 24(4), 214–228. doi: 10.5741/gems.24.4.214.
- ¹² Epstein, D. S. (1988). Amethyst Mining in Brazil. *Gems & Gemology*, 24(4), 214–228. doi: 10.5741/gems.24.4.214.
- ¹³ Epstein, D. S. (1988). Amethyst Mining in Brazil. *Gems & Gemology*, 24(4), 214–228. doi: 10.5741/gems.24.4.214.
- ¹⁴ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ¹⁵ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ¹⁶ *Greja São Gabriel - Ametista Do Sul - RS - Brasil 2/2*. YouTube, 2017. greja São Gabriel - Ametista do Sul - RS \ - Brasil 2/2.
- ¹⁷ COOGAMAI. Histórico. Retrieved from <http://www.coogamai.com.br/sobre/>
- ¹⁸ JDII- Brazil Interview E (October 11, 2019), [Telephone], Washington, D.C. - Salvador, Brazil.
- ¹⁹ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ²⁰ Coogamai Garimpeiros Recebem EPI's em Ametista do Sul. (n.d.). Retrieved from <http://www.coogamai.com.br/projeto/garimpeiros-recebem-epi-s-em-ametista-do-sul/90/>
- ²¹ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ²² JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ²³ Sobre Agência Nacional da Mineração. (n.d.). Retrieved from <http://www.anm.gov.br/>
- ²⁴ Agência Nacional de Mineração (N.D.). Institutional. [Google translate]. Retrieved from <http://www.anm.gov.br/aceso-a-informacao/institucional>
- ²⁵ Agência Nacional de Mineração (N.D.). Institutional. [Google translate]. Retrieved from <http://www.anm.gov.br/aceso-a-informacao/institucional>
- ²⁶ Agência Nacional de Mineração (N.D.). Institutional. [Google translate]. Retrieved from <http://www.anm.gov.br/aceso-a-informacao/institucional>
- ²⁷ Agência Nacional de Mineração (N.D.). Institutional. Retrieved from <http://www.anm.gov.br/aceso-a-informacao/institucional>
- ²⁸ JDII- Brazil Interview E (October 11, 2019), [Telephone], Washington, D.C. - Salvador, Brazil.
- ²⁹ Rodrigues, L. (October 10, 2019). Acordo entre MPF e União prevê R\$ 42 milhões para fiscalizar barragens. *Agência Brasil*. Retrieved from <http://agenciabrasil.ebc.com.br/justica/noticia/2019-10/acordo-entre-mpf-e-uniao-preve-r-42-milhoes-para-fiscalizar-barragens>
- ³⁰ Rodrigues, L. (October 10, 2019). Acordo entre MPF e União prevê R\$ 42 milhões para fiscalizar barragens. *Agência Brasil*. Retrieved from <http://agenciabrasil.ebc.com.br/justica/noticia/2019-10/acordo-entre-mpf-e-uniao-preve-r-42-milhoes-para-fiscalizar-barragens>
- ³¹ Rodrigues, L. (October 10, 2019). Acordo entre MPF e União prevê R\$ 42 milhões para fiscalizar barragens. *Agência Brasil*. Retrieved from <http://agenciabrasil.ebc.com.br/justica/noticia/2019-10/acordo-entre-mpf-e-uniao-preve-r-42-milhoes-para-fiscalizar-barragens>

-
- ³² Rodrigues, L. (October 10, 2019). Acordo entre MPF e União prevê R\$ 42 milhões para fiscalizar barragens. *Agência Brasil*. Retrieved from <http://agenciabrasil.ebc.com.br/justica/noticia/2019-10/acordo-entre-mpf-e-uniao-preve-r-42-milhoes-para-fiscalizar-barragens>
- ³³ COOGAMAI. Histórico. Retrieved from <http://www.coogamai.com.br/sobre/>
- ³⁴ COOGAMAI. Histórico. Retrieved from <http://www.coogamai.com.br/sobre/>
- ³⁵ Oheb Sion, A. (2019). The Mining Law Review - Edition 8: Brazil. *The Law Reviews*. Retrieved from <https://thelawreviews.co.uk/edition/the-mining-law-review-edition-8/1209353/brazil>
- ³⁶ Oheb Sion, A. (2019). The Mining Law Review - Edition 8: Brazil. *The Law Reviews*. Retrieved from <https://thelawreviews.co.uk/edition/the-mining-law-review-edition-8/1209353/brazil>
- ³⁷ JDII - Brazil Interview C (October 7, 2019), [Telephone], Washington, D.C. - Brasilia, Brazil.
- ³⁸ OCB System. (February 14, 2019). Projeto Sustentabilidade Mineral está a todo vapor. Retrieved from <http://www.sescoopr.coop.br/noticias/2019/02/14/projeto-sustentabilidade-mineral-esta-a-todo-vapor/>
- ³⁹ COOGAMAI. Histórico. Retrieved from <http://www.coogamai.com.br/sobre/>
- ⁴⁰ Edevaldo Stacke/Ascom Coogamai. (February 2019). COOGAMAI E FEPAM AVANÇAM SOBRE LICENCIAMENTO DO GARIMPO. Retrieved from <http://www.coogamai.com.br/projeto/coogamai-e-fepam-avancam-sobre-licenciamento-do-garimpo/83/>
- ⁴¹ COOGAMAI. Histórico. Retrieved from <http://www.coogamai.com.br/sobre/>
- ⁴² COOGAMAI. Histórico. Retrieved from <http://www.coogamai.com.br/sobre/>
- ⁴³ COOGAMAI. Histórico. Retrieved from <http://www.coogamai.com.br/sobre/>
- ⁴⁴ COOGAMAI. (February 15, 2019). Coogamai está apreensiva com mudanças na regulamentação da mineração. Retrieved from <http://www.coogamai.com.br/post/coogamai-esta-apreensiva-com-mudancas-na-regulamentacao-da-mineracao/60/>
- ⁴⁵ COOGAMAI. (February 15, 2019). Coogamai está apreensiva com mudanças na regulamentação da mineração. Retrieved from <http://www.coogamai.com.br/post/coogamai-esta-apreensiva-com-mudancas-na-regulamentacao-da-mineracao/60/>
- ⁴⁶ JDII - Brazil Interview C (October 7, 2019), [Telephone], Washington, D.C. - Brasilia, Brazil.
- ⁴⁷ EITI International Secretariat. Who we are. Retrieved from <https://eiti.org/who-we-are#implementing-countries>
- ⁴⁸ EITI International Secretariat. Countries. Retrieved from <https://eiti.org/countries>
- ⁴⁹ JDII - Brazil Interview C (October 7, 2019), [Telephone], Washington, D.C. - Brasilia, Brazil.
- ⁵⁰ JDII - Brazil Interview A (October 2, 2019), [Telephone], Washington, D.C - Minas Gerais, Brazil.
- ⁵¹ Shoretell, P. & Irwin, E. (May 2017). Governing the Gemstone Sector: Lessons from Global Experience. Retrieved from https://resourcegovernance.org/sites/default/files/documents/governing-the-gemstone_sector-lessons-from-global-experience.pdf
- ⁵² JDII - Brazil Interview A (October 2, 2019), [Telephone], Washington, D.C - Minas Gerais, Brazil.
- ⁵³ Open Government Partnership. (October 31, 2018). Brazil National Action Plan 2018-2020, Introduction [pdf]. <https://www.opengovpartnership.org/documents/brazil-national-action-plan-2018-2020/>
- ⁵⁴ Open Government Partnership. (October 31, 2018). Brazil National Action Plan 2018-2020, OPEN GOVERNMENT PARTNERSHIP IN BRAZIL [pdf]. <https://www.opengovpartnership.org/documents/brazil-national-action-plan-2018-2020/>
- ⁵⁵ Open Government Partnership. (2019). Approach. Retrieved from <https://www.opengovpartnership.org/about/approach/>
- ⁵⁶ Open Government Partnership. (2019). Access to Information Policy in the Federal Government – Promptness and Effectiveness to Information Requests (BR0086). Retrieved from <https://www.opengovpartnership.org/members/brazil/commitments/BR0086/>
- ⁵⁷ Open Government Partnership. (June 23, 2019). Brazil Mid-Term Report 2016-2018. Retrieved from <https://www.opengovpartnership.org/documents/brazil-mid-term-report-2016-2018/>
- ⁵⁸ Open Government Partnership. (October 31, 2018). Brazil National Action Plan 2018-2020, OPEN GOVERNMENT PARTNERSHIP IN BRAZIL [pdf]. <https://www.opengovpartnership.org/documents/brazil-national-action-plan-2018-2020/>
- ⁵⁹ Open Government Partnership. (October 31, 2018). Brazil National Action Plan 2018-2020, OPEN GOVERNMENT PARTNERSHIP IN BRAZIL [pdf]. <https://www.opengovpartnership.org/documents/brazil-national-action-plan-2018-2020/>
- ⁶⁰ Agência Nacional de Mineração. PLANEJAMENTO E ESTRATÉGIAS PARA 2019, Projeto MINERAÇÃO 4.0, [powerpoint slides]. Retrieved from <http://www.anm.gov.br/dnpm/documentos/palestra-planejamento-da-anm-para-2019>

-
- ⁶¹ Agência Nacional de Mineração. PLANEJAMENTO E ESTRATÉGIAS PARA 2019, APOIO DA OCDE, [powerpoint slides]. Retrieved from <http://www.anm.gov.br/dnpm/documentos/palestra-planejamento-da-anm-para-2019>
- ⁶² Agência Nacional de Mineração. PLANEJAMENTO E ESTRATÉGIAS PARA 2019, APOIO DA OCDE, [powerpoint slides]. Retrieved from <http://www.anm.gov.br/dnpm/documentos/palestra-planejamento-da-anm-para-2019>
- ⁶³ Agência Nacional de Mineração. PLANEJAMENTO E ESTRATÉGIAS PARA 2019, APOIO DA OCDE, [powerpoint slides]. Retrieved from <http://www.anm.gov.br/dnpm/documentos/palestra-planejamento-da-anm-para-2019>
- ⁶⁴ Uelze, H. & Leite, M.R. (November 2019). The Anti-Bribery and Anti-Corruption Review - Edition 8. *The Law Reviews*. Retrieved from <https://thelawreviews.co.uk/edition/the-anti-bribery-and-anti-corruption-review-edition-8/1210778/brazil>
- ⁶⁵ Uelze, H. & Leite, M.R. (November 2019). The Anti-Bribery and Anti-Corruption Review - Edition 8. *The Law Reviews*. Retrieved from <https://thelawreviews.co.uk/edition/the-anti-bribery-and-anti-corruption-review-edition-8/1210778/brazil>
- ⁶⁶ WIPO Lex. (2018). Brazil: Criminal Code. Retrieved from <https://wipolex.wipo.int/en/legislation/details/18676>
- ⁶⁷ Uelze, H. & Leite, M.R. (November 2019). The Anti-Bribery and Anti-Corruption Review - Edition 8. *The Law Reviews*. Retrieved from <https://thelawreviews.co.uk/edition/the-anti-bribery-and-anti-corruption-review-edition-8/1210778/brazil>
- ⁶⁸ Uelze, H. & Leite, M.R. (November 2019). The Anti-Bribery and Anti-Corruption Review - Edition 8. *The Law Reviews*. Retrieved from <https://thelawreviews.co.uk/edition/the-anti-bribery-and-anti-corruption-review-edition-8/1210778/brazil>
- ⁶⁹ Uelze, H. & Leite, M.R. (November 2019). The Anti-Bribery and Anti-Corruption Review - Edition 8. *The Law Reviews*. Retrieved from <https://thelawreviews.co.uk/edition/the-anti-bribery-and-anti-corruption-review-edition-8/1210778/brazil>
- ⁷⁰ FAFT. FAFT: Financial Action Task Force. Retrieved from <http://www.fatf-gafi.org/countries/#FATF>
- ⁷¹ FAFT. FAFT: Financial Action Task Force. Retrieved from <http://www.fatf-gafi.org/countries/#FATF>
- ⁷² FAFT. FAFT: Financial Action Task Force. Retrieved from <http://www.fatf-gafi.org/countries/#FATF>
- ⁷³ Vilhena, C. & Cançado Trindade, A.D. (October 2019). The Mining Law Review - Edition 8: Brazil. *The Law Reviews*. Retrieved from <https://thelawreviews.co.uk/edition/the-mining-law-review-edition-8/1209385/brazil>
- ⁷⁴ Vilhena, C. & Cançado Trindade, A.D. (October 2019). The Mining Law Review - Edition 8: Brazil. *The Law Reviews*. Retrieved from <https://thelawreviews.co.uk/edition/the-mining-law-review-edition-8/1209385/brazil>
- ⁷⁵ FAFT. GAFILAT: Financial Action Task Force of Latin America (GAFILAT). Retrieved from <http://www.fatf-gafi.org/countries/#GAFILAT>.
- ⁷⁶ Mutual Evaluation Report (Federal Republic of Brazil): Anti-Money Laundering and Combating the Financing of Terrorism. (2010, June 25). Retrieved from https://www.fatf-gafi.org/media/fatf/documents/reports/mer/MER_Brazil_full.pdf.
- ⁷⁷ Mutual Evaluation Report (Federal Republic of Brazil): Anti-Money Laundering and Combating the Financing of Terrorism. (2010, June 25). Retrieved from https://www.fatf-gafi.org/media/fatf/documents/reports/mer/MER_Brazil_full.pdf.
- ⁷⁸ Mutual Evaluation Report (Federal Republic of Brazil): Anti-Money Laundering and Combating the Financing of Terrorism. (2010, June 25). Retrieved from https://www.fatf-gafi.org/media/fatf/documents/reports/mer/MER_Brazil_full.pdf.
- ⁷⁹ Puppim de Oliveira, J. A. (November 13, 2010). Gemstone mining as a development cluster: A study of Brazil's emerald mines. Retrieved from http://www.uvm.edu/giee/pubpdfs/de_Oliveira_2011_Resources_Policy.
- ⁸⁰ JDII - Brazil Interview C (October 7, 2019), [Telephone], Washington, D.C. - Brasilia, Brazil.
- ⁸¹ Beard, M., Austin, G., Elmore, M., Woudenberg, C., & Zborowski, M. (2005). World Mining Report 2005 - Central and South America - Ganoksin Jewelry Making Community. Retrieved from <https://www.ganoksin.com/article/world-mining-report-2005-central-south-america/>
- ⁸² Beard, M., Austin, G., Elmore, M., Woudenberg, C., & Zborowski, M. (2005). World Mining Report 2005 - Central and South America - Ganoksin Jewelry Making Community. Retrieved from <https://www.ganoksin.com/article/world-mining-report-2005-central-south-america/>
- Brazil - Mining. (n.d.). Retrieved from <https://www.nationsencyclopedia.com/Americas/Brazil-MINING.html>.

-
- ⁸³ Beard, M., Austin, G., Elmore, M., Woudenberg, C., & Zborowski, M. (2005). World Mining Report 2005 – Central and South America - Ganoksin Jewelry Making Community. Retrieved from <https://www.ganoksin.com/article/world-mining-report-2005-central-south-america/>.
- ⁸⁴ Venegeroles, A. (2017). Milagre em Sento Se. Retrieved from <http://foco.atarde.uol.com.br/sentose/>.
- ⁸⁵ JDII - Brazil Interview G (October 18, 2019), [Telephone], Washington, D.C. -Para, Brazil.
- ⁸⁶ JDII - Brazil Interview G (October 18, 2019), [Telephone], Washington, D.C. -Para, Brazil.
- ⁸⁷ COOGAMAI. Histórico. Retrieved from <http://www.coogamai.com.br/sobre/>
- ⁸⁸ Coogamai. (n.d.). Institucional. Retrieved from <http://www.coogamai.com.br/sobre.php>.
- ⁸⁹ Agência Nacional de Mineração. (2014, June 25). Retrieved from <http://www.anm.gov.br/noticias/anm-dnpm-publica-o-informe-mineral-do-segundo-semester-de-2017>.
- ⁹⁰ Werneck, B. D., Torre, O. N. D., Filho, M., Filho, V., & Quiroga Advogados, M. J. e. (n.d.). Practical Law. Retrieved from: [https://content.next.westlaw.com/Document/I8417b23d1cb11e38578f7ccc38dcbee/View/FullText.html?contextData=\(sc.Default\)&transitionType=Default&firstPage=true&bhcp=1..](https://content.next.westlaw.com/Document/I8417b23d1cb11e38578f7ccc38dcbee/View/FullText.html?contextData=(sc.Default)&transitionType=Default&firstPage=true&bhcp=1..)
- ⁹¹ Agência Nacional de Mineração. (2014, June 25). Retrieved from <http://www.anm.gov.br/noticias/anm-dnpm-publica-o-informe-mineral-do-segundo-semester-de-2017>.
- ⁹² Interativos, W. A. P. (n.d.). Instituto Brasileiro de Mineração. Retrieved from <http://ibram.org.br/>.
- ⁹³ Beard, M., Austin, G., Elmore, M., Woudenberg, C., & Zborowski, M. (2005). World Mining Report 2005 – Central and South America - Ganoksin Jewelry Making Community. Retrieved from <https://www.ganoksin.com/article/world-mining-report-2005-central-south-america/>.
- ⁹⁴ Brazil - Mining. (n.d.). Retrieved from <https://www.nationsencyclopedia.com/Americas/Brazil-MINING.html>.
- ⁹⁵ Brazil - United States Department of State. (2019, July 11). Retrieved from <https://www.state.gov/reports/2019-investment-climate-statements/brazil/>.
- ⁹⁶ Szczesniak, P. (n.d.). 2015 Minerals Yearbook Brazil Advance Release. Retrieved from <https://prd-wret.s3-us-west-2.amazonaws.com/assets/palladium/production/atoms/files/myb3-2015-br.pdf>
- ⁹⁷ Puppim de Oliveira, J. A. (November 13, 2010). Gemstone mining as a development cluster: A study of Brazil's emerald mines. Retrieved from http://www.uvm.edu/giee/pubpdfs/de_Oliveira_2011_Resources_Policy.pdf.
- ⁹⁸ JDII - Brazil Interview A (October 2, 2019), [Telephone], Washington, D.C. - Minas Gerais, Brazil..
- ⁹⁹ JDII - Brazil Interview A (October 2, 2019), [Telephone], Washington, D.C. - Minas Gerais, Brazil..
- ¹⁰⁰ Barreto, Sandra & Schulze, Sheila. (2010). The gemstone deposits of Brazil: Occurrences, production and economic impact. *Boletín de la Sociedad Geológica Mexicana*. 62. 123-140.
- ¹⁰¹ Puppim de Oliveira, J. A. (November 13, 2010). Gemstone mining as a development cluster: A study of Brazil's emerald mines. Retrieved from http://www.uvm.edu/giee/pubpdfs/de_Oliveira_2011_Resources_Policy.pdf.
- ¹⁰² Puppim de Oliveira, J. A. (November 13, 2010). Gemstone mining as a development cluster: A study of Brazil's emerald mines. Retrieved from http://www.uvm.edu/giee/pubpdfs/de_Oliveira_2011_Resources_Policy.pdf.
- ¹⁰³ Puppim de Oliveira, J. A. (November 13, 2010). Gemstone mining as a development cluster: A study of Brazil's emerald mines. Retrieved from http://www.uvm.edu/giee/pubpdfs/de_Oliveira_2011_Resources_Policy.pdf.
- ¹⁰⁴ JDII - Brazil Interview G (October 18, 2019), [Telephone], Washington, D.C. -Para, Brazil.
- ¹⁰⁵ Szczesniak, P. (n.d.). 2015 Minerals Yearbook Brazil Advance Release. Retrieved from <https://prd-wret.s3-us-west-2.amazonaws.com/assets/palladium/production/atoms/files/myb3-2015-br.pdf>
- ¹⁰⁶ JDII - Brazil Interview G (October 18, 2019), [Telephone], Washington, D.C. -Para,
- ¹⁰⁷ JDII - Brazil Interview G (October 18, 2019), [Telephone], Washington, D.C. -Para, Brazil
- ¹⁰⁸ KPMG International Cooperative. 2015. ("KPMG International Brazil Country Mining Guide"). <https://assets.kpmg/content/dam/kpmg/pdf/2016/01/brazil-mining-country-guide.pdf>
- ¹⁰⁹ CIA Factbook and Economic Intelligence Unit (EIU).
- ¹¹⁰ KPMG International Cooperative. 2015. ("KPMG International Brazil Country Mining Guide"). <https://assets.kpmg/content/dam/kpmg/pdf/2016/01/brazil-mining-country-guide.pdf>
- ¹¹¹ KPMG International Cooperative. 2015. ("KPMG International Brazil Country Mining Guide"). <https://assets.kpmg/content/dam/kpmg/pdf/2016/01/brazil-mining-country-guide.pdf>
- ¹¹² Pedro Luize Juchem. Gem Materials in Rio Grande do Sul State, Brazil- A Field Trip Guide. Retrieved from https://www.cigem.ca/pdf/FIELD_TRIP_GUIDE.pdf
- ¹¹³ Venegeroles, A. (2017). Milagre em Sento Se. Retrieved from <http://foco.atarde.uol.com.br/sentose/>.

- ¹¹⁴ Pedro Luiz Juchem. Gem Materials in Rio Grande do Sul State, Brail- A Field Trip Guide. Retrieved from https://www.cigem.ca/pdf/FIELD_TRIP_GUIDE.pdf.
- ¹¹⁵ Pedro Luiz Juchem. Gem Materials in Rio Grande do Sul State, Brail- A Field Trip Guide. Retrieved from https://www.cigem.ca/pdf/FIELD_TRIP_GUIDE.pdf.
- ¹¹⁶ Pedro Luiz Juchem. Gem Materials in Rio Grande do Sul State, Brail- A Field Trip Guide. Retrieved from https://www.cigem.ca/pdf/FIELD_TRIP_GUIDE.pdf.
- ¹¹⁷ Pedro Luiz Juchem. Gem Materials in Rio Grande do Sul State, Brail- A Field Trip Guide. Retrieved from https://www.cigem.ca/pdf/FIELD_TRIP_GUIDE.pdf.
- ¹¹⁸ Luiz Juchem, P. (n.d.). *Figure 3 – Surface agate mining. A and B – open pits and underground adits opened in the weathered volcanic rock. C – miners collecting agate geodes in the removal regolith. D – agate geodes to be commercially classified; in the back side of the image, the surface mine.* . photograph, Rio Grande De Sul, Brazil.
- ¹¹⁹ JDII - Brazil Interview H (October 21, 2019), [Email], Washington, D.C.
- ¹²⁰ JDII - Brazil Interview H (October 21, 2019), [Email], Washington, D.C..
- ¹²¹ Pedro Luiz Juchem. Gem Materials in Rio Grande do Sul State, Brail- A Field Trip Guide. Retrieved from https://www.cigem.ca/pdf/FIELD_TRIP_GUIDE.pdf
- ¹²² KPMG International Cooperative. 2015. (“KPMG International Brazil Country Mining Guide”). <https://assets.kpmg/content/dam/kpmg/pdf/2016/01/brazil-mining-country-guide.pdf>
- ¹²³ KPMG International Cooperative. 2015. (“KPMG International Brazil Country Mining Guide”). <https://assets.kpmg/content/dam/kpmg/pdf/2016/01/brazil-mining-country-guide.pdf>
- ¹²⁴ KPMG International Cooperative. 2015. (“KPMG International Brazil Country Mining Guide”). <https://assets.kpmg/content/dam/kpmg/pdf/2016/01/brazil-mining-country-guide.pdf>
- ¹²⁵ KPMG International Cooperative. 2015. (“KPMG International Brazil Country Mining Guide”). <https://assets.kpmg/content/dam/kpmg/pdf/2016/01/brazil-mining-country-guide.pdf>
- ¹²⁶ Gemval.com “Gemsinfo for Amethyst” <https://gemval.com/gemsinfo/amethyst/>
- ¹²⁷ Machado, I. F., & Figueirôa, S. F. D. M. (2001). 500 years of mining in Brazil: a brief review. *Resources Policy*, 27(1), 9–24. doi: 10.1016/s0301-4207(01)00004-6
- ¹²⁸ Chiochetta, C.G., Radetski, M.R., Corrêa, A.X.R. et al. *Environ Sci Pollut Res* (2013) 20: 7656. <https://doi.org/10.1007/s11356-012-1269-2>
- ¹²⁹ Chiochetta, C.G., Radetski, M.R., Corrêa, A.X.R. et al. *Environ Sci Pollut Res* (2013) 20: 7656. <https://doi.org/10.1007/s11356-012-1269-2>
- ¹³⁰ Puppim de Oliveira, J. A. (November 13, 2010). Gemstone mining as a development cluster: A study of Brazil’s emerald mines. Retrieved from http://www.uvm.edu/giee/pubpdfs/de_Oliveira_2011_Resources_Policy.pdf.
- ¹³¹ Puppim de Oliveira, J. A. (November 13, 2010). Gemstone mining as a development cluster: A study of Brazil’s emerald mines. Retrieved from http://www.uvm.edu/giee/pubpdfs/de_Oliveira_2011_Resources_Policy.pdf.
- ¹³² JDII - Brazil Interview G (October 18, 2019), [Telephone], Washington, D.C. -Para, Brazil.
- ¹³³ Folle, D., Rodrigues, C. L., da Silva Vilasboas, F., Tonezer da Silva, J., & Bagatini, S. A. (n.d.). The licensing process of environmental industries extractors gems of Rio Grande do Sul, Brazil. *Enviromine2011*, 1–8. Retrieved from https://www.researchgate.net/profile/Fernanda_Vilasboas/publication/333866450_The_licensing_process_of_environmental_industries_extractors_gems_of_Rio_Grande_do_Sul_Brazil/links/5d09ba7192851cfcc622c013/The-licensing-process-of-environmental-industries-extractors-gems-of-Rio-Grande-do-Sul-Brazil.pdf
- ¹³⁴ Agência Nacional de Mineração. (2015, April 7). Retrieved from <http://www.anm.gov.br/noticias/novo-marco-regulatorio-da-mineracao-e-tema-de-debate-na-camara>.
- ¹³⁵ Agência Nacional de Mineração. (2015, April 7). Retrieved from <http://www.anm.gov.br/noticias/novo-marco-regulatorio-da-mineracao-e-tema-de-debate-na-camara>.
- ¹³⁶ Agência Nacional de Mineração. (2015, April 7). Retrieved from <http://www.anm.gov.br/noticias/novo-marco-regulatorio-da-mineracao-e-tema-de-debate-na-camara>.
- ¹³⁷ Decree-Law 227 of February 28, 1967 - Mining Code/Decree No. 98,812 of January 9, 1990 - Mining Permit Mining Basic Investor Information - National Mining Agency Law 9,478, of August 6, 1997 - National energy policy Law 11,685, of June 2, 2008. Mining Company Statute Law 11,909, of March 4, 2009 - Natural gas.
- ¹³⁸ Venegeroles, A. (2017). Milagre em Sento Se. Retrieved from <http://foco.atarde.uol.com.br/sentose/>.

-
- ¹³⁹ JDII- Brazil Interview A (October 2, 2019), [Telephone], Washington, D.C. - Minas Gerais, Brazil.
- ¹⁴⁰ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ¹⁴¹ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ¹⁴² Venegeroles, A. (2017). Milagre em Sento Se. Retrieved from <http://foco.atarde.uol.com.br/sentose/>.
- ¹⁴³ JDII- Brazil Interview A (October 2, 2019), [Telephone], Washington, D.C. - Minas Gerais, Brazil.
- ¹⁴⁴ Venegeroles, A. (2017). Milagre em Sento Se. Retrieved from <http://foco.atarde.uol.com.br/sentose/>.
- ¹⁴⁵ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ¹⁴⁶ JDII- Brazil Interview E (October 11, 2019), [Telephone], Washington, D.C. - Salvador, Brazil.
- ¹⁴⁷ JDII- Brazil Interview E (October 11, 2019), [Telephone], Washington, D.C. - Salvador, Brazil.
- ¹⁴⁸ Medianeira Pagnossin & da Fonseca Pires. "SILICOSIS IN PROSPECTORS OF AMETISTA DO SUL, BRAZIL". pp. 56-57.
- ¹⁴⁹ Medianeira Pagnossin & da Fonseca Pires. "SILICOSIS IN PROSPECTORS OF AMETISTA DO SUL, BRAZIL". pp. 56-57.
- ¹⁵⁰ Medianeira Pagnossin & da Fonseca Pires. "SILICOSIS IN PROSPECTORS OF AMETISTA DO SUL, BRAZIL". pp. 56-57.
- ¹⁵¹ Oheb Sion, A. (2019). The Mining Law Review - Edition 8: Brazil. *The Law Reviews*. Retrieved from <https://thelawreviews.co.uk/edition/the-mining-law-review-edition-8/1209353/brazil>
- ¹⁵² Coogamai. "Coogamai Distribui Equipamentos De Proteção a Garimpeiros." Coogamai. Accessed December 5, 2019. <https://www.coogamai.com.br/>.
- ¹⁵³ Oheb Sion, A. (2019). The Mining Law Review - Edition 8: Brazil. *The Law Reviews*. Retrieved from <https://thelawreviews.co.uk/edition/the-mining-law-review-edition-8/1209353/brazil>
- ¹⁵⁴ Coogamai. "Coogamai Distribui Equipamentos De Proteção a Garimpeiros." Coogamai. Accessed December 5, 2019. <https://www.coogamai.com.br/>.
- ¹⁵⁵ JDII- Brazil Interview E (October 11, 2019), [Telephone], Washington, D.C. - Salvador, Brazil.
- ¹⁵⁶ JDII- Brazil Interview A (October 2, 2019), [Telephone], Washington, D.C. - Minas Gerais, Brazil.
- ¹⁵⁷ JDII- Brazil Interview A (October 2, 2019), [Telephone], Washington, D.C. - Minas Gerais, Brazil.
- ¹⁵⁸ JDII- Brazil Interview C (October 7, 2019), [Telephone], Washington, D.C. - Brasilia, Brazil.
- ¹⁵⁹ JDII- Brazil Interview E (October 11, 2019), [Telephone], Washington, D.C. - Salvador, Brazil.
- ¹⁶⁰ JDII- Brazil Interview A (October 2, 2019), [Telephone], Washington, D.C. - Minas Gerais, Brazil.
- ¹⁶¹ JDII- Brazil Interview B (October 7, 2019), [Telephone], Washington, D.C. - Brasilia, Brazil.
- ¹⁶² COOGAMAI. (2019, August 30). Garimpeiros recebem EPI's em Ametista do Sul. *COOGAMAI Noticias*. Retrieved from <http://www.coogamai.com.br/projeto/garimpeiros-recebem-epi-s-em-ametista-do-sul/90/>
- ¹⁶³ JDII- Brazil Interview B (October 7, 2019), [Telephone], Washington, D.C. - Brasilia, Brazil.
- ¹⁶⁴ JDII- Brazil Interview A (October 2, 2019), [Telephone], Washington, D.C. - Minas Gerais, Brazil.
- ¹⁶⁵ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ¹⁶⁶ Heckmann, Buc. "Serious Deterioration of Human Rights and Indigenous Rights Conditions in Brazil." IWGIA. Accessed December 5, 2019. <https://www.iwgia.org/en/brazil/3320-serious-deterioration-of-human-rights-and-indigenous-rights-conditions-in-brazil>.
- ¹⁶⁷ JDII- Brazil Interview B (October 7, 2019), [Telephone], Washington, D.C. - Brasilia, Brazil.
- ¹⁶⁸ JDII- Brazil Interview E (October 11, 2019), [Telephone], Washington, D.C. - Salvador, Brazil.
- ¹⁶⁹ JDII- Brazil Interview B (October 7, 2019), [Telephone], Washington, D.C. - Brasilia, Brazil.
- ¹⁷⁰ JDII- Brazil Interview E (October 11, 2019), [Telephone], Washington, D.C. - Salvador, Brazil.
- ¹⁷¹ JDII- Brazil Interview B (October 7, 2019), [Telephone], Washington, D.C. - Brasilia, Brazil.
- ¹⁷² JDII- Brazil Interview B (October 7, 2019), [Telephone], Washington, D.C. - Brasilia, Brazil.
- ¹⁷³ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ¹⁷⁴ JDII- Brazil Interview E (October 11, 2019), [Telephone], Washington, D.C. - Salvador, Brazil.
- ¹⁷⁵ Venegeroles, A. (2017). Milagre em Sento Se. Retrieved from <http://foco.atarde.uol.com.br/sentose/>.
- ¹⁷⁶ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ¹⁷⁷ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ¹⁷⁸ COOGAMAI. (2019, July 4). A mulher no garimpo. *COOGAMAI Noticias*. Retrieved from www.coogamai.com.br/projeto/a-mulher-no-garimpo/88/
- ¹⁷⁹ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ¹⁸⁰ JDII- Brazil Interview E (October 11, 2019), [Telephone], Washington, D.C. - Salvador, Brazil.
- ¹⁸¹ JDII- Brazil Interview F (October 11, 2019), [Telephone], Washington, D.C. - Salvador, Brazil.
- ¹⁸² JDII- Brazil Interview E (October 11, 2019), [Telephone], Washington, D.C. - Salvador, Brazil.

-
- ¹⁸³ JDII- Brazil Interview E (October 11, 2019), [Telephone], Washington, D.C. - Salvador, Brazil.
- ¹⁸⁴ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ¹⁸⁵ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ¹⁸⁶ JDII- Brazil Interview E (October 11, 2019), [Telephone], Washington, D.C. - Salvador, Brazil.
- ¹⁸⁷ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ¹⁸⁸ JDII- Brazil Interview F (October 11, 2019), [Telephone], Washington, D.C. - Salvador, Brazil.
- ¹⁸⁹ JDII- Brazil Interview E (October 11, 2019), [Telephone], Washington, D.C. - Salvador, Brazil.
- ¹⁹⁰ JDII- Brazil Interview D (October 9, 2019), [Telephone], Washington, D.C. - Rio Grande do Sul, Brazil.
- ¹⁹¹ JDII- Brazil Interview E (October 11, 2019), [Telephone], Washington, D.C. - Salvador, Brazil.
- ¹⁹² “Tanzanite History and Lore.” Gemological Institute Of America. Accessed December 5, 2019.
<https://www.gia.edu/tanzanite-history-lore>.
- ¹⁹³ “Tanzanite Is A Bit Of Blue Heaven.” International Business Times, December 8, 2017.
<https://www.ibtimes.com/tanzanite-bit-blue-heaven-2626175>.
- ¹⁹⁴ TanzaniteOne. (n.d.). <https://www.tanzaniteone.com/sigholders>. Retrieved November 18, 2019, from
<https://www.tanzaniteone.com/sigholders>.
- ¹⁹⁵ Block, R., & Pearl, D. (2001, November 16). Bought, Sold by Militants Near Mine, Tanzanite Ends Up at Mideast Souks. *Wall Street Journal*.
- ¹⁹⁶ cart2cart. “Steve Moriarty Visits the Mines for Tanzanite.” Tanzanite Jewelry Designs. Tanzanite Jewelry Designs, July 31, 2015. <https://www.tanzanitejewelrydesigns.com/pages/tanzanite-mines>.
- ¹⁹⁷ United States. 2001. *The USA PATRIOT Act: preserving life and liberty: uniting and strengthening America by providing appropriate tools required to intercept and obstruct terrorism*. [Washington, D.C.]: [U.S. Dept. of Justice]. <http://purl.access.gpo.gov/GPO/LPS39935>.
- ¹⁹⁸ Shortell, P., & Irwin, E. (2017). Governing the Gemstone Sector: Lessons from Global Experience. *National Resource Governance Institute*. Pp 58
- ¹⁹⁹ Shortell, P., & Irwin, E. (2017). Governing the Gemstone Sector: Lessons from Global Experience. *National Resource Governance Institute*. Pp 58
- ²⁰⁰ Rarieya, Yvonne. “Tanzania President Inaugurates Wall around Gem Mines.” CGTN Africa, April 7, 2018.
<https://africa.cgtn.com/2018/04/07/tanzania-president-inaugurates-wall-around-gem-mines/>.
- ²⁰¹ JDII-Tanzania Interview D. (2019, Oct 11). [Telephone], Washington, DC – Thailand.
- ²⁰² Freedom House: Tanzania Profile. (n.d.). Retrieved from
<https://freedomhouse.org/report/freedom-world/2018/tanzania>.
- ²⁰³ JDII-Tanzania Interview D. (2019, Oct 11). [Telephone], Washington, DC – Thailand.
- ²⁰⁴ Shortell, P., & Irwin, E. (2017). Governing the Gemstone Sector: Lessons from Global Experience. *National Resource Governance Institute*. Pp 28-29
- ²⁰⁵ Shortell, P., & Irwin, E. (2017). Governing the Gemstone Sector: Lessons from Global Experience. *National Resource Governance Institute*. Pp 58
- ²⁰⁶ Shortell, P., & Irwin, E. (2017). Governing the Gemstone Sector: Lessons from Global Experience. *National Resource Governance Institute*. Pp 58
- ²⁰⁷ Mbowe, W. E. N., Lugobi, M., & Yabu, N. (2016). Tanzanite Processing in Tanzania: Challenges and Opportunities. *Applied Economics and Finance*, 3(10). Pp 239
- ²⁰⁸ JDII-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC
- ²⁰⁹ JDII-Tanzania Interview A. (2019, Oct 6). [Telephone], Washington, DC
- ²¹⁰ JDII-Tanzania Interview A. (2019, Oct 6). [Telephone], Washington, DC
- ²¹¹ JDII-Tanzania Interview A. (2019, Oct 6). [Telephone], Washington, DC
- ²¹² JDII-Tanzania Interview A. (2019, Oct 6). [Telephone], Washington, DC
- ²¹³ Shortell, P., & Irwin, E. (2017). Governing the Gemstone Sector: Lessons from Global Experience. *National Resource Governance Institute*. Pp 28-29
- ²¹⁴ JDII-Tanzania Interview D. (2019, Oct 11). [Telephone], Washington, DC – Thailand.
- ²¹⁵ Schroeder, R. A. (2010). Tanzanite as conflict gem: Certifying a secure commodity chain in Tanzania. *Geoforum*, 41(1). Pp 62-64
- ²¹⁶ Corruption Perceptions Index 2018: Tanzania. (n.d.). Retrieved from <https://www.transparency.org/country/TZA>.
- ²¹⁷ Freedom House: Tanzania Profile. (n.d.). Retrieved from
<https://freedomhouse.org/report/freedom-world/2018/tanzania>.
- ²¹⁸ Schroeder, R. A. (2010). Tanzanite as conflict gem: Certifying a secure commodity chain in Tanzania.

- Geoforum*, 41(1). Pp 62
- ²¹⁹ JDII-Tanzania Interview D. (2019, Oct 11). [Telephone], Washington, DC – Thailand.
- ²²⁰ Shortell, P., & Irwin, E. (2017). Governing the Gemstone Sector: Lessons from Global Experience. *National Resource Governance Institute*. Pp 28-29
- ²²¹ Martinez, Sara, Susan Ryan, Marisha Gupta, Zara Mirza, and Sakshi Mathur. “Meet the Men Who Discovered Tanzanite.” Shop LC, August 16, 2019. <https://blog.shoplc.com/who-discovered-tanzanite/>.
- ²²² Shortell, P., & Irwin, E. (2017). Governing the Gemstone Sector: Lessons from Global Experience. *National Resource Governance Institute*. Pp 58
- ²²³ JDII-Tanzania Interview D. (2019, Oct 11). [Telephone], Washington, DC – Thailand.
- ²²⁴ Vasani, B. S., Chaudhri, J., Gorsline, M. S., & Kotuby, C. T. (2017). Tanzania Overhauls Mining Laws, Fines Investor US\$190: Is Your Investment Protected? JonesDay.
- ²²⁵ TanzaniteOne. (n.d.). <https://www.tanzaniteone.com/sigholders>. Retrieved November 18, 2019, from <https://www.tanzaniteone.com/sigholders>.
- ²²⁶ Huggins, Christopher, and Abel Kinyondo. "Resource nationalism and formalization of artisanal and small-scale mining in Tanzania: Evidence from the tanzanite sector." *Resources Policy* 63, no. C (2019): 1-1.
- ²²⁷ ENACT. “Efforts to Curb Tanzanite Smuggling Make Tanzania Shine,” July 25, 2019. <https://enactafrica.org/research/trend-reports/efforts-to-curb-tanzanite-smuggling-make-tanzania-shine>.
- ²²⁸ “Tanzanite Buying FAQs.” Tanzanite Buying FAQs : Tanzanite Foundation. Accessed December 5, 2019. <http://www.tanzanitefoundation.com/buying-tanzanite/tanzanite-buying-faqs/>.
- ²²⁹ JDI-Tanzania Interview B. [Telephone], Washington, DC. October 7, 2019.
- ²³⁰ Diamond World News Service. “Tanzania: Govt. official suspends Tanzanite One's operations; says mine not benefiting locals & workers unpaid for 22 months”. August 2, 2019. Retrieved from <https://www.business-humanrights.org/en/tanzania-govt-official-suspends-tanzanite-ones-operations-says-mine-not-benefiting-locals-workers-unpaid-for-22-months>.
- ²³¹ Mbowe, Wilfred EN, Nicas Yabu, and Moto Lugobi. "Tanzanite Processing in Tanzania: Challenges and Opportunities." *Applied Economics and Finance* 3, no. 3 (2016): 236-257.
- ²³² Mzamo, P. “New Tanzanite location discovered”. *Mining News*. April 10, 2018. Retrieved from <https://miningnews.co.za/2018/04/10/new-tanzanite-location-discovered/>
- ²³³ Tanzanite Price. “Current Tanzanite Price: Tanzanite price per carat”. Retrieved October 30, 2019, from <http://www.tanzaniteprice.com/about-tanzanite-price/>.
- ²³⁴ Ngowi, D. “Tanzanite One Owner Sells His Mining Shares”. *Daily News*. February 9, 2019. Retrieved from <https://dailynews.co.tz/news/2019-02-095c5e8a73b9f11.aspx>
- ²³⁵ Ngowi, D. “Tanzanite One Owner Sells His Mining Shares”. *Daily News*. February 9, 2019. Retrieved from <https://dailynews.co.tz/news/2019-02-095c5e8a73b9f11.aspx>
- ²³⁶ Szczesniak, P. (n.d.). 2015 Minerals Yearbook Brazil Advance Release. Retrieved from <https://prd-wret.s3-us-west-2.amazonaws.com/assets/palladium/production/atoms/files/myb3-2015-br.pdf>
- ²³⁷ Bank of Tanzania. 2017-2018 Annual Report. Retrieved November 27, 2019, from [https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUK Ewipla_allvmAhUBpFkKHewXApUQFjAAegQIARAC&url=https://www.bot.go.tz/Publications/EconomicAndOperationsAnnualReports/BOT%20ANNUAL%20REPORT%2017-18.pdf&usg=AOvVaw3WZY7zbhvj_kf0Gb6jcLd](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKEwipla_allvmAhUBpFkKHewXApUQFjAAegQIARAC&url=https://www.bot.go.tz/Publications/EconomicAndOperationsAnnualReports/BOT%20ANNUAL%20REPORT%2017-18.pdf&usg=AOvVaw3WZY7zbhvj_kf0Gb6jcLd).
- ²³⁸ Tanzania Extractive Industries Transparency Initiative. “Final Report,” June 2017. https://eiti.org/sites/default/files/documents/2014-2015_tanzania_eiti_report.pdf.
- ²³⁹ Sabora, Raul. “New Mining and Rough Gemstone Export Legislation Passed in Tanzania.” Gemma News Service, April 28, 2010. <https://gemmanews.wordpress.com/2010/04/28/28-april-2010-0953/>.
- ²⁴⁰ Lahiri-Dutt, Kuntala, ed. *Between the Plough and the Pick: Informal, Artisanal and Small-Scale Mining in the Contemporary World*. ANU Press, 2018.
- ²⁴¹ Lahiri-Dutt, Kuntala, ed. *Between the Plough and the Pick: Informal, Artisanal and Small-Scale Mining in the Contemporary World*. ANU Press, 2018.
- ²⁴² Mbowe, Wilfred EN, Nicas Yabu, and Moto Lugobi. "Tanzanite Processing in Tanzania: Challenges and Opportunities." *Applied Economics and Finance* 3, no. 3 (2016): 236-257.
- ²⁴³ JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC.
- ²⁴⁴ The EastAfrican. “Mineral theft costs Tanzania \$2.7m yearly”. January 9, 2016. Retrieved November 21, 2019, from <https://www.theeastafrican.co.ke/business/Mineral-theft-costs-Tanzania--2-7m-yearly/2560-3026904-format-xhtml-fto76w/index.html>.

- ²⁴⁵ Mohammed, O. "Tanzanite miner gets bill as Tanzania cracks down on lost mineral revenues". *Reuters*. May 17, 2018. Retrieved from <https://www.reuters.com/article/us-tanzania-mining/tanzanite-miner-gets-bill-as-tanzania-cracks-down-on-lost-mineral-revenues-idUSKCN1112M>
- ²⁴⁶ India tanzanite sector in crisis. *The Citizen*. October, 2013. Retrieved from <https://tzexchange.blogspot.com/2013/10/india-tanzanite-sector-in-crisis.html>
- ²⁴⁷ ENACTAfrica.org. Efforts to curb tanzanite smuggling make Tanzania shine. July 25, 2019. Retrieved October 31, 2019, from <https://enactafrica.org/research/trend-reports/efforts-to-curb-tanzanite-smuggling-make-tanzania-shine>.
- ²⁴⁸ Mathew Nyaungwa, "Illegal tanzanite mining, smuggling: the twin evil facing Tanzania," *Rough & Polished*, 15 May 2015.
- ²⁴⁹ Block, R., & Pearl, D. "Bought, Sold by Militants Near Mine, Tanzanite Ends Up at Mideast Souks". *The Wall Street Journal*. November 16, 2001. Retrieved from <https://www.wsj.com/articles/SB1005860635600904840>
- ²⁵⁰ Schroeder, Richard A. "Tanzanite as conflict gem: Certifying a secure commodity chain in Tanzania." *Geoforum* 41, no. 1 (2010): 56-65.
- ²⁵¹ The New Humanitarian. "Government to monitor tanzanite trade". February 11, 2002. Retrieved October 31, 2019, from <http://www.thenewhumanitarian.org/fr/node/199058>.
- Schroeder, Richard A. "Tanzanite as conflict gem: Certifying a secure commodity chain in Tanzania." *Geoforum* 41, no. 1 (2010): 56-65.
- ²⁵² American Gemstone Traders Association. Tucson tanzanite protocol: restoring confidence in tanzanite. (2002).
- ²⁵³ Helliesen, Morten Skåra. "Tangled up in blue: Tanzanite mining and conflict in Mererani, Tanzania." *Critical African Studies* 4, no. 7 (2012): 58-93.
- ²⁵⁴ Roskin, G. "AFGEM to Dispose of Tanzanite Mine?". August 1, 2004. Retrieved November 3, 2019, from <https://www.jckonline.com/magazine-article/afgem-to-dispose-of-tanzanite-mine/>.
- ²⁵⁵ JDI-Tanzania Interview B. [Telephone], Washington, DC. October 7, 2019.
- ²⁵⁶ Donahue, Katherine C. "Tanzanite: Commodity fiction or commodity nightmare?." *THE PICK* (2018): 63.
- ²⁵⁷ JDI-Tanzania Interview D. (2019, Oct 11). [Telephone], Washington, DC - Thailand
- ²⁵⁸ Shimansky. (n.d.). Mining of Tanzanite. Retrieved November 3, 2019, from <https://www.shimansky.co.za/discover-tanzanite/about-tanzanite/mining>.
- ²⁵⁹ Collet, L. L., Curtze, K., & Reed, R. "Responsible Sourcing of Coloured Gemstones, Applied Research Seminar Report". *Graduate Institute of Geneva*. 2013.
- ²⁶⁰ Mbowe, W. E., Yabu, N., & Lugobi, M. (2016). Tanzanite Processing in Tanzania: Challenges and Opportunities. *Applied Economics and Finance*, 3(3), 236-257.
- ²⁶¹ African Mining Market. (2019, April 1). Foreign experts needed to process gemstones, jewelry in Tanzania. Retrieved November 3, 2019, from <https://africanminingmarket.com/foreign-experts-needed-in-processing-gemstones-jewelry-in-tanzania/3742/>.
- ²⁶² Ng, E. (2013). A Web of Violence: Local Perceptions on the Power Relations of the Tanzanite Trade Network in Arusha.
- ²⁶³ Mbowe, Wilfred EN, Nicas Yabu, and Moto Lugobi. "Tanzanite Processing in Tanzania: Challenges and Opportunities." *Applied Economics and Finance* 3, no. 3 (2016): 236-257.
- ²⁶⁴ Ng, Ellie. "A Web of Violence: Local Perceptions on the Power Relations of the Tanzanite Trade Network in Arusha." (2013).
- ²⁶⁵ Lange, Siri. *Benefit streams from mining in Tanzania: Case studies from Geita and Mererani*. Chr. Michelsen Institute, 2006.
- ²⁶⁶ Donahue, Katherine C. "Tanzanite: Commodity fiction or commodity nightmare?." *THE PICK* (2018): 63.
- ²⁶⁷ The Tanzanite Foundation. "About The Tanzanite Foundation". Retrieved November 3, 2019, from <http://www.tanzanitefoundation.com/about-the-tanzanite-foundation/>.
- ²⁶⁸ Ng, Ellie. "A Web of Violence: Local Perceptions on the Power Relations of the Tanzanite Trade Network in Arusha." (2013).
- ²⁶⁹ Ng, Ellie. "A Web of Violence: Local Perceptions on the Power Relations of the Tanzanite Trade Network in Arusha." (2013).
- ²⁷⁰ Mbowe, Wilfred EN, Nicas Yabu, and Moto Lugobi. "Tanzanite Processing in Tanzania: Challenges and Opportunities." *Applied Economics and Finance* 3, no. 3 (2016): 236-257.
- ²⁷¹ Tanzanite America. "How popular is tanzanite". Retrieved from <http://tanzaniteamerica.com/Tanzanite-FAQ.php#Popular>.

- ²⁷²Tanzanite America. "How popular is tanzanite". Retrieved from <http://tanzaniteamerica.com/Tanzanite-FAQ.php#Popular>.
- ²⁷³ Tanzanite Jewelry Designs. Tanzanite Price and Tanzanite Value. 2019. Retrieved November 18, 2019, from <https://www.tanzanitejewelrydesigns.com/pages/tanzanite-prices-per-carat-html>.
- ²⁷⁴ TanzaniteOne. Retrieved November 18, 2019, from <https://www.tanzaniteone.com/sigholders>.
- ²⁷⁵ JDI-Tanzania Interview B. [Telephone], Washington, DC. October 7, 2019.
- ²⁷⁶ Kindt, Roeland, Paulo Van Breugel, Caleb Orwa, Jens-Peter B. Lillesø, Ramni Jamnadass, and Lars Gradual. "Useful tree species for Eastern Africa: a species selection tool based on the VECEA map version 2.0." (2015).
- ²⁷⁷ Dozolme, P. Types of Detonators and the Latest Trends. January 27, 2019. Retrieved October 31, 2019, from <https://www.thebalance.com/different-types-of-detonators-used-in-mining-2367466>.
- ²⁷⁸ Mbowe, Wilfred EN, Nicas Yabu, and Moto Lugobi. "Tanzanite Processing in Tanzania: Challenges and Opportunities." *Applied Economics and Finance* 3, no. 3 (2016): 236-257.
- ²⁷⁹ Kotzias, D., K. Koistinen, and S. Kephelopoulos. "The index project, critical appraisal of the setting and implementation of indoor exposure limits in the EU. European Commission, Joint Research Centre." *Institute for Health and Consumer Protection, Ispra (VA), Italy* (2005).
- ²⁸⁰ Malisa, E. P., and C. P. Kinabo. "Environmental risks for gemstone miners with reference to Merelani tanzanite mining area, Northeastern Tanzania." *Tanzania Journal of Science* 31, no. 1 (2005): 1-12.
- ²⁸¹ Tanzania National Environment Management Council . "Act Supplement". 2016. Retrieved from [https://www.nemc.or.tz/uploads/publications/en1567492475-The Written Laws \(Miscellaneous Amendments\) \(No.3\) Act NO. 13 of 2016 .pdf.pdf](https://www.nemc.or.tz/uploads/publications/en1567492475-The Written Laws (Miscellaneous Amendments) (No.3) Act NO. 13 of 2016 .pdf.pdf)
- ²⁸² Tanzania mineral audit agency. "Annual Report". 2015.
- ²⁸³ Tanzania Ministry of Minerals. "About Ministry". <https://www.madini.go.tz/about-ministry/>
- ²⁸⁴ JDI-Tanzania Interview A.[Telephone], Washington, DC – Tanzania. October 6, 2019..
- ²⁸⁵ JDI-Tanzania Interview B. [Telephone], Washington, DC. October 7, 2019.
- ²⁸⁶ Malisa, E. P., and C. P. Kinabo. "Environmental risks for gemstone miners with reference to Merelani tanzanite mining area, Northeastern Tanzania." *Tanzania Journal of Science* 31, no. 1 (2005): 1-12.
- ²⁸⁷ JDI-Tanzania Interview D. [Telephone], Washington, DC – Thailand. October 11, 2019.
- ²⁸⁸ Malisa, E. P., and C. P. Kinabo. "Environmental risks for gemstone miners with reference to Merelani tanzanite mining area, Northeastern Tanzania." *Tanzania Journal of Science* 31, no. 1 (2005): 1-12.
- ²⁸⁹ Boniface, Respicious, Lawrence Museru, Victoria Munthali, and Ronald Lett. "Occupational Injuries and Fatalities in a Tanzanite Mine: Need to Improve Workers Safety in Tanzania." *Pan African Medical Journal* 16 (November 27, 2013). <https://doi.org/10.11604/pamj.2013.16.120.3420>.
- ²⁹⁰ Malisa, E P, and C P Kinabo. "Environmental Risks for Gemstone Miners with Reference to Merelani Tanzanite Mining Area, Northeastern Tanzania." *Tanzania Journal of Science* 31, no. 1 (December 2009). <https://doi.org/10.4314/tjs.v31i1.18404>.
- ²⁹¹ Boniface, Respicious, Lawrence Museru, Victoria Munthali, and Ronald Lett. "Occupational Injuries and Fatalities in a Tanzanite Mine: Need to Improve Workers Safety in Tanzania." *Pan African Medical Journal* 16 (November 27, 2013). <https://doi.org/10.11604/pamj.2013.16.120.3420>.
- ²⁹² Mrema, Ezra J., Aiwerasia V. Ngowi, and Simon H.d. Mamuya. "Status of Occupational Health and Safety and Related Challenges in Expanding Economy of Tanzania." *Annals of Global Health* 81, no. 4 (2015): 538. <https://doi.org/10.1016/j.aogh.2015.08.021>.
- ²⁹³ Malisa, Ep, and Cp Kinabo. "Environmental Risks for Gemstone Miners with Reference to Merelani Tanzanite Mining Area, Northeastern Tanzania." *Tanzania Journal of Science* 31, no. 1 (December 2009). <https://doi.org/10.4314/tjs.v31i1.18404>
- ²⁹⁴ Mrema, Ezra J., Aiwerasia V. Ngowi, and Simon H.d. Mamuya. "Status of Occupational Health and Safety and Related Challenges in Expanding Economy of Tanzania." *Annals of Global Health* 81, no. 4 (2015): 538. <https://doi.org/10.1016/j.aogh.2015.08.021>
- ²⁹⁵ Mrema, Ezra J., Aiwerasia V. Ngowi, and Simon H.d. Mamuya. "Status of Occupational Health and Safety and Related Challenges in Expanding Economy of Tanzania." *Annals of Global Health* 81, no. 4 (2015): 538. <https://doi.org/10.1016/j.aogh.2015.08.021>..
- ²⁹⁶ Boniface, Respicious, Lawrence Museru, Victoria Munthali, and Ronald Lett. "Occupational Injuries and Fatalities in a Tanzanite Mine: Need to Improve Workers Safety in Tanzania." *Pan African Medical Journal* 16 (November 27, 2013). <https://doi.org/10.11604/pamj.2013.16.120.3420>.
- ²⁹⁷ Malisa, Ep, and Cp Kinabo. "Environmental Risks for Gemstone Miners with Reference to Merelani Tanzanite Mining Area, Northeastern Tanzania." *Tanzania Journal of Science* 31, no. 1 (December 2009).

- <https://doi.org/10.4314/tjs.v31i1.18404>.
- ²⁹⁸ Helliesen, Morten Skåra. "Tangled up in Blue: Tanzanite Mining and Conflict in Mererani, Tanzania." *Critical African Studies* 4, no. 7 (2012): 58–93. <https://doi.org/10.1080/21681392.2012.10597799>.
- ²⁹⁹ Mrema, Ezra J., Aiwerasia V. Ngowi, and Simon H.d. Mamuya. "Status of Occupational Health and Safety and Related Challenges in Expanding Economy of Tanzania." *Annals of Global Health* 81, no. 4 (2015): 538. <https://doi.org/10.1016/j.aogh.2015.08.021>.
- ³⁰⁰ Huggins, C., & Kinyondo, A. (2019). Resource nationalism and formalization of artisanal and small-scale mining in Tanzania: Evidence from the tanzanite sector. *Resources Policy*, 63(C).
- ³⁰¹ The Where of Mineral Names: Merelaniite, Merelani (Mererani), Manyara Region, Tanzania
- ³⁰² Helliesen, Morten Skåra. "Tangled up in Blue: Tanzanite Mining and Conflict in Mererani, Tanzania." *Critical African Studies* 4, no. 7 (2012): 58–93. <https://doi.org/10.1080/21681392.2012.10597799>.
- ³⁰³ JDI-Tanzania Interview B. (2019), [Telephone], Washington, DC.
- ³⁰⁴ JDI-Tanzania Interview B. (2019), [Telephone], Washington, DC.
- ³⁰⁵ JDI-Tanzania Interview B. (2019), [Telephone], Washington, DC.
- ³⁰⁶ Helliesen, Morten Skåra. "Tangled up in Blue: Tanzanite Mining and Conflict in Mererani, Tanzania." *Critical African Studies* 4, no. 7 (2012): 58–93. <https://doi.org/10.1080/21681392.2012.10597799>.
- ³⁰⁷ "Steve Moriarty Visits the Mines for Tanzanite." Tanzanite Jewelry Designs. Tanzanite Jewelry Designs, July 31, 2015. <https://www.tanzanitejewelrydesigns.com/pages/tanzanite-mines>.
- ³⁰⁸ Helliesen, Morten Skåra. "Tangled up in Blue: Tanzanite Mining and Conflict in Mererani, Tanzania." *Critical African Studies* 4, no. 7 (2012): 58–93. <https://doi.org/10.1080/21681392.2012.10597799>.
- ³⁰⁹ JDI-Tanzania Interview B. (2019), [Telephone], Washington, DC.
- ³¹⁰ Tanzanite as conflict gem: Certifying a secure commodity chain in Tanzania
- ³¹¹ Hughes, Richard W. "Tanzanite Mines of Merelani • Working the Blue Seam • Lotus Gemology." LotusGemology.com. Accessed December 1, 2019. <https://www.lotusgemology.com/index.php/library/articles/144-working-the-blue-seam-the-tanzanite-mines-of-merelani>.
- ³¹² JDI-Tanzania Interview B. (2019), [Telephone], Washington, DC.
- ³¹³ Malisa, E P, and C P Kinabo. "Environmental Risks for Gemstone Miners with Reference to Merelani Tanzanite Mining Area, Northeastern Tanzania." *Tanzania Journal of Science* 31, no. 1 (December 2009). <https://doi.org/10.4314/tjs.v31i1.18404>.
- ³¹⁴ Malisa, E P, and C P Kinabo. "Environmental Risks for Gemstone Miners with Reference to Merelani Tanzanite Mining Area, Northeastern Tanzania." *Tanzania Journal of Science* 31, no. 1 (December 2009). <https://doi.org/10.4314/tjs.v31i1.18404>.
- ³¹⁵ JDI-Tanzania Interview B. (2019), [Telephone], Washington, DC.
- ³¹⁶ Stuckler, David, Sarah Steele, Mark Lurie, and Sanjay Basu. "Introduction: 'Dying for Gold': The Effects of Mineral Mining on HIV, Tuberculosis, Silicosis, and Occupational Diseases in Southern Africa." *International Journal of Health Services* 43, no. 4 (2013): 639–49. <https://doi.org/10.2190/hs.43.4.c>.
- ³¹⁷ Smith, Sonia. "Can Traditional Medicine and Modern Science Coexist?" *Slate Magazine*. Slate, June 9, 2011. <https://slate.com/news-and-politics/2011/06/fighting-aids-in-tanzania-can-traditional-medicine-and-modern-science-coexist.html>.
- ³¹⁸ Morten Skåra Helliesen MSc (2012) Tangled up in Blue: Tanzanite Mining and Conflict in Mererani, Tanzania, *Critical African Studies*, 4:7, 58-93, DOI: 10.1080/21681392.2012.10597799
- ³¹⁹ JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC
- ³²⁰ "Tanzania." Global Hunger Index - peer-reviewed annual publication designed to comprehensively measure and track hunger at the global, regional, and country levels. Accessed November 27, 2019. <https://www.globalhungerindex.org/tanzania.html>.
- ³²¹ "Human Development Reports." | Human Development Reports. Accessed November 27, 2019. <http://hdr.undp.org/en/countries/profiles/TZA>.
- ³²² Juma, Fredrick Kisika. "Effects of Mining on Food Security to Farming Communities Surrounding Nyamongo Gold Mine in Tarime District, Tanzania." *Effects of Mining on Food Security to Farming Communities Surrounding Nyamongo Gold Mine in Tarime District, Tanzania*. Sokoine University of Agriculture, 2015.
- ³²³ Juma, Fredrick Kisika. "Effects of Mining on Food Security to Farming Communities Surrounding Nyamongo Gold Mine in Tarime District, Tanzania." *Effects of Mining on Food Security to Farming Communities Surrounding Nyamongo Gold Mine in Tarime District, Tanzania*. Sokoine University of Agriculture, 2015. <http://www.suair.suanet.ac.tz:8080/xmlui/handle/123456789/1266>.
- ³²⁴ JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC

- ³²⁵ Helliesen, Morten Skåra. "Tangled up in Blue: Tanzanite Mining and Conflict in Mererani, Tanzania." *Critical African Studies* 4, no. 7 (2012): 58–93. <https://doi.org/10.1080/21681392.2012.10597799>.
- ³²⁶ JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC
- ³²⁷ JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC
- ³²⁸ JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC
- ³²⁹ JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC
- ³³⁰ "Toxic Toil: Child Labor and Mercury Exposure in Tanzania's Small-Scale Gold Mines." Human Rights Watch, April 18, 2018. <https://www.hrw.org/report/2013/08/28/toxic-toil/child-labor-and-mercury-exposure-tanzanias-small-scale-gold-mines>.
- ³³¹ JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC
- ³³² JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC
- ³³³ Huggins, C., & Kinyondo, A. (2019). Resource nationalism and formalization of artisanal and small-scale mining in Tanzania: Evidence from the tanzanite sector. *Resources Policy*, 63(C).
- ³³⁴ Huggins, C., & Kinyondo, A. (2019). Resource nationalism and formalization of artisanal and small-scale mining in Tanzania: Evidence from the tanzanite sector. *Resources Policy*, 63(C).
- ³³⁵ "Tanzania: Govt. Official Suspends TanzaniteOne's Operations; Says Mine Not Benefiting Locals & Workers Unpaid for 22 Months." Business & Human Rights Resource Centre, August 2, 2019. <https://www.business-humanrights.org/en/tanzania-govt-official-suspends-tanzanite-ones-operations-says-mine-not-benefiting-locals-workers-unpaid-for-22-months>.
- ³³⁶ *African Studies* 4, no. 7 (2012): 58–93. <https://doi.org/10.1080/21681392.2012.10597799>.
- ³³⁶ JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC
- ³³⁷ JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC
- ³³⁸ JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC
- ³³⁹ JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC
- ³⁴⁰ Smith, Nicole M., "Maasai and the Tanzanite Trade: New Facets of Livelihood Diversification in Northern Tanzania" (2012). Anthropology Graduate Theses & Dissertations.
- ³⁴¹ Tanzanite. Accessed November 25, 2019. <https://schmidtsjewelry.com/gemstone-details.php?ID=18>.
- ³⁴² Mirerani Tanzanite tourism. Twitter Post. August 7, 2018 12:39 AM. <https://twitter.com/tanzanitetours/status/1026734485008732161>
- ³⁴³ "Working to Secure the Rights of Minorities and Indigenous Peoples." Tanzania: Maasai loss of land, culture and heritage ~ State of the World's Minorities and Indigenous Peoples 2016: focus on culture and heritage ~ Minority Stories. Accessed November 3, 2019. <http://stories.minorityrights.org/cultureandheritage/chapter/4/>.
- ³⁴⁴ JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC
- ³⁴⁵ Smith, Nicole M., "Maasai and the Tanzanite Trade: New Facets of Livelihood Diversification in Northern Tanzania" (2012). Anthropology Graduate Theses & Dissertations.
- ³⁴⁶ Smith, Nicole M., "Maasai and the Tanzanite Trade: New Facets of Livelihood Diversification in Northern Tanzania" (2012). Anthropology Graduate Theses & Dissertations.
- ³⁴⁷ Smith, Nicole M., "Maasai and the Tanzanite Trade: New Facets of Livelihood Diversification in Northern Tanzania" (2012). Anthropology Graduate Theses & Dissertations.
- ³⁴⁸ JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC
- ³⁴⁹ "United Nations Tanzania - Gender." United Nations. United Nations. Accessed November 25, 2019. <https://tz.one.un.org/who-we-are/9-core-comittments/9-gender>.
- ³⁵⁰ JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC
- ³⁵¹ Kondo, Hamza. "Tanzanite Mines Interrupted - Ganoksin Jewelry Making Community." Ganoksin, 2005. <https://www.ganoksin.com/article/tanzanite-mines-interrupted/>.
- ³⁵² Kondo, Hamza. "Tanzanite Mines Interrupted - Ganoksin Jewelry Making Community." Ganoksin, 2005. <https://www.ganoksin.com/article/tanzanite-mines-interrupted/>.
- ³⁵³ Kondo, Hamza. "Tanzanite Mines Interrupted - Ganoksin Jewelry Making Community." Ganoksin, 2005. <https://www.ganoksin.com/article/tanzanite-mines-interrupted/>.
- ³⁵⁴ Kondo, Hamza. "Tanzanite Mines Interrupted - Ganoksin Jewelry Making Community." Ganoksin, 2005. <https://www.ganoksin.com/article/tanzanite-mines-interrupted/>.
- ³⁵⁵ "From Where I Stand: 'I Became a Man, Just to Access the Mines.'" UN Women, 2017. <https://www.unwomen.org/en/news/stories/2017/2/from-where-i-stand-pili-hussein>.
- ³⁵⁶ From Where I Stand: 'I Became a Man, Just to Access the Mines.'" UN Women, 2017. <https://www.unwomen.org/en/news/stories/2017/2/from-where-i-stand-pili-hussein>.

-
- ³⁵⁷ JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC
- ³⁵⁸ “From Where I Stand: ‘I Became a Man, Just to Access the Mines.’” UN Women, 2017. <https://www.unwomen.org/en/news/stories/2017/2/from-where-i-stand-pili-hussein>.
- ³⁵⁹ “From Where I Stand: ‘I Became a Man, Just to Access the Mines.’” UN Women, 2017. <https://www.unwomen.org/en/news/stories/2017/2/from-where-i-stand-pili-hussein>.
- ³⁶⁰ “Human Rights in Tanzania's Extractive Sector: Exploring the Terrain.” Human Rights in Tanzania's Extractive Sector: Exploring the Terrain | Institute for Human Rights and Business. Accessed November 3, 2019. <https://www.ihrb.org/focus-areas/commodities/human-rights-in-tanzanias-extractive-sector-exploring-the-terrain>.
- ³⁶¹ Kondo, Hamza. “Tanzanite Mines Interrupted - Ganoksin Jewelry Making Community.” Ganoksin, 2005. <https://www.ganoksin.com/article/tanzanite-mines-interrupted/>.
- ³⁶² Kondo, Hamza. “Tanzanite Mines Interrupted - Ganoksin Jewelry Making Community.” Ganoksin, 2005. <https://www.ganoksin.com/article/tanzanite-mines-interrupted/>.
- ³⁶³ JDI-Tanzania Interview B. (2019, Oct 7). [Telephone], Washington, DC
- ³⁶⁴ Famau, Aboubakar. “The Tanzanian Gemstone Mined by Child Labour.” BBC News. BBC, June 19, 2014. <https://www.bbc.com/news/av/world-africa-27933666/the-tanzanian-gemstone-mined-by-child-labour>.
- ³⁶⁵ “Gem Slaves: Tanzanite's Child Labour.” The New Humanitarian, December 1, 2015. <http://www.thenewhumanitarian.org/report/61004/tanzania-gem-slaves-tanzanites-child-labour>.
- ³⁶⁶ “Toxic Toil: Child Labor and Mercury Exposure in Tanzania's Small-Scale Gold Mines.” Human Rights Watch, April 18, 2018. <https://www.hrw.org/report/2013/08/28/toxic-toil/child-labor-and-mercury-exposure-tanzanias-small-scale-gold-mines>.
- ³⁶⁷ “Toxic Toil: Child Labor and Mercury Exposure in Tanzania's Small-Scale Gold Mines.” Human Rights Watch, April 18, 2018. <https://www.hrw.org/report/2013/08/28/toxic-toil/child-labor-and-mercury-exposure-tanzanias-small-scale-gold-mines>.
- ³⁶⁸ Famau, Aboubakar. “The Tanzanian Gemstone Mined by Child Labour.” BBC News. BBC, June 19, 2014. <https://www.bbc.com/news/av/world-africa-27933666/the-tanzanian-gemstone-mined-by-child-labour>.
- ³⁶⁹ Gem Slaves: Tanzanite's Child Labour.” The New Humanitarian, December 1, 2015. <http://www.thenewhumanitarian.org/report/61004/tanzania-gem-slaves-tanzanites-child-labour>.
- ³⁷⁰ The Where of Mineral Names: Merelaniite, Merelani (Mererani), Manyara Region, Tanzania
- ³⁷¹ JDI-Tanzania Interview A, B, C [Telephone], Washington, DC.
- ³⁷² Lyimo, Joseph “Tanzania: Mines Closed After One Killed in Clashes. *All Africa*. July 31, 2017. Tanzania: Mines Closed After One Killed in Clashes
- ³⁷³ Daley, E, K Lanz, A Mhinda, Z Driscoll, J Ndakaru, J Grabham, K Kereri, and E Mbise. “Gender, Land and Mining in Pastoralist Tanzania.” *Gender, Land and Mining in Pastoralist Tanzania*. WOLTS, June 2018.
- ³⁷⁴ Daley, E, K Lanz, A Mhinda, Z Driscoll, J Ndakaru, J Grabham, K Kereri, and E Mbise. “Gender, Land and Mining in Pastoralist Tanzania.” *Gender, Land and Mining in Pastoralist Tanzania*. WOLTS, June 2018.
- ³⁷⁵ Daley, E, K Lanz, A Mhinda, Z Driscoll, J Ndakaru, J Grabham, K Kereri, and E Mbise. “Gender, Land and Mining in Pastoralist Tanzania.” *Gender, Land and Mining in Pastoralist Tanzania*. WOLTS, June 2018.
- ³⁷⁶ United States Department of State *2018 Trafficking in Persons Report – Tanzania*, 28 June, 2018, available at: <https://www.refworld.org/docid/5b3e0a624.html>
- ³⁷⁷ United States Department of State *2018 Trafficking in Persons Report – Tanzania*, 28 June, 2018, available at: <https://www.refworld.org/docid/5b3e0a624.html>
- ³⁷⁸ Kamazima S, Ezekiel M, Kazaura M. Study report: Dynamics of Trafficking in Persons in Tanzania. 2016.