



A REVIEW OF CONVENTIONS, PROTOCOLS, AND AGREEMENTS: IMPORTANCE OF SUSTAINABLE MINING IN ACHIEVING SUSTAINABLE DEVELOPMENT GOALS

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Abstract— A set of global objectives for equitable and sustainable health at every scale, from the global biosphere to the local community, are known as the Sustainable Development Goals (SDGs). The goal is to eradicate poverty, save the environment, and guarantee that everyone lives in peace and prosperity both now and in the future. Minerals are necessary for human health and are used in almost every economic sector. Minerals are essential for the general running of the world; one cannot imagine the world without minerals and mining is solely liable for 4 to 7 per cent of greenhouse gas (GHG) emissions. Mining activities can also contribute to long-term development, especially in economics. It can help a country generate cash, fuel economic growth, create jobs, and contribute to infrastructure development. As a result, Mining has positive and negative implications for the SDGs, with 11 of the 17 SDGs having exceptionally high impacts. This paper reviews the Conventions, Protocols, and Agreements and importance of Sustainable Mining in achieving SDGs.

Keywords—Conventions, Protocols, Agreements, Sustainable Mining, Sustainable Development Goals.

I. INTRODUCTION

Mineral extraction from the ground creates opportunities, challenges, and threats for long-term development. Minerals are necessary for human health and are used in almost every economic sector. Minerals are essential for the general running of the world; one cannot imagine the world without minerals. On the other hand, Mining poses significant hurdles and threats to long-term sustainability. Mineral resources, at least on human or biological timescales, are limited and non-renewable [1]. Mining's environmental and social difficulties,

as well as the risks it poses, are increasingly causing tensions between mining firms and local people. With most mineral ore grades dropping, resource intensity and waste generated per unit of resource produced are anticipated to rise. The related environmental costs will become a persistent and growing concern. Globally, Mining is solely liable for 4 to 7 per cent of greenhouse gas (GHG) emissions, while coal mining is projected to be responsible for 3 to 6 per cent of fleeing methane emissions.

Efforts should be made throughout the life of a mine and the entire value chain of Mining to limit environmental consequences, safeguard human rights, promote social participation, and increase benefits from mining for development [2]. The effects of Mining are best understood by looking at the mine's life cycle: mineral discovery, mine development, mining operations, and mine closure, which helps governments and other stakeholders to identify concrete actions that may be taken at various stages of Mining.

The world started to come together to combat environmental problems in early 1969. At first, the Vienna convention took place, followed by the Montreal protocol, Intergovernmental Panel on Climate Change, Rio earth summit, Kyoto protocol, and Paris agreement. In late 1998, nine of the world's leading mining firms decided to launch a new effort on the tenth centennial of the Rio Earth Conference. The goal was to change how the industry tackled today's problems significantly. The Global Mining Initiative was the name given to it. It comprised an internal reform program, a review of the numerous associations to which they belonged, and a thorough examination of the societal challenges they had to deal with [3].

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Figure 1. Sustainable Development Goals [4]

Whereas poverty, quality education, affordable clean energy, economic growth, industry and innovation are the enhancing parameters for attaining sustainable growth. Zero hunger, health and well-being, gender equality, clean water and sanitation, inequalities, sustainable cities, responsible consumption and production, climate action, life below water, life on land, peace, justice and partnership for goals are the mitigating factors for achieving sustainable development. To achieve the SDGs, unparalleled cooperation and partnership will be required among governments, non-governmental organizations, development partners, the private sector, and communities. The mining industry is well-positioned to contribute significantly to this success. This paper mainly emphasizes the conventions, protocols, and agreements that lead to the SDGs agenda 2030 and the importance of sustainable Mining in achieving the SDGs.

II. A REVIEW OF CONVENTIONS, PROTOCOLS, AND AGREEMENTS

A. Vienna Convention–

The Vienna Convention on Treaty Regulation (VCLT) is a worldwide agreement that governs treaties between nations. It was signed on May 23, 1969, and it became effective on January 27, 1980. Establishes detailed rules, procedures, and recommendations for how treaties are defined, drafted, revised, interpreted, and generally carried out. The United Nations Environment Programme governs the Vienna Convention on the Safety of Ozone [5].

B. Montreal Protocol–

The Montreal Protocol committed to the progressive phase-out of numerous ozone-depleting substances to protect the ozone layer. Adopted on September 16, 1987, it went into effect on

August 26, 1989. September 16 is designated as International Day for the Preservation of the Ozone Layer [6]. By January 2012, the agreement had been ratified by 197 countries (Universal ratification). In 1990, 92, 95, 97, 99, and 2016, six revisions were made. It set a tremendous example for international environmental cooperation. Greenhouse gases include methane, nitrous oxide, and a class of man-made gases known as chlorofluorocarbons (CFCs), created in the late 1920s [6].

Chlorofluorocarbons (CFCs) are effective heat trappers, even at considerably lower quantities in the atmosphere; indeed, they are ten thousand times more potent, molecule for molecule, than CO₂. CFCs have been used in various applications, ranging from propellants in aerosol cans to coolants in refrigerators [7,8]. Using NASA satellite data, researchers from the British Antarctic Survey discovered a "hole" in the ozone layer above Antarctica in 1985. The ozone layer weakened and degraded in the atmosphere due to 96 ozone-depleting compounds such as chlorofluorocarbons, halons, and transitional elements such as hydro-chlorofluorocarbon (HCFC). Because Ozone absorbs UV rays, the danger was immediate. The loss of Ozone threatens massive skin cancer epidemics around the world, as well as catastrophic consequences for animal and plant life on the planet [9].

Because of this anxiety, the Montreal Protocol, which would ban chlorofluorocarbons, was signed by twenty-four countries in record time by 1987. The Montreal Protocol directly influenced the climate-change movement [10]. It acknowledged that rising greenhouse gas concentrations were worrisome. It emphasized the widespread acceptance of the idea that human activity damages the Earth's atmosphere. It also illustrated that countries might quickly band together to address a common environmental danger.

C. Intergovernmental Panel on Climate Change

Scientists founded the Intergovernmental Panel on Climate Change (IPCC) in November 1988 in Geneva. Two international institutions provided legitimacy to the IPCC: the World Meteorological Organization and the United Nations Environment Program [11]. Later it was endorsed by National General Assembly, headquarters at Geneva, Switzerland. IPCC was a self-regulating, self-governing organism, a coordinated network of research scientists collaborating across boundaries, aided by more affordable and improved communications. Bert Bolin, a Swedish meteorologist and the "indispensable man" of climate science, was the first "coordinator in chief."

The IPCC provides objective and complete scientific information on anthropogenic climate change, encompassing environmental, political, and economic impacts and dangers and viable mitigation strategies. It doesn't produce original research or track climate change; instead, it regularly reviews all relevant published literature [12]. Scientists worldwide and other specialists give their time to analyze data and synthesize critical findings into assessment reports for lawmakers and the



general public [13], dubbed the scientific community's most crucial peer-review process.

The IPCC is a globally recognized authority on climate change, and both prominent climate scientists and governments essentially accept its findings [11,12]. Its reports are essential to the United Nations Framework Convention on Climate Change (UNFCCC), with the Fifth Assessment Report underpinning the historic Paris Agreement in 2015. [14] For contributions to human understanding of climate change, the IPCC and Al Gore received the Nobel Peace Prize in 2007 [15].

Members of the IPCC elect a bureau of scientists to serve for the duration of an assessment cycle (typically six to seven years); the bureau selects specialists nominated by governments and observer organizations to prepare IPCC reports [16]. A secretariat and other "Technical Support Units" from specialized working groups and task forces support the IPCC [16]. Hoesung Lee, a Korean economist, is the current chair of the IPCC [17].

In 1990, the IPCC released its First Assessment Report on climate change, which stated that the temperature would rise by 0.5o C per decade during the 21st century, followed by a supplementary report in 1992. The second assessment report in 1995 on the scientific and socio-economic assessment of the climate change of then available data. The Third Assessment Report in 2001 on the socio-economic and scientific evaluation of the climate change of then available data. The Fourth Assessment Report, published in 2007, focuses on scientific, technological, and socio-economic data on climate change, its possible implications, and adaptation and mitigation measures. The Fifth Assessment Report in 2014 is a series of reports on the scientific assessment of climate change [18]. The IPCC is currently preparing its Sixth Assessment Report, which will be released in 2022.

D. Rio Earth Summit

More than 160 heads of state and governments, and international organizations attended the Rio Earth Summit held between June 3-14, 1992, with 10,000 other government officials and another 25,000 activists, NGOs, business leaders, and journalists. Several NGOs had an essential role in negotiating, which had never happened before.

Climate change was now enshrined as a top priority for the entire world. The ultimate goal of the Framework Convention was ambitious: "the stabilization of greenhouse gas meditations in the atmosphere at a level that averts harmful anthropogenic interference with the climate system"[19]. The convention focused on releasing greenhouse gases from human activity, notably burning coal, oil, natural gas and deforestation. The rich countries promised to manage their emissions as part of the deal. They also pledged to "give new and extra financial resources" to assist developing countries in reducing their emissions. The notion of "joint implementation" was created, which entails governments encouraging

enterprises within their boundaries to collaborate with similar groups in other countries.

A noteworthy achievement was the agreement on the Climate Change Convention, which led to the Kyoto Protocol and the Paris Agreement [20]. Another deal was that "no operations on indigenous peoples' territories that would cause environmental damage or be culturally incorrect" would be carried out [21]. Agenda 21, a comprehensive plan of action to form a worldwide partnership for sustainable development to improve human lives and safeguard the environment, was adopted by over 178 countries.

E. KYOTO Protocol

The Kyoto Protocol was signed on December 11, 1997. It emanated into power on February 16, 2005., after a lengthy ratification procedure. The Kyoto Protocol now has 192 signatories. In a nutshell, the Kyoto Protocol puts the convention into action by requiring industrialized countries to restrict and reduce Green House Gases (GHGs) emissions by individually agreed-upon targets [22]. The convention requires those countries to establish mitigation strategies and activities and report 30 regularly. The Kyoto Protocol is founded on the convention's principles and provisions and follows the convention's annexe-based structure. Because it recognizes that industrialized countries are primarily responsible for the current high levels of GHGs emissions in the atmosphere, it only binds them. It lays a higher burden on them under the premise of "common but differentiated responsibility and respective capabilities."

In Annexe B of the Kyoto Protocol, 36 industrialized countries and the European Union set binding emission reduction objectives. Over the five years 2008–2012, these targets amount up to an average 5% reduction in emissions relative to 1990 levels (the first commitment period). In 2012, the Doha Amendment to the Kyoto Protocol was adopted for a second commitment period, starting in 2013 and lasting until 2020. However, the Doha Amendment has not yet entered into force [23].

The Kyoto Protocol has two fundamental components. The binding carbon reduction pledges for developed nation Parties were the first element. This meant that the amount of space available to pollute was restricted and that what was rare came at a cost [24]. GHGs, mainly CO₂, became a new commodity. The Kyoto Protocol began to internalize an unpriced externality that had been identified. The second component was introducing flexible market mechanisms based on emission permit trading. Protocol of Kyoto Parties bound by targets must meet them primarily by domestic action, i.e., lowering their emissions. They can, however, reach a portion of their commitments through three market-based mechanisms that, in theory, promote GHG reduction to begin where it is most cost-effective, such as in developing countries [25]. It makes no difference where emissions are cut; what matters is that they are eliminated from the atmosphere. This has the added benefit of encouraging green investment in developing



nations while also including the private sector to reduce and stabilize GHG emissions at a safe level. The Kyoto Protocol also established strict monitoring, evaluation, and verification system and a compliance mechanism to maintain openness and hold Parties accountable.

F. Paris Agreement

The Paris Agreement is a 2015 international climate change accord. Climate change mitigation, adaptation, and finance are all addressed. One hundred ninety-six countries reached the accord at the United Nations Climate Change Conference in 2015. At a ceremony in New York on April 22, 2016, the Paris Agreement was opened for signature. The Paris agreement's long-term temperature goal is to keep the rise in mean global temperature well below two °C above pre-industrial levels, preferably below 1.5 ° C, recognizing that this would significantly reduce climate change's effects. Emissions should be reduced as quickly as practicable to achieve net-zero emissions by the middle of the twenty-first century [26]. To restrict global warming at 1.5 ° C, emissions must be reduced by roughly half by 2030. This is the sum of each country's contributions as decided at the national level [27].

Its goal is to improve parties' ability to respond to the effects of climate change and mobilize appropriate funding. Each country is required by the agreement to determine, plan, and report on its contributions regularly. No mechanism obligates a government to set precise emissions goals, although each goal should be higher than the preceding one. Unlike the Kyoto Protocol of 1997, the boundary between industrialized and developing countries is blurred, requiring the latter to submit plans for emission reductions [28].

In addition, the agreement lays out several measures to improve action before 2020, including tightening the technical inspection process, enhancing the availability of urgent financing, technology, and support, and bolstering high-level engagement. According to the decision, all non-Party players, including civil society, the commercial sector, financial institutions, cities, and other sub-national authorities, are encouraged to address and respond to climate change. These stakeholders are encouraged to expand their efforts and display them on the Non-State Actors in Climate Action platform.

Parties also agreed on the importance of improving knowledge, technology, and practices: local communities and indigenous peoples' initiatives and the critical role of using mechanisms like domestic policies and carbon pricing to provide incentives [29].

The UN General Assembly began negotiating the post-2015 development agenda in January 2015. At the UN Sustainable Development Summit in September 2015, the process concluded with the approval of the 2030 Schema for Sustainable Development, which embraces 17 SDGs [30].

III. SUSTAINABLE DEVELOPMENT GOALS (SDG)

Sustainable development goals are a combination of different goals to end poverty, protect the environment and biodiversity, to create a peaceful and sustainable planet for every society in the world. Most of the time, sustainable development goals consist of the environment, community, and economy. The Sustainable Development Goals, which were espoused by the United Nations General Assembly and agreed upon by all associates of the United Nations in September 2015, run from 2016. The goals are part of the United Nations' Transforming Our World: the 2030 Agenda for Sustainable Development, which lays out the vision, values, and commitments for the next 15 years [31].

According to [32], there are 17 fundamental goals of sustainable development (Figure 1.) goals in the plan by 2030. Those are:

A. End poverty

Poverty is well-defined as a shortage of adequate income and resources to maintain a healthy lifestyle. Hunger and famishment constrained access to education and other essential services, social prejudice and exclusion, and a deficient involvement in decision-making are examples of its expressions. For long-standing job creation and equality, economic growth must be inclusive.

B. End hunger

End hunger by 2030 and ensure that all people, particularly the poor and those in vulnerable situations, including infants, have year-round access to safe, nutritious, and sufficient food.

C. Good Health and Well-Being

Sustainable development requires ensuring healthy lifestyles and encouraging well-being for all people of all ages. Life expectancy has increased significantly, and some common child and maternal mortality killers have been reduced considerably. There has been significant success in improving access to safe drinking water and sanitation and tumbling malaria, TB, polio, and the blowout of HIV/AIDS.

D. Quality Education

Obtaining a high-quality education is essential for improving people's lives and ensuring long-term sustainable development. There has been significant progress in improving educational access. At all levels, increasing registration rates in schools, particularly for women and girls. Basic literacy skills have vastly improved, but more aggressive efforts are required to achieve the desired results and even more progress toward universal education goals.

E. Gender Equality

While the Millennium Development Goals have made progress toward gender equality and women's empowerment (including equal access to elementary education for girls and boys),



women and girls continue to face discrimination and violence in every area of the world.

Not only is gender parity a fundamental human right and a requirement for a peaceful, prosperous, and sustainable world. Equal access to education, health care, a decent job, and participation in political and economic decision-making for women and girls would help drive sustainable economies and benefit societies and humanity as a whole.

F. Clean Water and Sanitation

Everyone should have access to adequate safe drinking water is essential. There is enough fresh water available on the Earth to accomplish this. Every year, however, millions of people, the majority of whom are children, die due to diseases linked to insufficient water, sanitation, and hygiene owing to bad economics or poor infrastructure. Water scarceness, deprived water quality, and poor sanitation harm poor families' food security, livelihood options, and educational opportunities worldwide. Drought is wreaking havoc on some of the world's poorest countries, causing hunger and malnutrition to worsen.

G. Affordable and Clean Energy

Almost every critical difficulty and opportunity the world faces today revolves around energy. Access to energy is critical for everyone, whether for jobs, security, climate change, food production, or increased revenue. Sustainable energy is a game-changer for people, businesses, and the environment.

H. Decent Work and Economic Growth

Approximately half of the world's population lives on less than \$2 per day. Furthermore, in far too many places, having a job does not imply that you will be able to overcome poverty. We must rethink and retool our economic and social policies targeted at reducing poverty due to this delayed and uneven development. Inadequate investments, underconsumption, and a lack of decent labour opportunities all contribute to the deterioration of the essential social contract that underpins democratic societies: all must share in progress. Long after 2015, practically all economies will face substantial difficulty in creating quality jobs. Sustainable economic growth will necessitate communities creating conditions that enable individuals to work in high-quality employment that stimulates the economy while minimizing environmental damage. Positions available.

I. Industry, Innovation, and Infrastructure

In many countries, investments in infrastructure, transportation, irrigation, energy, and information and communication technology are critical for long-term growth and community empowerment. Infrastructure investment is required to increase productivity and earnings and improve health and educational results. The primary source of revenue generation is inclusive and sustainable industrial growth, which allows for quick and sustained gains in living standards for all people while also

providing technological solutions for environmentally sound industrialization.

J. Reduced Inequalities

The international community has made noteworthy advancements in alleviating poverty. The least developed countries, landlocked developing countries, and tiny island developing states continue to make progress in reducing poverty. Inequality, however, persists, with considerable differences in access to health and education services and other assets. Furthermore, while income disparities between countries may have decreased, disparities within countries have increased. Economic growth alone will not suffice to alleviate poverty if it is not inclusive and does not include the three pillars of sustainable development: economic, social, and environmental.

K. Sustainable Cities and Communities

Cities serve as crossroads for ideas, commerce, culture, science, production, and social growth, among other things. Cities have helped people progress socially and economically at their best. However, managing cities in a way that continues to provide jobs and wealth without putting pressure on land and resources present several issues. Congestion, a lack of finances to provide essential services, a housing shortage, and deteriorating infrastructure are common urban issues. Cities may solve their problems in ways that allow them to prosper and grow while eliminating pollution and poverty. Cities of opportunity for all, with essential services, energy, housing, transportation, and more, are part of the future we seek.

L. Responsible Consumption and Production

Sustainable consumption and production entail increasing resource and energy efficiency, building sustainable infrastructure, and ensuring that all people have access to essential services, green and good jobs, and a higher quality of life. Its implementation aids in achieving overall development goals, reducing future economic, environmental, and social costs, and strengthening economic competitiveness and poverty reduction. Sustainable consumption and production attempt to "do more with less," maximizing net welfare gains from economic activities by minimizing resource use, degradation, and pollution throughout life while improving quality of life. Various parties are involved, including businesses, customers, policymakers, researchers, scientists, retailers, the media, and development cooperation agencies.

M. Climate Action

Every country on every continent is currently impacted by climate change. It is causing national economies to collapse and lives to be lost, costing people, towns, and countries dearly today and even more tomorrow. Climate change significantly influences people, altering weather patterns, increasing sea levels, and more extreme weather occurrences. Human-caused greenhouse gas emissions, which continue to rise, are driving



climate change. They've reached their all-time highs. Without intervention, the global average surface temperature is expected to rise during the twenty-first century, exceeding 3 degrees Celsius this century — with certain regions of the world expected to warm significantly more. The weakest and most vulnerable people bear the brunt of the burden.

N. Life Below Water

The sea is ultimately responsible for providing and regulating our freshwater, drinking water, climate, seashores, much of our sustenance, and even the oxygen we breathe. Oceans and seas have always been important commercial and transit hubs throughout history. A sustainable future requires careful management of this critical global resource.

O. Life on Land

Forests encompass 30% of the Earth's surface and, in addition to supplying food and shelter, they are critical in combatting climate change, maintaining biodiversity, and defending indigenous people's homes. Each year, thirteen million hectares of forest are lost, while 3.6 billion hectares of desertification have resulted from the continued degradation of drylands. Human-caused deforestation, desertification, and climate change offer significant obstacles to sustainable development, affecting the survival and livelihoods of millions of individuals. Forest management and desertification mitigation efforts are underway.

P. Peace and Justices Strong Institutions

Pointedly plummeting all forms of violence and related death rates everywhere dedicated to endorsing peaceful and inclusive communities for sustainable development, providing equal access to justice for all, and establishing effective, accountable institutions at all levels are among the Sustainable Development Goals.

Q. Partnership to Achieve the Goals

Governments, the commercial sector, and civil society must work together to achieve a successful sustainable development agenda. These inclusive partnerships are required at the worldwide, provincial, national, and local levels based on common moralities and values, a collective vision, and common goals that prioritize people and the Earth.

IV. SUSTAINABLE DEVELOPMENT IN THE CONTEXT OF MINING

According to the imperative analysis of [33] and [34] Mining, processes have the ability to affect a wide range of environmental entities. They are of interest to a diverse range of stakeholder clusters, so there is plenty of room for the industry to become more sustainable. A mine can improve performance in both the environmental and socio-economic arenas by improving planning, implementing sound ecological management tools and cleaner technologies, extending social responsibility to stakeholder groups, forming sustainability

partnerships, and enhancing training. Due to its vast global presence and frequent position in ecologically vulnerable and underdeveloped areas, the mining sector fits within the sustainable development framework.

Few sustainable development goals linked to Mining are as follows; those goals are at least addressing the issues. Through Mining, among 17 SDGs, 9 SDGs like good health and well-being, clean water and sanitation, inexpensive, clean energy, decent work and economic growth, sustainable cities and communities, responsible consumption and production, life on land, peace, justice, and robust institutions collaboration for the goals can be achieved.

Mining businesses have the ability to directly contribute to economic growth, employment, and profit in low-income nations. Additionally, they may ensure that the advantages of Mining last beyond the life of the mine itself through collaborations with government and civil society, ensuring that the mining industry has a favourable impact on the environment, climate change, and social capital.

Likewise, mining firms will be urged to conduct responsible extraction, create less waste, employ safer procedures, implement innovative sustainable technologies, encourage the enhancement of the well-being of nearby communities, reduce emissions, and enhance environmental stewardship.

Along with these, clean energy production like eliminating blasting by using cutting machines like Surface continuous miner, Becket wheel excavator etc., underground coal gasification, shale gas production, natural gas production etc., proper implementation of the mine closure plan, and legitimate maintenance of the Heavy Earth Moving Machinery (HEMM) will reduce fuel consumption and emission of diesel particulate matter (DPM). In summary, clean mining production technologies are significant for achieving the SDGs by 2030.

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