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THE FUTURE OF MINING IN AFRICA

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The mining industry is involved in the extraction of precious minerals and other geological materials. The extracted materials are transformed into a mineralized form that serves an economic benefit to the prospector or miners. In many sub-Saharan African countries, the mining sector makes an important contribution to foreign exchange earnings, government revenues, employment and gross domestic product. However, many of the mineral-rich economies of Africa risk continuing to be dependent on mining. Africa is a major producer of many key mineral commodities, with bountiful reserves of metals and minerals such as gold, diamond, cobalt, bauxite, iron ore, coal, gems, stone and copper across the continent. Some of the major mining countries in Africa are Democratic Republic of Congo (DRC), South Africa, Namibia, and Zimbabwe etc. The investment in different mines in Africa continent can lead to economical development, reduction of poverty, rapid urbanization, and increase in the GDP of different nations. The entire move can be achieved through the implementation of Artificial intelligence, digitalization and cognitive intelligence to improve the effectiveness and profitability of the mining site across African countries. Artificial intelligence shifts raw materials mining from a people-oriented operation to a process-oriented one, which is critical to ensure appropriate health and safety conditions for the mineworkers, a high level of accuracy, error elimination, and a faster decision-making process. To sum things up, Artificial Intelligence solves tasks that require human intelligence while ML is a subset of artificial intelligence that solves specific tasks by learning from data and making predictions.

Keywords: mining industry; economical development; Artificial Intelligence; digitalization.

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БУДУЩЕЕ ГОРНОДОБЫВАЮЩЕЙ ПРОМЫШЛЕННОСТИ В АФРИКЕ

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Горнодобывающая промышленность занимается добычей драгоценных минералов и других геологических материалов. Извлеченные материалы преобразуются в минерализованную форму, что приносит экономическую выгоду старателям или горнякам. Во многих странах Африки к югу от Сахары горнодобывающий сектор вносит важный вклад в валютные поступления, государственные доходы, занятость и валовой внутренний продукт. Однако многие страны Африки, богатые полезными ископаемыми, рискуют по-прежнему зависеть от горнодобывающей промышленности. Африка является крупным производителем многих основных полезных ископаемых, обладая обильными запасами металлов и полезных ископаемых, таких как золото, алмазы, кобальт, бокситы, железная руда, уголь, драгоценный камень и медь по всему континенту. Некоторыми из основных горнодобывающих стран Африки являются Демократическая Республика Конго (ДРК), Южная Африка, Намибия, Зимбабве и т. д. Инвестиции в различные шахты на африканском континенте могут привести к экономическому развитию, сокращению бедности, быстрой урбанизации и увеличению ВВП разных стран. Все это может быть достигнуто за счет внедрения искусственного интеллекта, цифровизации и когнитивного интеллекта для повышения эффективности и прибыльности горнодобывающей промышленности в африканских странах. Искусственный интеллект переводит добычу сырья из деятельности, ориентированной на людей, в процессно-ориентированную, что имеет решающее значение для обеспечения надлежащих условий здоровья и безопасности горняков, высокого уровня точности, исключения ошибок и более быстрого процесса принятия решений. Подводя итог, можно сказать, что искусственный интеллект решает задачи, требующие человеческого интеллекта, в то время как машинное обучение – это подмножество искусственного интеллекта, которое решает конкретные задачи, изучая данные и делая прогнозы.

Ключевые слова: горнодобывающая промышленность; экономическое развитие; Искусственный интеллект; цифровизация.

Introduction.

This research is based on the “Future of mining in Africa” with the aid of artificial intelligence, digitalization and diversification to create a strong model of mining which will create opportunity in the different sector of mine. This model of mining is kin to attract investor to be cautious of the outcome the mine will produce, how much to be invested, how profitable it will be, to avoid waste of time and resources. The implementation of this mining model will improve economic and social development of many African nations that has a profitable mine; this refers to the entire mine in Africa. It also has the potential to increase the Gross Domestic Product (GDP). From the mining sector we can develop African continent and social policies.

Nevertheless, In Africa mining sector, the country, Investors, citizens etc can benefit a lot from different perspective of these business, since to run a successful mine controlled by artificial intelligence and digitalization is very resourceful, the investor will need to construct Infrastructure which is in favor of the mine and the country infrastructure to allow the smooth flow of business, The mine can also generate energy that can be enough for the mine and the communities close to them which they are operating; this can also branch out to agriculture and health care service for the employees and the community members they are operating in, and creating employment opportunity for the population in different countries.

The aim of this research is to show how Russian government and investors from Russian and around the Globe can dominate the future of African mining in a more profitable and easy way. The implementation of this research will review the potential of the every state and how artificial intelligence and digitalization can be in favor of both the country and the investor at the same time developing the nations with its commodities, Labor forces, values etc that it can produce for commercialization globally.

Methodology.

The African continent host many industrial mining projects and many more are planned due to recent prospecting discoveries and increasing demand for various mineral product like Metal, coal, oil, gemstone, Limestone, Gold, silver, iron ore, diamond, coal, bauxite etc

These commodities cannot be fraudulent easily that’s what makes them valuable. Artificial intelligence, digitalization and diversification are disrupting mining model and creating new opportunities; this means mining in the future will be vastly different from today “But what exactly will change” and how can we adapt to it.

“Let us imagine the future of mining in 2040” artificial intelligence and cognitive intelligence guide targeted cost effective exploration that open up new discoveries. Unlike the large pit of today Africans mine in many countries with less or no machine, the miners mostly work manually without knowing if are going to find something or not mostly it’s a waste of time, energy and resources. The implementation of artificial intelligence, digitalization and cognitive intelligent will reduce the risk of that. The mining future of Africa will be complex and more geographical dispersed. The use of artificial intelligence, digitalization and cognitive intelligence will help the engineers in the mine to spot the pit to be dug, this will build trust between miners and investors since the investment will be profitable and there are less risk and waste of time, money, and resources. This will also attract alternative source of capital to finance different mines in different region and countries expecting high returns and favorable outcome [1].

We have seen the emerging national mines in some private mines companies in Africa with the government operating some mines themselves. But, they are not really investing in artificial intelligence, digitalization and cognitive intelligence to advance the effectiveness of the mine and make it more profitable in way that will not only benefit the miners but the entire country.

The value of African mines cannot be calculated because it will take decades if not centuries for it to be exploited to its fullest and no company of government has really tap into the mining sector full potentials. By investing artificial intelligence, digitalization and cognitive intelligence everything will be automated in the site to reduce risk and increase effectiveness starting from the machines used for digging the ground, trucks, and processing equipment. This can also improve safety. Automation and electrification will enable deeper access to underground, 3D- printers’ the waste of time and micro-

grinds power mines with renewable electricity reducing the cost of carbon emission, in Africa there is approximately nine (9) hours of sunlight which can charge a reasonable amount of solar energy to reduce energy cost and enable the mines work 24 hours a day, this feature will provide sustainability.

The implementation of artificial intelligence, digitalization and cognitive intelligence will create jobs in different domains, part-time, full-time, remote working, on site, off site, programmers etc resources can be transferred offsite through railway.

Discussion.

The mining industry faces considerable challenges, including a combination of burgeoning commodity demand, finite existing supply, and rapidly rising commodity prices. Africa offers an area full of potential, but also poses substantial risk to mining companies, both below and above the ground. Mining has often been associated with deforestation, land degradation, air pollution, and disruption of the ecosystem. For example, the recent strikes and deaths in major platinum and gold fields in South Africa have highlighted the social impacts and uncertainties surrounding the country's strategic mining sector. In a world of deeper mines, more complex ore bodies, rising energy costs, social and geopolitical risks, infrastructure shortages and resource nationalism, mining companies remain under exceptional pressure to control costs, heighten efficiency and improve safety performance.

The mining industry faces considerable challenges that make running a mining company more difficult than ever. High quality, geologically easy-to-mine resources in easily accessible locations have been long identified and exploited; this requires miners to venture into new, increasingly remote, climatically difficult locations to find still rich mineral deposits. The rapid industrialization of India and China is creating a surge in demand for raw materials that far exceeds the industry's ability to supply, causing prices to escalate rapidly. Higher prices and scarce supply, in turn, have driven these countries to seek security of their own asset bases and supplies to hedge against the risk of excessive cost and shortages of material that may blunt their surging economies—further fueling the upward spiral in prices. While these trends are sobering, the African continent offers opportunities for mining companies to address the challenges they face—if they work with national governments and local communities to manage risks and create economic growth for these constituencies. Currently, Africa accounts for as little as 6 percent of global mineral production, despite holding an estimated 30 percent of global mineral resources. Africa's share of production significantly lags behind its global resource share across several minerals. Low production figures follow logically from historically low levels of investment in the continent. In 1991, for example, Africa collectively commanded only 5 percent of the world's exploration and development expenditure. In the past two decades, however, Africa's share of global mineral exploration and development budget has climbed steadily; exceeding 13 percent in 2010 helping to fuel this growth is the presence of countries with sovereign wealth such as Brazil and China, which are making significant investments in some of the less mature and higher-risk mineral economies across Africa. Rising levels of investment in the exploration and development of Africa's mineral resources offer a promising signal for Africa's production potential. The continent is shifting quickly from a prospective region to a pipeline region. And as new projects come online, the surge in investment is expected to be mirrored by growth in Africa's global production share.

These are African countries and the commodities they produce massively (table 1).

Table 1 – African countries and the commodities they produce massively [3]

Country	Mineral
ALGERIA	petroleum
ANGOLA	petroleum, diamonds
BOTSWANA	diamonds
BURKINA FASO	manganese, limestone
BURUNDI	gold
CAMEROON	petroleum, aluminium
CABO VERDE	salt

Country	Mineral
CENTRAL AFRICAN REPUBLIC	diamonds
CHAD	uranium
CONGO (Brazzaville)	petroleum, diamonds
CONGO (Kinshasa)	copper, diamonds, cobalt, gold, zinc
COTE D'IVOIRE	petroleum, diamonds, manganese
EGYPT	petroleum, iron ore, phosphates
EQUATORIAL GUINEA	petroleum
ERITREA	gold, potash, zinc
ETHIOPIA	gold, copper
GABON	petroleum, manganese
GHANA	gold, bauxite, manganese
GUINEA	bauxite, iron ore, uranium
KENYA	limestone, soda ash, rubies
LESOTHO	water (hydro)
LIBERIA	iron ore, diamonds
LIBYA	petroleum, gypsum
MADAGASCAR	graphite, chromites, coal, bauxite
MALAWI	limestone
MALI	gold, phosphates
MAURITANIA	iron ore, gypsum, copper
MOROCCO	phosphates, iron ore, manganese
MOZAMBIQUE	coal, titanium
NAMIBIA	diamonds, copper, uranium, gold
NIGER	uranium, coal, iron ore
NIGERIA	petroleum, tin, columbine, iron ore
RWANDA	gold, tin ore
SENEGAL	phosphates, iron ore
SIERRA LEONE	diamonds, bauxite, iron ore
SOMALIA	uranium
SOUTH AFRICA	gold, diamonds, uranium, chromium
SUDAN	petroleum, iron ore, copper
SWAZILAND	asbestos, coal, clay
TANZANIA	tin, phosphates, iron ore, diamonds
TOGO	phosphates, limestone
TUNISIA	petroleum, phosphates, iron ore
UGANDA	copper, cobalt
ZAMBIA	copper, cobalt, zinc, lead
ZIMBABWE	coal, chromium ore, asbestos

Industry leaders and policymakers must work together to capitalize on the opportunities that digitalization brings.

Mineral resources are a critical source of revenue for Africa. In 2019, minerals and fossil fuels accounted for more than a third of exports from at least 60 percent of African countries. The continent produces around 80 percent of the world's platinum, two-thirds of its cobalt, half of its manganese, and a substantial amount of chromium, leaving it in a strong position to benefit from growing demand for these minerals. Moreover, Africa is believed to have some of the world's largest untapped mineral reserves. Unfortunately, a lack of systematic geological mapping and exploration means that the full scope of the continent's resources remains unknown. To unlock mineral-rich African countries' full potential, mining companies and African governments must embrace Fourth Industrial Revolution

(4IR) technologies. Artificial intelligence (AI), automation, and big data can help mining firms limit damage to the environment, improve working conditions, reduce operating costs, and boost productivity.

The adoption of efficient renewable-energy systems already is helping the mining sector reduce its environmental impact. Autonomous 4IR technologies complement the clean-energy transition by cutting fuel consumption in processes such as loading, hauling, crushing, and drilling. According to one estimate, driverless technology could lead to a 10-15 percent decrease in fuel use on mine sites.

Better use of data and analytics can improve mine performance as well. Mining companies generate enormous amounts of data throughout their operations, but only a few use it in a way that provides real value. This represents a major missed opportunity, because advanced analytics can optimize mine planning, increase yields, and reduce equipment downtime. In South Africa, a 30-year-old mine boosted its mineral recovery by 2 percent by applying advanced analytics to its main processing steps [3].

The Syama mine in Mali is another example of a site that has benefited from digitalization. In 2015, Resolute Mining took over operations at Syama and transformed it into the world's first purpose-built automated mine. Employees use a fiber-optic network connected to above-ground control centers to manage and monitor all activities, from the clearing of the drill point to extraction, loading, and hauling. Although the initial investment was steep, the changes are expected to cut mining costs by 30 percent and improve overall efficiency. The machines can operate 22 hours a day, and there is no time lost due to shift changes.

4IR technologies will define the future of mining. But while they represent tremendous opportunities for boosting productivity, improving safety, and mitigating the environmental impact of mining, they also raise legitimate concerns. Many of the new technology-enabled jobs require skilled workers that the labor market cannot supply, implying limited employment opportunities in the absence of educational and training programs to re-skill workers.

“As mines become more productive-and more profitable-national governments will have more revenue to spend on investment in infrastructure, like roads, schools, and health clinics”.

One proposed solution is for mining companies to use the profits gained from the higher margins made possible by the introduction of new technologies to train relevant workers in AI and machine learning. And new curricula in schools can teach the tech skills the next generation will need for 4IR-enabled jobs – including with the mining companies.

Another possibility is for mining companies to encourage the development of other local industries to reduce communities' dependence on the mine for employment. In Mauritania, mining companies finance a number of ventures that encourage local economic development, including a jewellery production facility, a brick-making plant, and an agricultural cooperative [4].

Mines that embrace the digital transformation will increase their production, run more efficiently and effectively, and be more environmentally sustainable. They will set new standards for workers' health and safety, and they could contribute to re-skilling through educational and training programs. In short, they will disrupt Africa's mining sector; but the advantages of digitalization, if harnessed correctly, will far outweigh the risks.

Result and Recommendations.

Artificial intelligence (AI), automation, and big data can help mining firms limit damage to the environment, improve working conditions, reduce operating costs, and boost productivity. AI is poised to impact Africa in several ways. It has been hailed by many as a transformative force for African societies, promising to reduce inequality, alleviate poverty, and improve access to public services like health and education. The mining industry is increasingly using AI as a tool to optimize processes, enhance decision-making, derive value from data, and improve safety. I believe Russian government and investor can collaborate with African governments to build and own multiple Artificial Intelligence mine to generate profitable income and serves as a socio-economical development for multiple nations.

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