

Ministry of Natural Resources
Tony Shield Memorial Essay Competition
University of Guyana Category

Email: sarah_bovell@hotmail.com

Topic: How can the development of new mining technology and regulations improve the efficiency of mining and reduce its environmental impact? (1500-2000 Words)

According to the Merriam Webster Online dictionary development is an event constituting a new stage in a changing situation.¹ While mining is defined as the act, process or industry of extracting ores, minerals, etc. from mines;² within Guyana the major mining sectors are gold, diamond, bauxite and oil mining. Technology refers to methods, systems, and devices which are the result of scientific knowledge being used for practical purposes.³ Regulations are rules made by a government or other authority in order to control the way something is done or the way people behave.⁴ Efficiency is the good use of time and energy in a way that does not waste any.⁵ Improve means to enhance in value or quality.⁶ To reduce is to lower in degree, intensity, etc. Environmental impact refers to the effect that the activities of people and businesses have on the environment.⁷

With respect to the forgoing definitions the topic now reads, 'How can the event constituting a new stage in a changing situation of new mining methods, systems, and devices which are the result of scientific knowledge being used for practical purposes and regulations enhance in value or quality the good use of time and energy in a way that does not waste any of the act, process or industry of extracting ores, minerals, etc. from mines and lower in intensity the effect that the activities of people and businesses have on the environment?

On the precepts of the global recognition of the devastating impacts of human endeavors upon our planet (the climatic extremities and rapidly depleting resources), there is the manifest need for corrective measures and innovative procedures to meet the pressing demand for a continued supply on the luxuries to which man has grown accustomed with increased efficiency while attempting to reduce the negative environmental impact of these activities. This recognition has come slowly and at a time where the adverse effects of human industrialization are clear and undisputable. Therefore, it is up to the current generation to establish, enforce, maintain and improve corrective procedures in attempts to undo the damage already done. Of course merely attempting to undo the old sufferings to the Earth, as difficult as it is, makes no sense if similar damage is continued. Thus, the human species faces the unique self-inflicted predicament of remedying the full scope of their detrimental activities.

Generally, the increased awareness of damaging effects has brought about modern 'remedial measures'⁸ within areas that have environmental impact which have rendered the former processes

¹ Merriam Webster Online Dictionary <<https://www.merriam-webster.com/dictionary/development>>

² Dictionary Online <<https://www.dictionary.com/browse/mining>>

³ Collins Dictionary Online <<https://www.collinsdictionary.com/dictionary/english/technology>>

⁴ Collins Dictionary Online <<https://www.collinsdictionary.com/dictionary/english/regulation>>

⁵ Cambridge Online Dictionary <<https://dictionary.cambridge.org/dictionary/english/efficiency>>

⁶ Merriam Webster Online Dictionary <<https://www.merriam-webster.com/dictionary/development>>

⁷ Dictionary Online <<https://dictionary.cambridge.org/dictionary/english/efficiency>>

⁸ Remediation Measures means all actions to: (i) clean up, remove, treat or remediate Hazardous Substances in the indoor or outdoor environment; (ii) perform post-remedial monitoring and care; or (iii) respond to any requests for information or documents from any Governmental Authority in any way relating to cleanup, removal, treatment or

archaic and hazardous, thus presenting the paradigm shift from which concept of new mining technology and improved regulations has been birthed. Inevitably the development of new technology would be called upon to improve efficiency within the field while still decreasing the environmental impact of the activities. Though a common question that arises as to whether this is factually attainable.

Prior to the industrialization age mining was done on an extremely small scale. Prospect mining was carried out mostly by lone individuals who panned for gold along slow rivers and dug up a small part of the land. Subsequently man began to modernize everyday living; this modernization birthed the industrial revolution. The lifestyle developed during the industrial revolution greatly demanded fuel, consequently charcoal and oil mining rapidly developed. This development, however, has been devastating to the Earth, its flora and fauna and humans. Through the technological advancements in the field there has been considerable gain and increased efficiency in mining. Through these advancements sturdy machinery and complex software developments currently exist. The machinery such as excavators, drill, industrial pumps, conveyers coupled with the software applications for complete or semi-automated process and water resistant machinery has completely revolutionized the sector.

One way to maximize efficiency has been to utilize the most technologically advanced machinery available within the mining process. With an increase in automation and increased use of machinery as there can be drilling and excavating of the top soil without a tremendous labor force. This would decrease the amount of manual labor required and reduce the amount of persons exposed to work related hazards. The labor force reduction would cut costs to the mine owners and operators in the form of wages, food, transportation and injury to person that would have otherwise arisen. Although this can be seen as a reduction of mining related employment the potential benefit to be harvested is with reduced cost there would be several smaller mining camps which would both boost small businesses and the economy. Additionally, it would reduce the massive amounts of time these activities generally consume and allow for a smother and continuous flow of mining carried out for longer periods (even at night), thus, potentially increasing the amount of mined resources and allowing for greater market competition.

In an article named '**These five technologies will shake up the mining industry in 2018**', Ben Robinson and Charlton Morris indicated that the next step in mining automation could even be mines with no miners, after Rio Tinto unveiled their plans for a \$2.2B 'intelligent mine' packed with driverless trains, trucks and robotics. They're not necessarily just replacing jobs either – some automation in mining is allowing producers to drill deeper and with narrower shafts into conditions uninhabitable for humans.⁹ Moreover, since machines do not face physical exhaustions like humans or animals would one said machine is regularly serviced and appropriately used it can *pay for itself* as it would remove massive amounts of resources at rapid and continuous speeds.

All together the owner of the machinery currently used stands to make a considerable gain as opposed to the lesser advanced mining techniques. For instance in underground mining, safety is a top priority

remediation or potential cleanup, removal, treatment or remediation of Hazardous Substances in the indoor or outdoor environment, that in any such case are required under any applicable Environmental Law or by a Governmental Authority pursuant to any applicable Environmental Law.

⁹ Ben Robinson et al. These five technologies will shake up the mining industry in 2018 (2018)

<<http://www.mining.com/web/five-technologies-will-shake-mining-industry-2018/>>

and in 2018 a company called Atlas Copco released their new line of Underground Mobile Miners which has been specifically developed for hard rock mines. They believe their technology has the potential to 'change the mining industry'.¹⁰ This new technology circumvents the traditional, and more dangerous, drill and blast method and also means that mines wouldn't have to be evacuated in order to mine hard rock.

It's not all hardware that will be changing the game in 2018. Mining software has been making every mine 'smarter' for some time, an innovative example of this is X-ray diffraction. This is used to analyse samples to check their property densities which saves both time and money when targeting particularly rich materials. Several companies like ALROSA have already success through effectively utilizing the technology.¹¹ Thus allowing for the detection of minerals without actual mining, saving both time and resources.

Innovation is going beyond the mines as companies have been investing heavily in new mineral processing technology, with sensor based sorting being a particular area of focus. Sensor based sorting is designed to split commercially valuable minerals from ores as efficiently and cheaply as possible – leading to increased productivity. Steinert and Tomra are both big players in sensor based sorting, and likely to develop the incorporation of even newer technology into separation, such as mining magnets.¹²

Considering the natural division of the thesis, the benefit of efficiency in mining arises from the increased technological advancements within the field which lends itself sometimes to the reduction of the environmental impact. However, it is not always the case. While mining isn't necessarily seen as an environmentally friendly industry, and with the Paris Climate Agreement and a host of other factors urging the international community to do more to reduce emissions and tackle climate change, the use of electric vehicles is set to become increasingly popular, replacing their diesel-powered alternatives. It's an interesting non-monopolized market space and, whilst companies like Cat are developing products like their Underground Electric LHD, there's a host of smaller players moving into the area. ETF Manufacturing have recently introduced their all-electric surface haul truck and GHH have also introduced their own range of electric LHDs.¹³

Which the newer mining regulations place specific prohibitions and requirements which stand to benefit the Earth and reduce the negative environmental impacts that are caused by certain mining procedures. It is a marvelous gain for environmentalist to see lawmakers actively involved in the preservation of the Earth. It is indeed a proud moment for the country as a whole to find recognition for the beauty, wonder and necessity of nature and all that it encompasses. These regulations treat the mass deforestation as the plight is against all species and attempts to reign in the destructive nature of all mining upon the eco systems, natural habitats, forest species, by extension all species, especially humans. Humans stand to face extinction as rapid deforestation dramatically reduces the level of oxygen present within the atmosphere. Further, deforestation level the massive amounts of carbon dioxide that is pumped daily into the air to go unchecked and without the natural removal process due to the trees absorption of the carbon dioxide the air quality with reach new lows and could very well poison humans across the world.

¹⁰ Ibid

¹¹ Ibid

¹² Ibid

¹³ Ibid

This is clearly evidenced within China where certain provinces have such poor air quality the sky is always visibly gray and requires persons to wear a mask in attempts to filter the air.¹⁴

Standard legislation concerning the efficiency of mining is far from being the most productive and strictest government mandates that exists today. Regulations differ between nations and some countries more advanced than others. However, there's a continuous need for improvement in this industry, which inevitably causes some environmental damage. In Canada for example, mines like the Island Copper Mine on Vancouver Island stands as a highly regulated mine site that operated from 1971 until 1995 when it was closed for resource depletion. It was due to the regulation and control of the government that a detailed mine closure plan was developed to comfortably close the mine in order to protect the few resources which remained, and enacted the contaminated sites regulation process which was awarded the Certificate of Conditional Compliance. It is this kind of federal regulation that will not only protect environmental and public health, but that will improve the lifespan of the mining industry.¹⁵

The mining industry is one that is always in need of proper research and development in order to make sure the industry to ever-changing with today's commitment to sustainability and turning the world into a more "green friendly" place. Through either state or federal agencies, collecting funding and allowing that funding to be dispersed into ROD funds for Green Mining can be one way to positively impact the environment before and after mining projects. By pushing the envelope and never letting the future slip too far from reach, staying ahead can prevent unnecessary waste in the sense of less reusable materials, better efficiency and a better understood industry.¹⁶

A seemingly simple but rarely prioritized activity, replenishing mine sites and mine environments is one of the key factors to not only earning the respect and cooperation of those living near the mine, but will ultimately protect the mine's impact on the environment. Simple solutions like replenishing native soils and grasses, cleaning excess waste, proper waste removal, site inspections and replanting trees and natural forestry can rejuvenate a long-term ecosystem repair and sustain the environment for years beyond when the mine is no longer operating. The entire reclamation process should include: removing hazardous materials, reshaping land, restoring topsoil, and planting native grasses, trees or ground cover natural to the site. In closely monitoring the standard mining supply chain, mining industry giants will be forced to confront the ways in which a company can improve its efficiency by seeing exactly where the organization is lacking in terms of sustainability and green mining initiatives. This supervision of the manufacturing process is essential in order to develop new ways of thinking, new metrics, and new management/supervisory tools that will help cushion the transition into more efficient and less environmentally-harmful patterns of resource use in modern societies. Organizations like The World Resources Institute are currently conducting research on the most frequently used resources and materials, in order to better understand how the industry can conserve its non-renewable materials. The WRI has been working towards developing a database, and can now indicate the flow of materials through industrial economies. Material flows analyses will track the physical flows of natural resources

¹⁴ The Guardian, Inside Beijing's airpocalypse – a city made 'almost uninhabitable' by pollution (2014)
<https://www.theguardian.com/cities/2014/dec/16/beijing-airpocalypse-city-almost-uninhabitable-pollution-china>

¹⁵ Laurie Tahija, et. al. North Island Copper and Gold Project M3-PN170038 October 24, 2017 Revision 0 NI 43-101 Technical Report Preliminary Economic Assessment British Columbia, Canada <http://www.northisle.ca/wp-content/uploads/2017/10/NorthIsle_NI_43-101_PEA_Rev0_24-Oct-17_RC2.pdf>

¹⁶ Ibid

through extraction, production, fabrication, use and recycling, and final disposal, accounting for both the gains and losses occurring throughout the supply chain.¹⁷

In summation, the development of new mining technology and regulations improve the efficiency of mining through a decreased of the required labor force, which by extension reduces cost and occupational safety hazards. The technology can assess mineral rich areas without actual mining being done. While, automated mines can go deeper into the earth and work in conditions unfit for humans. Additionally, the technology allows for longer periods of continuous mining that covers a greater area at a reduced cost ultimately improving the manufacturing process. With respect to the reduction of mining's environmental impact the machinery is being developed to use alternative sources of energy as opposed to the refined fossil fuels. The new regulations stand to reduce the environmental impact dramatically through the enforcement of efforts for the replenishment of the environment, reduction of soil erosion, decreased deforestation and hazardous waste. The increased reforestation and protective measures will preserve the natural habitats, eco systems, wildlife and endangered species.

¹⁷ Ibid

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