The Materiality of Media: To What Extent Has the Boom in the Manufacture of Modern Technological Devices Been Implicated in Territorial Conflicts Within Democratic Republic of Congo?

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Abstract

Although the aesthetics of devices such as the I-phone may not encourage consideration for what lies beneath the surface, these are also products comprised of naturally occurring materials. Despite an ongoing humanitarian and ecological crisis, particularly in the east of DRC, a dearth of academic publications exist which intrinsically link the mobile technology industry to circumstances on the ground. During this period of research my aim has been to investigate the extent to which this crisis has been paralleled or perpetuated by a boom in the manufacture of mobile technological devices and the trade in ubiquitous raw materials which originate from DRC. By tracking the plight of three particular materials (coltan, cobalt and cassiterite) as geological artefacts I have researched the extent to which a geopolitical narrative has impacted lives of people in this region. The magnitude of this trade has also been expressed in the sense that; 'just as sugar was significant to the growth of urban industrial centres in Western Europe in the 18th and 19th centuries, so too has Congolese coltan been pivotal to the digital revolution within which we now find ourselves' (Mantz, 2008: 41). In respect of the complexities of media and in contextualising their relationship with the material world, it has been noted that 'an attention to materiality is most fruitful where it is often deemed irrelevant, in the "immaterial" domains of electronic media' (Fuller 2005, 2).

In contextualising what is meant by the term 'materiality of media', one can look back at the work of early media theorists such as Marshall McLuhan whose book *Understanding Media: The Extensions of Man*, published in 1964 as well as the maxim 'the medium is the message' have become influential in the years which have followed. Jussi Parikka's 2015 book *A Geology of Media* begins to look in more literal terms at circumstances around the physical materials from which modern media technologies are comprised. The origins and destinations of such materials may be determined by their metallurgical properties, such that 'what moves to the forefront is a "territorial" organization, in the sense that all the segments, whether of lineage, land, or number, are taken up by an astronomical space or a geometrical extension that overcodes them' (Deleuze and Guattari, 1987: 388). On a slightly different footing, Wendy Chun's 2016 book entitled *Updating to Remain the Same: Habitual New Media* highlights the ways in which consumer markets in new media are manipulated to maximise profitability. Many electronics companies have maintained that their supply chains are too complex for inherent ethical issues to be addressed because of the sheer number of actors involved in moving minerals from mines in Congo all the way to the gadgets in our pockets (Prendergast and Lezhnev, 2009: 1).

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PREFACE

On Monday December 10th 2018, Congolese doctor Denis Mukwege was jointly awarded the Nobel Peace Prize for his work in the eastern regions of Democratic Republic of Congo. Below is an excerpt from his acceptance speech;

"My name is Denis Mukwege. I come from one of the richest countries on the planet. Yet the people of my country are among the poorest of the world.

The troubling reality is that the abundance of our natural resources – gold, coltan, cobalt and other strategic minerals – is the root cause of war, extreme violence and abject poverty.

We love nice cars, jewellery and gadgets. I have a smartphone myself. These items contain minerals found in our country. Often mined in inhuman conditions by young children, victims of intimidation and sexual violence.

When you drive your electric car; when you use your smart phone or admire your jewellery, take a minute to reflect on the human cost of manufacturing these objects.

As consumers, let us at least insist that these products are manufactured with respect for human dignity.

Turning a blind eye to this tragedy is being complicit.

It's not just perpetrators of violence who are responsible for their crimes, it is also those who choose to look the other way."

Although the circumstances referred to in Mr Mukwege's speech have been ongoing since the mid-1990s and paralleled with a worldwide boom in the manufacture of items such as the mobile phone, the laptop or the playstation, the international community has largely been turning a blind eye to what has been the most deadly conflict since the second world war on a global scale. The physician has spent large parts of his adult life helping the victims of sexual violence in DRC and since the Panzi Hospital was established in Bukavu, South Kivu province in 1999, Dr. Mukwege and his staff have treated thousands of patients who have fallen victim to such assaults. Most of the abuses have been committed in the context of a long-lasting civil war that has cost the lives of more than six million Congolese, many of whom were children (Nobel, 2018).

In light of the problematic circumstances involved in the manufacture of modern technological devices, ethical concerns are especially salient. Stemming from a colonial past, a disproportionate division of labour has been perpetuated by a boom in global communications. As a number of the materials required by the digital technology industry are found as natural resources within DRC, this region has continued to suffer at the hands of an exploitative economic system. In a global context, it has been expressed that 'the real problem for most of us is thus our material dependence on this corrupt system aimed at accumulation and profiteering, which shows scant interest in the resilience of ecological

processes, in the decline in biodiversity, in the quantity and quality of resources destined for social reproduction, or in the type and rhythms of work that fails to sustain a good quality of human life' (De Angelis, 2017, p.7). A focus on tangible materiality provides a rational basis in order to evaluate circumstances behind the aesthetic gloss or veneer of technological products. A closer look at circumstances around the manufacture of items such as the mobile phone and the computer reveals an industry with an unparalleled human cost in modern times.

Despite an ongoing humanitarian and ecological crisis, particularly in the east and south of DRC, a dearth of academic publications exists which intrinsically links the mobile technology industry to circumstances on the ground. During this period of research my aim has been to investigate the extent to which this crisis has been paralleled or perpetuated by a boom in the manufacture of mobile technological devices and the trade in ubiquitous raw materials which originate from DRC. As much of the manoeuvring in the global economy moves towards the advent of 5G technology and renewable energy sources, ethical considerations linking circumstances on the ground in the region with the main players in the technology industry have consistently been overlooked. Some discourse around the phenomena of social media and the smart phone generation has focussed on the 'affect' of interfaces and devices in the sense that 'these devices become the digital gateway through which worker and consumer engagements are increasingly lived through and managed' (Sampson, 2016, p.64). Notwithstanding, an attention to materiality is also an important aspect in the apparently immaterial domains of electronic media.

Drawing from a diversity of expertise which encompasses areas such as media geology, assemblage theory, geo-political relations, cultural theory and the history of colonialism, the aim of this project has been to provide a unique piece of research which despite being of a retrospective nature is also relevant at the point of publication. Notably since the commencement of this period of research in January 2019, a series of key events both within DRC as well as globally have had their effect in changing the complexion of the manufacturing industry of digital media devices, particularly in relation to an increased demand for lithium batteries.

Circumstances involved in global supply chains and the manufacture of digital technology were brought to light in 2021 as the effect of a global shortage in semi-conductors began to re-shape markets. Unprecedentedly low levels of rainfall across Taiwan resulted in a lack of silicon wafers being produced, a key component in computer chips. Prior to this shortage, Taiwan had been producing approximately 90% of advanced microchips globally (Sui, 2021). As demand has continued to exceed supply due to factors such as a boom in the production of electric vehicles as well as circumstances around the covid-19 pandemic resulting in sales of domestic computers increasing by an estimated 26% (International Data Corporation, 2021), manufacturers have been forced to scale back operations and search for alternatives in the assembly of their products. Following the closure of chip making plants in Texas in February 2021 due to the freezing weather as well as a huge fire at one of the car industry's biggest computer chip factories in Japan the following month

(Kelion, 2021), in May the South Korean government announced plans to invest $451 billion to ramp up semiconductor production in an effort to meet this surge in demand (Gooding, 2021). In December 2021, the US senate passed the 'Innovation and Competition Act', expressly banning the import of goods including semi-conductors from China's Xinjiang province, highlighting concerns about forced labour among workers. Despite not necessarily pertaining to an inherent physicality, semi-conductors are an omnipresent element among computer technology and therefore the global economy.

By examining in detail the scale and magnitude of consequences of the technology industry upon populations in the context of DRC, one aim of this PhD project has been to highlight ways in which manufacturers can take more responsibility for their actions. The people of Congo have for too long been suffering from a prevailing outlook which continues to take advantage of inherent inequalities within global economic systems. Materials from DRC are playing an increasingly important role in the global economy, yet it is largely not in the interest of those who stand to benefit from a proliferation of digital transactions to highlight a disproportionate global division of labour. The United Nations estimates the mineral trade in Congo to be worth 24 trillion dollars meaning that the trade in these materials is likely to continue to grow. Governments and multi-national companies have continually taken advantage of the people of this region and consistently failed to fully address an ongoing humanitarian crisis. Violent clashes in the north, east and south of the country have continued in recent years, causing the deaths of civilians and mass migration in the process.

CHAPTER 1: INTRODUCTION

MINING IN DRC AND THE TELECOMMUNICATIONS INDUSTRY – HISTORICAL CONTEXT

In understanding how today's circumstances have come about, it is important to start by recognising how history has led us to this stage. Repercussions from the colonial period appear to still be ongoing in some regions of the world and as a researcher who wishes to examine the current situation in detail, I believe it is important to demonstrate an understanding of how the past is affecting the present. Following King Leopold II of Belgium's annexation of what is now DRC as his own personal possession in approximately 1880 and the Berlin conference which followed in 1884, the early part of the 20th century was characterised by countries such as Belgium, France, Portugal, UK and Germany advancing and seeking control of territory in the African continent.

Documentation of the activities of European colonialists in the region in the early 1900s such as *The Casement Report* (1903) highlight the particularly brutal and exploitative tactics which were inflicted upon local populations as the trade began to grow in natural resources such as rubber, copper, ivory, diamonds and other minerals which were being exported, whilst guns and ammunition were simultaneously being moved into the area . Incredibly, the death toll associated with the rubber trade beginning in the west of the Congo around the year 1900 is believed to be comparable with that of territorial conflicts in the east of country around the year 2000 (Hochschild, 1998, p.223) (Deibert, 2013, p.127). The magnitude of the trade in digital minerals originating from DRC has also been expressed in another light; 'just as sugar was significant to the growth of urban industrial centres in western Europe in the 18th and 19th centuries, so too has Congolese coltan been pivotal to the digital revolution within which we now find ourselves' (Mantz, 2008, p.41)

In focusing on the plight of raw materials found within modern telecommunications devices, it is necessary to delineate the period of history being referred to. Although records do exist of materials such as coltan and cobalt being sourced from Congo / Zaïre as early as 1910 (International Peace Information Service, 2012, p.16), it was during the late 1990s that mobile telecommunications began to be distributed on a worldwide scale with 'Chinese imports from Congo alone expanding from only US$1 million in 2000 to US$1.6 billion in 2008' (Deibert, 2013, p.122). Although the history of Congo - Zaïre - DRC has been tumultuous across the 20th century and into the 21st, it is important to recognise how intrinsic the grapple for this country's resources has become culturally on the part of the international community and multinational corporations (Isla, 2017, p.3). The term 'resource curse' has widely been applied to Congo, defined 'in the sense that mineral exploitation has impeded long-term economic development' (Geenen, 2012, p.8).

When independence from Belgium was eventually achieved in 1960 with Patrice Lumumba inaugurated as the first prime minister before he was assassinated the following year, a global grapple for this country's resources began to take on a new complexion with foreign

organisations such as the CIA gaining a foothold in the region under the guise of the apparent threat of communism. The year 2020 marked the 60th anniversary of Congo's independence from Belgium. However, although many strides have been made in moving away from a colonial past including for example the nationalisation of the copper mining industry in the early 1960s which resulted in 70% of state revenues coming from the industry by the early 1970s (Geenen, 2012, p.8), still today the economic centre of power in relation to the nation's resources can in many cases be found to be located outside of the country.

Returning to the circumstances of the modern day and the connection between mining in DRC and the telecommunications industry, it is also important to remember the genocide which took place in neighbouring Rwanda in 1994. Having been perpetuated by colonialists in the region at earlier points in the 20th century as a tactic of dividing and controlling the local population, a tribal and ethnic conflict ignited a murderous wave of violence. More than one million people lost their lives in the space of just 3 months. The violence also caused approximately half of Rwanda's population of 7.5 million to migrate, with many crossing the border into the eastern provinces of Zaïre (Dunn, 2003, p.2). By the middle of1999, 'the rebel movement had managed to capture one-third of the DRC, thereby installing a new balance of power in a country which was now divided into certain occupation zones (Moyroud, 2002, p.162). In these regions 'key elements of electronics products including cell phones and personal computers' were to be found, industries which have continued to thrive until today, providing the principal source of revenue for armed groups and military units preying on civilians in Eastern Congo (Prendergast and Lezhnev, 2009, p.1).

Following the end of the Rwandan genocide in 1995, the territorial conflicts which ensued on the Congolese side of the border between 1996-2003 are widely referred to as the deadliest in recent global history, with DRC having remained 'the most dangerous place in the world to be a woman or a girl – in significant part because of the international demand for electronic products that requires minerals found in Eastern Congo' (Enough Project, 2009, p.1). It has been widely documented that the electronics industry is the principal end user of minerals mined in Eastern DRC, often referred to as the 3Ts or 3TGs (tantalum, tin, tungsten, gold). Other industries with a significant stake include tin can manufacturers, industrial tool and light bulb companies for tungsten, aerospace and defence contractors, as well as the banking and jewellery industries in the case of gold (Prendergast and Lezhnev, 2009, p.7).

Moreover, the plundering of Congo's resources has been orchestrated by increasingly privatised networks, in which the armies of occupying countries have also played a role. This trend, in which conflict has moved beyond the conventional divisions between sovereign states and armies has also been described as a "network war" with the strategic importance of tantalum (coltan) for the high-tech industry having prompted military actors to engage themselves in this lucrative business (Raeymaekers, 2002, p.35). As with circumstances around any militarised conflict, the supply chains through which weapons

themselves are distributed becomes an important site of investigation. Research conducted by the International Peace Information Service published in 2002 reveals a vicious circle of economic warfare in DRC with many foreign actors involved as well as connections with the diamond industry.

It has also been noted that 'actions to address the conflict in Eastern Congo have largely been reactive and incommensurate to the scale of the problem' (Enough Project, 2009, p.5). Violent armed groups have remained well-financed as they take resources that belong collectively to Congo's people. All the while globally, consumers continue to purchase electronics products, unaware that their devices may be fuelling a viscous cycle of despair. Many electronics companies have maintained that their supply chains are too complex for these issues to be addressed because of the sheer number of actors involved in moving minerals from mines in Congo all the way to the gadgets in our pockets (Prendergast and Lezhnev, 2009, p.1).

As will be discussed in more detail later in this text, any solutions to the conflicts and humanitarian crises in DRC associated with the manufacture of today's media devices have been difficult to come by upon a backdrop of a history and culture of exploitation. Notwithstanding all of the problems associated with it, the international trade in conflict minerals remains and as has been identified 'if international companies simply walk away from Congo and the market for all its minerals dries up, this could make the situation on the ground worse' (Enough Project, 2009, p.10). This question has also been addressed in the sense that if demand wasn't there what would disappear would be 'the major source of funding that allows the conflicts in the DRC to reach and maintain in the proportions they have, staggering to say the least' (Ayres, 2013, p.179). An estimated 50-90% of materials mined in Eastern DRC are not subject to official declarations due to factors such as the extortionate price required to obtain a mining licence (Prendergast and Lezhnev, 2009, p.2), tax evasion and lack of capacity and weak governance within state institutions (Taka, 2011, p.37). In recent years traceability schemes have begun to be implemented, however crucially consumers and global citizens continue to have a critical role in demanding that companies and governments exercise leverage over supply chains in order to end the trade in Congo's conflict minerals.

MEDIA MATERIALITY

In contextualising what is meant by the term 'materiality of media', one can look back at the work of early media theorists such as Marshall McLuhan whose book *Understanding Media: The Extensions of Man*, published in 1964 as well as the maxim 'the medium is the message' have become influential in the years which have followed. In a television interview broadcast in 1967 on the BBC, when asked 'what message the medium has on the world this afternoon' McLuhan stated that 'a huge mosaic has been created in which, in effect, an x-ray of world cultures, not a story-line, not a perspective, not a point of view,

but a kind of x-ray through this mosaic, is created in which everybody can participate'. In demonstrating this idea, McLuhan was able to offer the audience some perspective in reaching behind the veneer of new and improved technological products with a view towards the underlying implications of media forms.

On a slightly different footing, Wendy Chun's 2016 book *Updating to Remain the Same: Habitual New Media* highlights the ways in which consumer markets in new media are manipulated to maximise profitability. For example, documentation suggests that first I-phone prototype was developed by Apple Inc. in 1983 (Sniderman, 2011), yet nearly 40 years later they are still releasing the same product in a staggered and incremental fashion. Although the aesthetics of devices such as the I-phone may not encourage consideration for what lies beneath the surface, these are products comprised of naturally occurring materials. The manufacture of such products is contingent upon a complex set of processes which may ultimately obscure any connection with the fact many of the necessary materials are sourced from parts of the world such as DRC.

An ostensibly immaterial sphere of instantaneously accessible information might be best plotted on a continuum of time encompassing where the materials inside devices have come from and where they will end up among a 'constellation of singularities' (Deleuze and Guattari, 1987, p.406). The origins and destinations of such materials may be determined by their metallurgical properties, such that 'what moves to the forefront is a "territorial" organization, in the sense that all the segments, whether of lineage, land, or number, are taken up by an astronomical space or a geometrical extension that overcodes them' (Deleuze and Guattari, 1987, p.388).

Jussi Parikka's 2015 book *A Geology of Media* begins to look in more literal terms at circumstances around the physical materials from which modern media technologies are comprised. As well as taking stock of the geopolitical circumstances and disproportionate division of labour found within the manufacturing process of such devices, Parikka proposes that these considerations be understood from the perspective of 'deep time'. Developments in the manufacture of modern media forms may be viewed as part of a cycle or continuality of time whereby the residue of our expired industrial equipment and personal devices will eventually reach the inevitable destination of re-absorption unto the earth, a viewpoint which is further extrapolated in Siegfried Zielinski's 2006 book *Deep Time of the Media*.

As we move further into the 21st century it is possible to identify processes of conditioning which have taken place among populations whereby a variety of tools which would later become domesticized such as the telephone, the television or the radio have in many cases now become housed within one singular device. The relationship between the physical and the social via the medium of wireless technologies has been described as being of a nature whereby 'the difficulty of registering the role of objects comes from the apparent incommensurability of their modes of action with traditionally conceived social ties' (Latour, 2005, p.74).

Building on the work of media theorists who have recognised the role of materials within media forms, this research has been anchored by a rationale based in physicality. Areas such as 'media geology', 'media ecology' and 'media archaeology' have retained their relevance throughout this work and a contextualisation of each of these terms is included in an effort to more accurately place the materials which are extracted and assembled to become housed within the most popular receivers of media today. The identification of metallurgical properties of particular materials has also been important to this research. Ultimately, in exploring this rationale around materiality 'it is important to remember that the ore these miners carve precariously out of the earth is the material bedrock on which the entire digital age, and everything associated with it, is founded' (Mantz, 2008, p.48).

ASSEMBLAGE THEORY

The implications of increasingly large proportions of communication and global economic activity taking place via forms of wireless telephony today are manifold. Nevertheless, there are also parallels to be drawn between the assemblage of materials found within items of mobile technology and the assemblage of populations among a wider rhizomatic social network as part of what has been termed a process of 'neuropharmaceutical control of inattentiveness via the territorialisation of everyday life by neuroculture' (Sampson, 2016, p.5). The term 'assemblage' has also been contextualised in the sense that 'when a nested set of assemblages has many levels, we need to be able to keep track at what level of the nested set a given deterritorialisation or decoding is taking place, then follow its cascading effects' (DeLanda 2016, p.83).

One definition describes an assemblage as 'every constellation of singularities and traits deducted from the flow—selected, organized, stratified—in such a way as to converge (consistency) artificially and naturally; an assemblage, in this sense, is a veritable invention' (Deleuze and Guattari, 1987, p.406). In the context of what are described as emergent properties deriving from relations of exteriority in such a way that constellations of singularities form wider assemblages, it has been asserted that 'for sociologists of associations, what is new is not the multiplicity of objects any course of action mobilizes along its trail—no one ever denied they were there by the thousands; what is new is that objects are suddenly highlighted not only as being full-blown actors, but also as what explains the contrasted landscape we started with, the over-arching powers of society, the huge asymmetries, the crushing exercise of power' (Latour 2005, p.72). Attention has been paid to the idea that objects assembled in manufacture may take on levels of agency which are above and beyond the sum of their parts in the digital era, characterised by 'huge worldwide machines branched out over the entire ecumenon at a given moment, which enjoy a large measure of autonomy in relation to the States' (Deleuze and Guattari, 1987, p.360).

As much as 20th century geo-political discourse may have at times been characterised as a clash between the ideals of capitalism and communism appositely and binarily, it may be useful to characterise a wider conformity and subscription to today's most popular forms of telecommunication as being a culmination of both value sets, resulting in the formation of a milieu of interiority (Deleuze and Guattari, 1987, p.352). Significantly, materials originating from Congolese soil have played an integral role at each stage of this progression, from the uranium which built the first nuclear weapons (Deibert, 2013, p.115) to the extraction of cobalt for the construction of electric cars. Incidentally, the Shinkolobwe mine in Katanga province which supplied the radioactive materials for atomic bombs during World War II partially flooded in 1956 and moreover no official production has been recorded from the mine (World Bank, 2008, p.38), a pattern which has repeated itself in recent years in relation to exports of what have been dubbed 'digital minerals' not being declared as originating from DRC.

In an effort to comprehend the physicality of modern technological devices and the processes involved in their manufacture, an ability to view each of the components which comprise the infrastructure of networks of information seems an appropriate rational starting point. As the supply chain of materials leads to them ultimately being encountered by the end user as internalised within devices, the process of production in many cases involves a very complex web across many parts of the world, from mining to refinement and eventual manufacture. By viewing a smart phone or a laptop in situ as an assemblage of materials, it is possible to begin to deconstruct this whole as combination of constituent parts. This perspective can be useful to the extent that 'parts that are fitted together are not uniform either in nature or origin, and that the assemblage actively links these parts together by establishing relations between them' (DeLanda, 2016, p.2).

METHODOLOGY

Following periods of consultation with my supervisory team and having given due consideration to a variety of approaches, ultimately all research during this project has been desk-based and compiled from secondary literary sources. As there has been a lot of important work done on this topic by other academics over the course of the last 25 years in particular, my work here has gone as far as possible to unify and consolidate these texts as well as provide additional findings with a view to future developments. One intention of this project has been to examine more closely the extent to which vested interests of some of the world's biggest companies have been impacting the political landscape in DRC. Expressed in another way, 'the specific concern is whether the cell phone industry can ensure that it is not using a mineral that causes vast bloodshed including war and violations of human rights, and how a conflict that has already caused suffering of historical dimension can be brought to a halt' (Ayres, 2013, p.178). Although it may be a difficult question to answer, I have also endeavoured to retain consideration for the

question of how could it be that in an age in which populations increasingly have access to such an abundance of information at their fingertips that the deadliest war worldwide in modern times could have gone so unreported?

Notwithstanding, it is also important to acknowledge that as all research in this project has involved secondary sources the output will be subject to some inherent limitations as a result. With no first-hand presence of mine workers or conversely others involved in the supply chain of minerals used in communications technologies such as employees of electronics companies for example, it is difficult to go deeper in investigating current circumstances. It is also important to acknowledge that as a researcher of circumstances in DRC, my perspective will have been limited by not having travelled to the region, a proposal which was ultimately not approved by my university as part of the application process for this project due to safety concerns. As much of the accessible documentation of Congo's history has been told by westerners to date, it has been important to retain an awareness of the limitations of particular forms of discourse (Foucault, 1980). It is also to be acknowledged that the majority of texts involved in this research project have been published in English as opposed to another language. Furthermore, and somewhat paradoxically, every stage of this project has involved sitting in front of a computer, a product which is very likely to have been assembled from the very materials whose circumstances are examined herein.

There are also a number of positives to be identified about the use of secondary sources in this project's methodology. For example, the site of research being locatable in sources of existing publications has meant for an achievable remit and one already situated within contemporary academic discourse by its nature. Although that which exists within these margins pertains to its own genealogical subjectivity, this angle also has the ability to bring together and consolidate the work of a diversity of researchers in a potentially unique and unifying way. The link between the mineral trade and the activities of several armed groups in the DRC has been well documented and 'reports that describe the conflict, seek to uncover the motives of the warring parties, and make recommendations, have been written by various actors including advocacy groups, local civil society, international organisations and academics' with analyses and recommendations ultimately tending to 'vary considerably' (International Peace Information Service, 2012, p.11).

Although this research has not been underpinned by the generation of numeric or quantitative data, the quotation of secondary sources has at times involved information of this nature. In bringing together the work of other researchers who have been studying the relationship between mining in DRC and the manufacture of telecommunications devices, my work has focused on 3 case studies and the trajectory of these specific materials on their journey from being mined, transported, refined, assembled in manufacture, consumed and ultimately discarded. Documentation relating to the mining of these specific materials in both geographical and economic terms has been an important aspect of this project. Coltan, cobalt and cassiterite are only three among many minerals sourced from DRC which are utilised by various forms of industry around the world, others include

amethysts, bauxite, bismuth, cadmium, coal, diamonds, germanium, gold, iron ore, manganese, pyrochlore, silver, tourmaline, uranium, wolframite (tungsten) and zinc. However, with an estimated 80% of global supplies of coltan, 58% of cobalt and 33% of cassiterite originating from this nation, there is a strong rationale for tracing the path of these three materials in particular.

Three main types of mine exist: underground mines, open-pit mines and alluvial mines. Underground mining usually takes place in old industrial mines in tunnels that can be up to 500 metres in length and reach a depth of 30 metres. Tunnels collapsing and asphyxiation are professional hazards for artisanal miners working underground. Open-pit mining often occurs at tailing sites, with each site containing several pits. Alluvial mining takes place in rivers, with miners sifting through mud for minerals (International Peace Information Service, 2012, p.21).

CASE STUDY 1 – COLTAN

A material which has become synonymous within the global trade of conflict minerals is coltan, otherwise known as columbite-tantalite. The term 'coltan' is the adjunction of the two terms columbite and tantalite, originally thought to be two different materials. English chemist Charles Hatchett is credited with the discovery of columbite in the area of the northern USA now known as Connecticut in 1801. Enigmatically, Hatchett is said to have named the material as such in honour of Christopher Columbus in respect of his supposed "discovery of America". Documentation suggests that tantalite was discovered in Sweden one year later in 1802 by chemist by Anders Gustaf Ekenberg at which time it was thought to be an allotrope of the element niobium.

Primarily sourced from within the provinces of North and South Kivu in the east of DRC, greater awareness exists with regard to the plight of coltan when compared with other raw materials extracted from within the country and used by the telecommunications industry. A huge boom in the mining of coltan took place in these regions between 1998-2003, a period during which approximately 5 million lives are said to have been lost due to territorial conflicts (Taka, 2014). Accounts exist of the way in which the local population in many cases moved from their previous occupations to take part in the mining of this material, almost overnight as it became in such strong demand. In 2011 the government in the United States passed what has been dubbed the 'conflict-free coltan law' in an attempt to prevent US companies from funding armed conflict in DRC. However, this law known as the Dodd-Frank act received a mixed reception, with both positive and negative consequences felt on the ground.

Coltan is a ubiquitous and indispensable ingredient in the manufacture of digital technology. From coltan ores are extracted the metals tantalum and niobium which have several uses in advanced technological products, notably in high density capacitors used in

cameras, mobile phones and other compact electronic devices. Tantalum has several unique properties that have made it essential to certain applications and the material has gained wide acceptance for use in electronic components, chemical equipment, missile technology, and nuclear reactors. The electronics industry consumes the majority of tantalum produced (approximately 60%) for capacitors (Pole Institute, 2002, p.5). In the context of wireless telecommunications, transistor capacitors store and regulate the flow of electricity from the power source to parts of the electronic device that perform functions, such as the display windows of mobile phones or storage areas for digital information (Nest, 2011, p.8).

Control over coltan ores in the east of DRC has helped to fund domestic militia and foreign armies, prolonging the war crimes and human rights abuses committed there over many years (Sutherland, 2011, p.3). In the context of a history of exploitation of Congo's natural resources, it has been identified that 'cell phones were the pneumatic tires of the new century' in the sense that 'what rubber had been in 1900, coltan was in 2000: a raw material, available locally in huge quantities, that was suddenly in acute demand around the world' (Van Reybrouck, 2014, p.293). In one light, 'coltan holds importance for understanding the conflicting and diffuse global role of the digital age, as a source of hope and creativity on the one hand; and as an instrument of terror, regimentation, and routinisation on the other' (Mantz, 2008, p.34).

CASE STUDY 2 – COBALT

A material utilised in the construction of lithium-ion batteries, cobalt has in recent years become a particularly desirable commodity in the global market. Due to its uses in the manufacture of mobile technologies, global demand for cobalt has been soaring over the last 20 years. The role of lithium-ion batteries has been described as being of a nature whereby 'smartphones would not fit in pockets without them. Laptops would not fit on laps. Electric vehicles would be impractical' (Frankel, 2016).

At source, this demand is met by workers including children, who work in harsh and dangerous conditions. An estimated 100,000 cobalt miners in Congo use hand tools to dig hundreds of feet underground with little oversight and few safety measures, according to workers, government officials and evidence found by journalists. Cobalt mining mainly takes place in the south of DRC in the provinces of Lualaba and Haut-Katanga, in close proximity to a mineral vein known as the copper belt which spans across the region. Because of its by-product status, cobalt beneficiation processes are usually of secondary importance compared to the process required to recover the main commodity (i.e. nickel or copper). Stemming from the industry around the mining of copper earlier in the 20th century and its subsequent nationalisation and unionisation, much of the infrastructure around the mining of cobalt in recent times has been of an artisanal nature, yet under the guise of 'Gécamines' (La Générale des Carrières et des Mines).

Cobalt can account for a fifth of the material in a lithium-ion cathode, typically in the form of either nickel manganese cobalt oxide or nickel cobalt aluminium oxide. As an ingredient in these batteries, cobalt has a stabilising effect and prevents cathode corrosion that can lead to a battery fire (Oberhaus, 2020). The use of cobalt is believed to be key for boosting energy density and battery life because it keeps the layered structure stable as lithium ions get reversibly stuffed into and extracted from the cathode during battery operation (Patel, 2020). In recent years the development of renewable energy sources and electric vehicles has increased the demand for cobalt originating from DRC. There is said to be approximately 5-10 grams of cobalt in an average mobile phone, 25-30 grams in a laptop and between 5-10 kilograms in an electric car (Frankel, 2016). Two-thirds of the world's cobalt was produced in DRC in 2017 (Africa Research Bulletin, 2020).

Across what is a complex supply chain which traverses the planet, a key factor characterising ethical problems associated with the industry around cobalt is highlighted in the pay gap between consumer brand workers in Europe and African mine workers, the ratio of which is said to be in the region of 25 to 1 (Amnesty, 2016, p.27). In December 2019 companies such as Apple, Google, Dell, Microsoft and Tesla were named as defendants in a lawsuit filed in Washington DC by human rights firm International Rights Advocates on behalf of 14 parents and children from DRC. The lawsuit, which is the result of field research conducted by anti-slavery economist Siddharth Kara, accused the companies of aiding and abetting in the death and serious injury of children who they claim were working in cobalt mines in their supply chain.

CASE STUDY 3 – CASSITERITE

Cassiterite (otherwise known as tin) has multiple uses but in the context of the manufacture of mobile devices it’s primary use in the construction of circuit boards. Materially, the role of cassiterite as housed among the circuitry of today’s digital media devices is one of connection, facilitating the flow of electricity across components. Another application of tin in the manufacture of today’s media devices is as transparent and electrically conducting indium-tin-oxide, a coating on flat glass for screens and displays and touchscreen technology.

Tin extraction is said to date back as far as 3000 BC and thus has a long and illustrious history in manufacturing processes and in the development of forms of technology. In the context of DRC, cassiterite mining takes place across several provinces in the east of the country such as North Kivu, South Kivu, Tshopo, Maniema, Tanganyika and Haut-Lomami. Partly through recognition among the international community of the circumstance at Bisie mine near the town of Walikale in North Kivu, cassiterite has now become defined as a ‘conflict mineral’. Walikale was the centre of the cassiterite boom in 2003-04 and at the height of that boom, war broke out around the control of cassiterite trading.

At the beginning of what has been more aptly described as a 'value chain' rather than a supply chain (Cuvelier, 2010, p.30), deposits of cassiterite are usually locatable near the surface or coming through the soil. Extraction of cassiterite from the earth usually involves mining via the dredging of alluvial deposits which is followed by the ore being broken up by either high-pressure water, an excavator or by hard-rock mining methods in the case of underground mines. In general, very little rights exist for mine workers in these settings and working conditions are far from satisfactory. Typically, cassiterite from DRC is profited from several times over by individuals and organisations outside of the region and is characterised by a disproportionate division of labour and extortion of wealth.

During the period prior to the implementation of due diligence and traceability schemes resultant from the US government's Dodd-Frank Wall Street Reform and Consumer Protection Act in 2011, it was presumed that about half of cassiterite production was leaving Eastern DRC informally. A pertinent area of analysis in assessing circumstances around the supply chain of materials such as cassiterite centres around the question of what the effect of these reforms has ultimately been, as experienced by the worker on the ground as well as the industry more widely. Despite these initiatives pertaining to somewhat admirable aspirations, observers have pointed out that attempts to regulate the cassiterite industry have merely resulted in a process of deterritorialization and a gradual articulation of externally legitimised extraction' (Vogel, Musamba and Radley, 2018, p.1107). Notwithstanding, the concept of 'due diligence' has become a key aspect of organisations' attempts to address failures around ethical sourcing of the material.

CHAPTER 2: DEMOCRATIC REPUBLIC OF CONGO: A HISTORICAL PERSPECTIVE

INTRODUCTION

In understanding how today's circumstances in DRC have come about, recognition of the recent history of the region seems an appropriate place to begin. As identified by author Kevin Dunn, 'to understand Congo's current condition, one needs an examination of the Congo's origins and the forces that have produced and defined it' (Dunn, 2003, p.6). As much of the accessible documentation of Congo's history has been told by westerners, Dunn also acknowledges how this discourse has been limited. The author highlights Michel Foucault's genealogical approach in explaining that this may be 'a form of history which can account for the constitution of knowledges, discourses, domains of objects etc, without having to make reference to a subject which is either transcendental on relation to the field of events or runs in its empty sameness throughout the course of history' (Foucault, 1980, p.117). With global industries around particular materials having been influential in shaping Congo's history over the course of the 20th century, from rubber and copper in the early 1900s to uranium towards the middle of the century, the early 21st century has seen ongoing conflict related to the sourcing of ubiquitous minerals which are utilised in the manufacture of today's telecommunications devices.

Perspectives found within the work of Foucault have the ability to provide valuable insight when it comes to studies of African history. In highlighting some of the problems which can potentially arise from the authorisation of history and any resultant discrepancies between what happened and what is portrayed, it is asserted as 'a fact that there are nodal problems in history which are neither a matter of trivial circumstances nor of those beautiful structures that are so orderly, intelligible and transparent to analysis' (Foucault, 1980, p.114). In some ways it may be necessary to consider historical discourse as its own entity or medium which retains some independence from historical events themselves as 'the problem does not consist in drawing the line between that in a discourse which falls under the category of scientificity or truth, and that which comes under some other category, but in seeing historically how effects of truth are produced within discourses which in themselves are neither true nor false' (Foucault, 1980, p.118).

The term 'archaeology' as utilised in the writings of Foucault is referred to as the examination of discursive traces and orders left by the past in order to write a history of the present. In other words, archaeology in this context is about looking at history as a way of understanding the processes that have led to where we are today. However in relation to historical discourses, inherent limitations of perspective are also necessary to recognise as the reader is warned that 'there is always a secret origin – so secret and so fundamental that it can never be quite grasped in itself' (Foucault, 1969, p.25). Simultaneously but in a more literal rather than conceptual sense, the term 'archaeology' as applicable in relation to the physical world around us also provides a footing whereby matter mined from under the ground in DRC and used in forms of digital media becomes visible. In this context,

distributors and receivers of information are tied to an economic culture whose lineage stems from an era of colonialism and continues to be exploitative in its operations. Within the work of Foucault a distinction can be drawn between theory concerning archaeology, characterised by formative processes and his later writing about genealogy which seeks to question the foundations of historical discourse and the transcendental associations within.

> 'From the political mobility at the surface down to the slow movements of 'material civilization', ever more levels of analysis have been established: each has its own peculiar discontinuities and patterns; and as one descends to the deepest levels, the rhythms become broader' (Foucault, 1969, p.3).

The term 'genealogy' as conceptualised in the writings of Foucault deals similarly with the substrata of knowledge and culture, however it is described as a level where the grounds of the true and the false come to be distinguished via mechanisms of power. Said to have derived from the writings of Friedrich Nietzche, in the context of Foucault's writings genealogy 'displaces the primacy of the subject found in conventional history and targets discourse, reason, rationality and certainty', as well as illuminating 'the contingency of what we take for granted, to denaturalise what seems immutable, to destabilise seemingly natural categories as constructs and confines articulated by words and discourse and to open up new possibilities for the future' (Crowley, 2009, p.3). It has been asserted that this approach 'seeks to trace how rituals of power arose, took shape, gained importance, and affected politics' and 'asks how certain terms and concepts have historically functioned within discourse' (Campbell, 1992, p.5). Although Foucault's contextualisation of both archaeology and genealogy are useful at the site of interpretation of historical events intellectually when it comes to Congo as well as more widely in post-colonial discourse, in an epistemological sense greater identity can be found through the genealogical approach by comparison. After all, the mining of physical matter from under the ground in DRC is happening in a literal sense rather than a conceptual one.

On this basis it seems important to recognise that discourses on Zaïre / Congo's identity have been neither monolithic nor unchallenged. In a McLuhanesque sense whereby the message is in the medium as such, it has been noted that history tends to be written by those in a position to write it. Each discourse establishes a closure and dominance over other discourses but is always incapable of establishing a completely closed, stable and fixed position (Doty, 1996, p.6). 'It is not enough to only examine the dominant or hegemonic discourses, for that gives only a partial picture and works to reify the imagery of domination' (Dunn, 2003, p.107). Stuart Hall conceives of any communication process as being 'produced and sustained through the articulation of linked but distinctive moments – production, circulation, distribution / consumption, reproduction' (Hall, 1980, p.166). The production of discourses is 'encoded' with meanings based on specific frameworks of knowledge. When these discourses are consumed and reproduced, their meanings are 'decoded' through a framework of knowledge held by the consumer. Conversely, the writings of Foucault attempt to circumvent the series of binaries – 'that is, between truth

and falsity, reality and representation, and the symmetrical relationship between self and other' (Khan, 2004). Foucault's approach is criticised by Hall in the sense that a thoroughgoing scepticism about any determinacy between practices is committed to the necessary non-correspondence of all practices to one another. He goes on to assert that 'from such a position neither a social formation, nor the State, can be adequately thought' (Hall, 1980, p.71). Further criticism of the application of Foucault's genealogy has also been expressed where 'colonial strategies of occupation have long concentrated on genealogy to identify (and thus coerce) existing political authority and to identify an anthropology of "Otherness" that marks the colonized through a divisive cut of difference (which in turn justified theft of territory and persons)' (Yusoff, 2018, p.29).

From this viewpoint, a critique of the nation state as a perceived entity is possible and bears relevance when looking at the formation of the country today known as DRC. One may ask whether there is a need to emphasise the politics of borders as a way of separating people, particularly when looking at circumstances around authorisation of these borders regionally and internationally. Attention has been paid where 'the exercise of sovereignty, in turn, consists in society's capacity for self-creation through recourse to institutions inspired by specific social and imaginary significations' (Mbembe, 2019, p.13). Congo's strategic location in the middle of Africa and its natural endowment of minerals and other resources have since 1884 ensured that it would serve as a theatre for the playing out of economic and strategic interests of outsiders; the colonial powers during the 'scramble for Africa'; the superpowers during the Cold War; and neighbouring African states in the post-Cold War era. It has been suggested that one needs to understand developments in Central Africa during the 1990s through an appreciation of 'the politics of borderlands' and issues of deterritorialisation (Dunn, 2003, p.147). It is the construction and political emancipation of these boundaries that warrants analysis. Indigenously articulated identity discourses have historically been delegitimised and dismissed by western powers who have claimed a superior perspective, often with detrimental consequences.

Looking at current circumstances in DRC, repercussions from the colonial period appear to still be ongoing and thus the past is still affecting the present. The year 2020 marked the 60th anniversary of Congo's independence from Belgium, however economic agency over many of the country's exports can still be found situated in other parts of the world with processes of resource colonialism still in flow. Although the history of DRC has been tumultuous across the 20th century and into the 21st, it is important to recognise how intrinsic the grapple for this country's resources has become culturally on the part of the international community and multinational corporations (Isla, 2017, p.3). Following the election in late 2018 of Félix Tshisekedi as successor to President Joseph Kabila, the eastern regions of North and South Kivu have been affected by the second largest Ebola outbreak on record as well as an escalation in tensions between local populations and UN (MONUSCO) peacekeepers (Al Jazeera, 2019). This had followed a process of expulsion of the UN presence in neighbouring Burundi over previous months and years (Miles, 2019).

The period leading up to the 2018 election in DRC proved to be turbulent. At the centre of the electoral process were electronic voting machines, the vast majority of which were destroyed in a fire in a warehouse on the outskirts of the capital Kinshasa on December 13th, 10 days before the election date which had been set as December 23rd following two postponements over the previous two years. Whilst a decision had been made to again postpone the vote until December 30th and then once again until March 2019, a further period of power jostling saw an influx of replacement voting machines arrive as a donation from the South Korean government to be distributed around the country in order for the poll to go ahead on the planned date. Among the series of events was also a plane crash said to be carrying materials related to the ballot in which 3 members of Russian ambassadorial staff to DRC were killed along with 6 others. The election finally took place on December 30th with voting in three regions Beni, Butembo and Yumbi postponed until March. In total, approximately half of the nation's population of 82 million were registered to take part in the election. On January 1st 2019, the government switched off internet and text message facilities whilst votes were being counted in order to prevent the distribution of misinformation and any potential violence.

Patterns of violence and brutality have become synonymous within eastern regions of DRC since the mid-1990s as armed groups have sought control of territories in which valuable resources are located. Although DRC's abundant natural resources have been integral across a variety of industries throughout the 20th century as various forms of technology have developed, it is the telecommunications sector which has been the main beneficiary in more recent times and in particular 'small-size, high-tech equipment like the smartphone' (Taka, 2017). Before looking in more detail at the events of recent years within the region, a broader look at how the culture of exploitation of this country's resources has developed throughout the 20th century is required in an effort to contextualise the circumstances of today.

A quote which may be indicative of the general attitude of western governments towards Congo, taken from 'Not So Much a Programme More a Way of Life' which was broadcast on the BBC in the early 1960s:

'*We have seen more than half a million people butchered, mutilated, raped and torn limb from limb. Only this week we have read of massacres in Stanleyville of mass shooting down and of unarmed women and children being murdered, of the burning alive of 60 men tied together and soaked in petroleum. Through all these events your directors and I have asked ourselves only one question; To what extent will the operations of your company be affected? We are pleased to record that the events of this particular week, taking place as they did in Stanleyville province over 1000 miles from the seat of our mining operations need not in any way directly concern us.'*

PRE-COLONISATION (- 1876)

Due to being situated in the centre of the African continent, the history of the country we now know as DRC is characterised by a population of linguistically and culturally related peoples, the majority of whom speak Bantu languages and 'in addition to the linguistic unity binding the majority of the peoples of Central Africa, the Congo's ties to its immediate neighbours are reinforced by the fact that many of its ethnic groups straddle national boundaries' (Nzongola-Ntalaja, 2002, p.14).

The 'Congo' did not enter the European collective consciousness until the arrival of a Portuguese ship in 1542 at the mouth of a great river to find a society, historically referred to as 'The Kingdom of Kongo'. Over the following four hundred years or so, various European groups attempted to venture up the river but were largely unsuccessful. When the Atlantic slave trade began to decimate the Kingdom of Kongo, that nation was under the reign of Nzinga Mbemba Affonso who gained the throne in 1506 and ruled for 40 years. Affonso's life spanned a crucial period in that when he was born no one in the Kingdom is said to have known of the existence of Europeans, yet when he died a slave-selling fever had taken hold (Hochschild, 1998, p.11). In 1665 the Kingdom of Kongo fought a battle with the Portuguese in which it was defeated and the King beheaded. That said, until the onslaught of the East African slave trade and the slave like Leopoldian regime in the 1840s and 1890s, much of the country had not been exposed to the establishment of trade relations with Europe or the Atlantic slave trade (Nzongola-Ntalaja, 2002, p.14).

Thousands of miles away from what would eventually become the seat of a nation's colonial operations, the 1830s saw the inauguration of Belgium as a nation. Following an eventful period in which a revolution broke out in Brussels as various parts of the population grew to feel unrepresented by a government situated in the Netherlands to the north, in January 1831 a protocol was signed recognising the formation of a new Kingdom. In July 1831, a German prince and cousin of British monarch Queen Victoria, Leopold Georg Christian Friedrich was named as the first king of a small nation which was in some ways an uneasy amalgam of French and Flemish speakers (Hochschild, 1998, p.33). During what could be seen as the period in which the character of the Belgian nation was forged, this would soon become a colonial entity whose practices would bear comparison to that of other nations situated in western Europe who had sought up to carve up the world map into the territories of empires. In this sense, Belgium as a colonial power 'moved beyond its physical and economic limitations to take its place amongst the larger, stronger nations of Europe' (Dunn, 2003, p.29). An arbitrariness of national boundaries comes into light at times when examining processes of deterritorialisation during this historical period whether it be in relation to circumstances in Belgium or the notion of property and privatisation of territory within the processes of colonialism.

The formation of Congo's identity and the way that this perceived identity has shaped the actions of external actors has all but 'allowed the current state of affairs in Congo to develop' (Dunn, 2003, p.12). Furthermore, 'discourses – rhetoric, representations and –

actions, are 'encoded' with meaning based in specific frameworks of knowledge' (Dunn, 2003, p.13). As has been identified 'to exercise sovereignty is to exercise control over mortality and to define life as the deployment and manifestation of power' (Mbembe, 2019, p.12) and indeed the country's borders as we know them today are largely the result of the colonial period as Europeans sought to divide up the land. Additionally, 'colonial authorship of a Congolese social identity was primarily concerned, first and foremost, with fixing and policing boundaries of difference' (Dunn, 2003, p.27). One example of this is the province formerly known as Katanga, within which the 'copper belt' region is situated. Previously part of the state of Garenganze or the Yeke Kingdom, between the years of 1856-1891 King Msiri presided over what was briefly the most powerful state in Central Africa. The assassination of Msiri in 1891 by an officer of the Congo Free State 'marked the real beginning of the incorporation of the mineral rich region of Katanga in the Belgian colonial empire' (Nzongola-Ntalaja, 2002, p.15).

In the 120 years of mineral extraction from Katanga which have followed, the wealth of the region has not been used to the benefit of the vast majority of its people. Ever since the days of King Leopold it has gone to serve the interests of the country's rulers and those of their political allies and business partners in the international community. It has also been identified that imperial rivalries between Britain and Belgium over control of this region 'played a major role in shaping the history of Katanga' (Nzongola-Ntalaja, 2002, p.30). A strike of Katanga mineworkers in 1941 over pay demands resulted in the Lubumbashi massacre where more than 100 workers were killed. Notably, 'anticolonial revolts in the form of peasant uprisings and urban rebellions did play their part in consolidating a tradition of resistance that later proved useful for the independence struggle and the democracy movement in Congo' (Nzongola-Ntalaja, 2002, p.51).

COLONISATION (1885 – 1908)

Prior to King Leopold of Belgium's annexation of what would later become known as 'Congo Free State' in 1885, September 1876 saw Brussels host a 'Geographical Conference' with representatives from several other European nations such as France, Germany, Britain, Austria-Hungary and Russia in attendance. With Belgium's sovereignty having been established 45 years earlier in 1831 and thus not yet having become a colonial nation, the decisions made at this conference are said to have gone a long way towards the establishment of the Belgian presence around the Congo basin and throughout the rest of the country. For several years following this conference and until the establishment of the 'Congo Free State', Congolese land which had been conquered was claimed as the King's personal possession.

Documentation of the proceedings at the conference highlight what appears to have been a prevalent view throughout the colonial period on the part of European nations, the

inherently white supremacist view that despite a recognition of the presence of local populations, these were lands which had not yet been discovered. It is almost as if the native population were not considered to exist in the same way as Europeans, as is highlighted in this quote from the King himself;

'*To open up to civilisation the only part of the globe which it has not penetrated, to pierce the darkness in which entire populations are enveloped, is, I venture to say, a crusade worthy of this age of progress, and I am happy to perceive how much the public feeling is in favour of its accomplishments; the tide is with us*.'

- Leopold II (quoted in Banning 1877, p.152-3)

The colonial mindset of this period of history, not just on the part of Belgium but also the other nations whose representatives were in attendance at the Brussels conference appears to be characterised by a belief that the conquests of Europeans were somehow a force of 'civilisation' on a 'wonderful conquest' rather than being associated to processes of exploitation. Throughout existing documentation of the conference, a consistent lack of acknowledgement of the local population is palpable. It is written that people were to be 'rescued from an isolation of centuries' with Congo's 'virgin and fruitful soil' (Banning, 1877, p.13) glorified.

For those able to identify the character of western European nations in this context as being that of the oppressor rather than some sort of force for humanity, Emile Banning's 1877 book stands as a thorough record of the Brussels conference. It goes some way towards demystifying what was going through the minds of the invading forces and potentially what equipped people to later perpetrate such acute violence. The first half of the book provides a general account of the history and geography of Africa as an entirety from a colonial perspective before moving on to matters such as the rationale involved in slavery, with an inherent pre-supposition that Africans were somehow inferior or socially backwards. The second half documents matters discussed during the meeting in Brussels including the potential for the abolition of the slave trade which is described as 'the enemy and stumbling block of all progress' (Banning, 1877, p.103), along with the recommendation that its suppression be prosecuted with 'invincible energy' (Banning, 1877, p.138). It has been identified that Leopold as the effective leader of the association disguised 'his colonial enterprise as a humanitarian venture for scientific research and economic development in Africa' (Nzongola-Ntalaja, 2002, p.15). A common theme among these discussions related to how infrastructure such as 'European stations' could be utilised going forward and how what were colonial enterprises could be adapted or improved in particular ways via representatives who were present at the meeting. There is also an account of discussions held around how areas of the African continent as yet unexplored by Europeans could be conquered.

Found within the chapter of Banning's book entitled 'Conclusion' are several assertions and predictions for the future of Africa. However, as part of what history has now proven to be an inaccurate forecast, the same chapter reads that it would not be possible within

50 years of the book's publication that 'Africa should become one of the great markets producing some of the primary materials of European industry' (Banning, 1877, p.143). A section which seems to reverberate in a 21st century context in light of developments in telecommunications, the author then goes on to describe how in the establishment of 'profitable modes of application of this new soil' that 'the combined efforts of so many men of different nationality will create among the states of the Old World an additional bond of solidarity, and, in its enlarged domain, mankind will henceforth see all the races of the globe co-operating towards the fulfilment of its destinies' (Banning, 1877, p.143). Perhaps this vision found its destiny within the rhizomatic 'constellation of singularities' identified in Deleuze and Guattari's seminal 1987 book *A Thousand Plateaus: Capitalism and Schizophrenia*, a concept which will be examined more thoroughly later in this text.

Following King Leopold of Belgium's annexation of the land as his personal possession in approximately 1880 and then the establishment of the Congo Free State in 1885, the years around the turn of the 20th century saw the advance of other nations such as France, Portugal, UK and Germany who were seeking control over this region. Between November 15th 1884 and February 26th 1885, the Berlin West African conference hosted delegates from 14 countries, namely Austria-Hungary, Belgium, Denmark, France, Germany, Britain, Italy, Netherlands, Sweden-Norway, Portugal, Russia, Spain, Turkey and the United States. The conference concluded with German chancellor Otto Van Bismarck reading a letter from the Association Internationale du Congo 'informing the conference of its recognition of Leopold's Congo as a sovereign state by all the powers that mattered, the delegates rose and applauded loudly' (Nzongola-Ntalaja, 2002, p.17). During Leopold's 23-year period as the ruler of Congo he never once set foot on Congolese soil, instead ruling the land remotely as an absentee landlord who left his day-to-day affairs to his professional managers.

By 1900 the majority of 'African societies of present-day Democratic Republic of Congo had lost their independence as a result of European conquest and occupation in the era of imperialism' (Nzongola-Ntalaja, 2002, p.13). Publications such as 'The Casement report' (1903) provide documentation of the boom in the trade of rubber and ivory mainly in the west of Congo Free State, a period which saw unprecedented levels of violence inflicted upon the local population. As the Free State established its monopoly over these products, each village was required to bring a certain number of kilos of ivory or rubber or risk punishment. As numbers of elephants and latex bearing plants began to diminish over time, villagers were forced to roam further into the forest to the point where competing circumferences were reached from two or more geographic origins. As villages failed to meet quotas, punishment escalated and many Congolese lost their lives (Tuner, 2007, p.27). 'Villages unable to meet the assigned daily quotas were subject to rape, arson, bodily mutilation and murder' (Nzongola-Ntalaja, 2002, p.22). Incredibly, the death toll associated to the rubber trade between 1891 and 1911 is said to have surpassed 10 million due to murder, starvation, exhaustion and disease. This loss of life is comparable with that of the territorial conflicts of more recent years around the turn of the 21st century

(Hochschild, 1998, p.223) (Deibert, 2013, p.127). Both periods have in common a grapple for the country's resources. The practices of companies responsible for the exportation of rubber from Congo during this period such as the Anglo-Belgian India Rubber Company (Abir), Goodyear, Continental or Dunlop may bear comparison to that of the manufacturers of today's telecommunications devices such as Apple, Samsung, Huawei, Dell, Nokia, Sony and so on.

Initially presented to the Parliament in Westminster in 1901, Roger Casement's report provides description of what was happening in Congo during the late 19th century. Having worked for Henry Morton Stanley and the African International Association as well as in the role of British Consul, Casement grew to mistrust imperialism and thus he worked extensively, investigating and documenting colonial atrocities against indigenous peoples in both South America and Africa. He was later sentenced to death by the British state for the charge of treason relating to his role in the Irish republican movement which eventually lead to Ireland gaining independence from Britain. Casement travelled for weeks in the upper Congo Basin interviewing people throughout the region, including workers, overseers and mercenaries. He delivered a long, detailed eyewitness report to the Crown that exposed abuses such as the enslavement, mutilation, and torture of natives on the rubber plantations. The report provoked controversy, and some companies with a business interest in the Congo rejected its findings.

The report describes some of the brutality inflicted upon local populations by colonial forces as the rubber trade was burgeoning. Detail is also provided regarding the legality of certain actions relating to taxation and land law through the lens of the British legal system, for example it is noted that 'no one has the right to dispossess natives of the lands which they occupy' (Casement, 1903, p.152) according to the ordinance of the 1st July, 1885, Article 2. The report also details how no legal basis exists for the abuses of the governing administration; 'Neither the summary arrest and taking away from their homes of the men whose names were given to me nor the imposition of the very heavy line of brass rods find any warrant in this page of the Congo Statute Book' (Casement, 1903, p.41). It is documented that the currency mainly in use during this period in the Upper Congo consisted of brass wire or brass rods, twenty of which were equal to one French Franc. In 1887 Casement is said to have travelled for a week along the Congo river in the company of Belgian commander Guillaume Van Kerckhoven and listened aghast as it was cheerfully explained to him how Van Kerckhoven paid his black soldiers in the form of "5 brass rods ($2.5) per human head they brought him during the course of any military operations he conducted. He said it was to stimulate their prowess in the face of the enemy" (Hochschild, 1998, p.196). This extreme example may be viewed as symbolic of the way in which the global economy has continued to evolve divergently in subsequent years. Despite countries which were previously colonised having gained independence with regard to governance, economic agency can often be found to be centralised elsewhere with currencies being anchored by their relation to that of say the dollar, the pound or the franc.

The report states that freedom of trade was complete in the Congo at this time, and that it was restricted neither by monopoly nor privilege. Everyone was free to sell or buy every sort of produce in which it is lawful to trade. The law protected this freedom by forbidding any interference with the freedom of business transactions. It is expressed that "anyone who has employed violence or threats with a view to compel the natives, whether on the roads in the interior, or in the markets, to part with their goods to particular persons or at particular prices "will be punished along with those who, by violence, abuse, or threats, shall, have interfered with the freedom of trade, with a view either to stop trade caravans on the public roads or to obstruct the freedom of traffic whether by land or water" (ordinance of July 1st 1885) (Casement, 1903, p.144).

Although the style of writing within the report is affected by an inherently colonialist mindset, this document stands nonetheless as an important account of what was happening in the region. Casement describes; 'perhaps the most striking change observed during my journey into the interior was the great reduction observable everywhere in native life. Communities I had formerly known as large and flourishing centres of population are to-day entirely gone, or now exist in such diminished numbers as to be no longer recognizable.' (Casement, 1903, p.22). He also describes in some detail the mutilation practices which were uniformly inflicted upon the local population by the colonialists such as the amputation of hands and feet. Harrowing passages are also locatable whereby he describes the personal accounts of local people being murdered including children and families.

Following the report, Leopold was extensively criticised by British sources for whom he had to create a response via the media. During the years 1903-1907 a European wide PR battle for public opinion about what been happening in Congo came into focus.

BELGIAN CONGO (1908 – 1960)

Following the filtering back to Europe of reports of the acute levels of violence and ruthless exploitation inflicted upon the Congolese population during the era of the Congo Free State which had resulted in diplomatic pressure both domestically and internationally, on October 18th 1908 the Belgian parliament voted in favour of Congo becoming part of Belgium. This movement was written into law on November 15th, despite some opposition from Leopold who had attempted to retain certain regions of the country as part of the domain of the crown. Violence perpetrated by colonialists in the region is said to have been curbed somewhat during the years that followed.

From 1911 onwards copper production soared exponentially with exports of 30,000 tonnes recorded in 1917 (Van Reybrouck, 2014, p.93). Prior to the outbreak of the first world war, all of this copper was sold to Germany, then during the war Britain became the primary destination for copper exports. Diamond and gold mining also ramped up during this

period. Battles between Germany and an Anglo-Belgian alliance took place in the east of the country with the region previously known as German East Africa becoming part of Belgian territory in 1924 when it was renamed Ruanda – Urundi. It has been documented that from an early date under German rule, the Europeans were convinced that Rwanda and Burundi were over populated and that 'this lead to programmes to transfer families from Rwanda to Eastern Congo, with consequences that are still being felt' (Turner, 2007, p.29)

The palm oil industry also took hold during this period with quantities of exports steadily increasing between 1921 and 1957 along with other commodities such as cotton, rice and cocoa (Marchal, 2008, p.190). Mandatory cultivation was introduced, forcing Congolese peasants to grow cash crops for export. The books of Belgian author Jules Marchal provide an important insight into developments during the years of the Congo Free State and then Belgian Congo, including the 2008 publication entitled *Lord Leverhulme's Ghosts: Colonial Exploitation in the Congo* which focuses specifically on the palm oil trade. William Lever was an English industrialist and colonialist who was to become the founder of the multinational company 'Unilever' whose products can be found far and wide in today's consumer marketplace. Machal documents how 'Leverhulme set up a private kingdom reliant on the horrific Belgian system of forced labour, a program that reduced the population of Congo by half and accounted for more deaths than the Nazi holocaust' (Marchal, 2001, p.348). The establishment of the industry around palm oil took place in the western regions of Belgian Congo, with economic and monopolistic practices put into place by colonialists in order to retain control over the industry. As a variety of challenges were encountered whereby workers might have felt a sense of empowerment towards improving their working conditions for example, an evolution of new tactics were introduced by European landlords in an attempt to ensure that local populations were consistently treated as a lower class who were not entitled to the same privileges.

In an effort to make the colonial administration more effective, a series of decrees took place between 1906 and 1933 which delegated local regional authority to traditional rulers or chiefs. This policy 'succeeded in setting the chiefs against their own people' and by implementing administrative collective obligations to the state, they transformed the chiefs into 'subaltern functionaries of the colonial administration' (Nzongola-Ntalaja, 2002, p.35). As railroads were constructed during the 1920s and 1930s, workers were pulled in from all over the country in order for them to be built. Europeans were said to be carried in hammocks whilst the local populations travelled on foot with practices such as the kidnapping of villagers for slave labour being commonplace (Nzongola-Ntalaja, 2002, p.29). Anglo-Belgian mining company Union Minière also received big investment for its copper and cobalt operations in Katanga province, diamonds in Kasai and gold in Ituri. The industry around uranium mining was also established from 1921 onwards, with the material for the nuclear bombs dropped during the second world war over Hiroshima and Nagasaki sourced from Shinkolobwe mine in Katanga. Much of the uranium that was used by both the USA and USSR to build their nuclear weapons was sourced from this region

(Deibert, 2013, p.115). During the 1950s it was believed that Shinkolobwe contained roughly half of the world's known reserves of uranium.

In 1932 the Belgian administration expanded its recognition of 4 provinces to become 6 with the capital city being relocated from Boma, 300 kilometres inland to Leopoldville. The great economic depression of the 1930s as experienced in Europe and the United States indirectly affected several industries as demand for products decreased. Seventy per cent of employment is said to have been lost in Katanga alone, a pattern which has been shown to repeat itself in subsequent years as fluctuations in global commodity prices affect workers in Congo, at times causing mass migration.

During the 1930s in neighbouring Rwanda, the Belgians helped to create a myth that would have terrifying consequences. It was said that the Tutsis were a noble and intelligent race who had originally come from Egypt and that the Hutus were a separate race of ignorant peasants. In reality, there was no evidence for this at all. The Tutsis were a ruling elite but the two groups had always shared the same land and did not see each other as separate races. Many Hutus shared equally in government but the Belgians who ran Rwanda took the myth and used it ruthlessly. They brought in scientists to prove it biologically, they measured people's skulls and propagated the belief that the Tutsis had larger brains so were the natural rulers. They then made each group carry racial identity cards and created a segregated system in which the Tutsis ruled the Hutus with a brutal arrogance, encouraged by their Belgian masters Then, asindependence approached at the end of 1950s, liberals high up in the Belgian administration had encouraged the Hutus to rebel against their Tutsi overlords. The Hutus began massacring the Tutsis and the myth the Belgians had created was running out of control, the consequences of which would continue to be felt decades later in both Rwanda and Eastern Zaïre during the 1990s.

During the Second World War the Belgian government relocated to London because of the Nazi occupation, meaning that its colonial operations were headquartered there instead of Brussels. During the period which followed the end of WWII, the Belgians invested in infrastructure in Congo following a ten-year plan launched by the government in 1949. This included emphasis on house building, energy supply, rural development and health-care infrastructure. In 1953, the Belgian administration granted the population the opportunity to buy or sell property. At the same time, with materials such as uranium, copper, cobalt and diamonds having been discovered in such abundance, a strategic interest opened up on the part of the west 'in preventing the Soviet Union and its allies from gaining influence in Central Africa' (Nzongola-Ntalaja, 2002, p.29).

INDEPENDENCE AND 'THE CONGO CRISIS' (1960 – 1965)

For almost 80 years the Congo had been ruled by Belgium, but in June 1960 it became an independent nation with Patrice Lumumba elected as the first prime minister. This

followed the formation of an anti-colonial alliance comprised of workers and the proletarianised masses who converged with the common objective of political emancipation. Lumumba held out a heroic vision of a new independent Africa and sought to mobilise all strata of the population to join the independence struggle. The Congo was central to the modern world because hidden in its forests was an extraordinary range of minerals. Whether in relation to the construction of atom bombs or the new electronic systems and computers that would run the cold war, the old colonial towns would become battle grounds where rebels and soldiers fought for control of the precious mines.

In January 1959 riots began to take place in the Congolese capital, still known as Leopoldville at this time before the city was officially renamed Kinshasa in the early days of Joseph Mobutu's presidency in June 1966. Signs of social unrest began to awaken the Belgian administration into recognising that the sweep of independence movements taking place in Africa might actually affect them and thus prompted moves towards processes of decolonialisation with some attacks against European settlers taking place as a people's movement took hold. As reports began to emerge of the country's move towards independence, export industries also began to be affected with the price of copper plunging and materials such as cotton, coffee, and rubber no longer being exported (Van Reybrouck, 2014, p.190).

The establishment of a new and independent government was achieved through a nationwide democratic poll which was held on May 22nd 1960. After a period of negotiations, Lumumba was elected prime minister as his MNC (Mouvement National Congolais) party had won the most votes, with Joseph Kasa-Vubu being appointed as president as his ABAKO (Alliance of Bakongo) party had come second. On June 30th the formation of a new administration and a proclamation of independence was announced with Lumumba addressing supporters through an acceptance speech from the national palace in Leopoldville. During his speech he asked the following rhetorical question; 'who will forget the rifle-fire from which so many of our brothers perished, or the jails into which were brutally thrown those who did not want to submit to a regime of oppression and exploitation, which were the means the colonialists employed to dominate us' (Deibert, 2013, p.20).

Reports suggest that although consensus among the Belgian administration had grown to recognise the need to start working towards an independent Congo, they had not anticipated the speed and decisiveness with which this process was taking place. As a result, Belgian ministers began to direct their energy towards the southern provinces of Katanga and Kasai which were both to declare independence from the centralised government in Leopoldville in August 1960. Although a great deal more documentation exists on the situation in Katanga during the early 1960s in comparison to Kasai, the secession of both regions became increasingly politicised both continentally and internationally with a variety parties getting involved in an attempt to retain or establish economic interests, largely around natural resources.

As the initial period following the proclamation of independence had proven to be particularly turbulent, the United Nations began to establish itself in the country. On the face of it and in terms of what was publicly declared, this presence was of a noble nature in the sense that they were there to help confirm independence. All aid to Congo was to be distributed via the UN and as the situation developed the organisation's vested political interests became more apparent, causing contention to grow between Lumumba's administration and international representatives. The deployment of UN peacekeeping troops which began in July 1960 was at the time the largest and most ambitious mission undertaken by the organisation with 20,000 soldiers stationed on the ground. As an overview, it has been noted during the years between Lumumba's inauguration and Mobutu's instatement as the country's leader, 'the death toll among the Congolese population itself during this period was too high for meaningful estimates' (Van Reybrouck, 2014, p.183).

Moreover, the actions of foreign entities such as the US, UN and Belgium are said to have accentuated political cleavages that existed between moderates and radicals. As Lumumba began to attempt to consolidate his prime ministership across the nation, organisations such as the CIA grew increasingly sceptical as he began to develop ties with the Soviet Union and other countries of contrasting political ideology within a cold war context. It is believed that at this point in late 1960 the CIA began to explore ways of eliminating Lumumba before he was ultimately assassinated on January 17th 1961. The U.S administration were worried that Lumumba would ally with the Soviet Union so they and the Belgians helped to organise a coup. Lumumba was kidnapped by rebels from the mining areas, he was taken to the forests of the Eastern Congo where he was killed and his body eventually dissolved in acid. It has since been identified that 'Lumumba's fall and assassination were the result of a vast conspiracy involving US, Belgian and UN officials on the one hand, and his Congolese political enemies' on the other (Nzongola-Ntalaja, 2002, p.107).

It has subsequently been noted that 'if the UN was not directly involved in Lumumba's assassination as Belgium and US, it was nevertheless an accessory before the fact' (Nzongola-Ntalaja, 2002, p.112). As an extension of US foreign policy in the region, the Katanga separatist movement which had been led by Moïse Tshombe was forcefully brought to an end on the orders of John F. Kennedy in December 1962. Tshombe was later to return as the Prime Minister of Congo in June 1964, replacing Cyrille Adoula at which point the UN declared its mission complete. With the UN presence now exiting the country, at this point the US was forced to find an alternative way to retain its interests in the region and in late 1964 a large-scale military insurgency took place, initiated by the CIA.

During the years that followed Lumumba's assassination, territorial conflicts ensued as an independent Congo began to take formation. Due to shortcomings which resulted in the first independence movement being compromised, what became known as the second independence movement began in 1963 with Lumumba recognised as a martyr. As new

governments lead by figures such as Joseph Ileo, Justin Bomboko, Cyrille Adoula, Moïse Tshombe, and Évariste Kimba struggled to consolidate their power in a turbulent context, army chief Joseph Mobutu began to gain increasing influence and by September 1964 the military operation of the Conseil National de Libération had claimed control of 7 out of 21 provincial capitals. Some of the key personnel among this organisation had initially received military training in China. To add to the complexity of the situation, the infamous Che Guevara had based himself in Kivu province on the banks of Lake Tanganyika for 6 months in 1964, attempting to lend his support to the liberation struggle. However, the balance of force between the second independence movement and the neo-colonial state stifled these attempts.

Eventually in November 1965 Mobutu met with 14 members of the army high command as his grip on power came into focus. All the while amidst the chaos, the western mining companies carried on their operations unhindered, above all the giant Union Minière whose influence had partly contributed to the secession of Katanga. From 1967 Union Minière was renamed 'Société générale des Carrières et des Mines' or 'Gécamines', a state-owned mining company.

MOBUTU / ZAÏRE (1965 – 1997)

Having seized power in a coup and deposing the democratically elected government once lead by Patrice Lumumba five years earlier, Joseph Mobutu began his 32-year reign as Congo / Zaïre's military dictator in 1965. During the early years of Mobutu's tenure, a number of reforms were put into place which would ultimately determine the direction of travel for the country. After all, following the bloody struggle for independence this was to be the formative period in which Congo would strive to govern itself.

Among these reforms was a process of renaming towns, cities and provinces away from their previously colonial titles as part of what was termed an 'authenticity campaign' which is said to have been 'partly aimed at an international community more versed in existentialist rhetoric than the Congolese populace' (Dunn, 2003, p.119). Mobutu changed Congo's name to Zaïre in 1971 (the name came from a Portuguese interpretation of the word nzere of nzadi, meaning the river that swallows all rivers). The national currency was also changed from Francs to Zaïres in 1967.

Philosophically, Mobutu's construction of a Zaïrian identity might be most appropriately recognised as having been counterhegemonic in nature. In Foucault's terms, hegemony consists of the codification of a whole number of power relations that render its functioning possible, while counterhegemony is a different type of codification of the same power relations. Hegemonic discourses worked to map or classify specific understandings of the Congo's identity, while Mobutu sought to alter that 'horizon of the taken-for-granted' (Dunn, 2003, p.121). It has also been noted that Mobutu 'was accepted by the

west because, in large part, he was not threatening western notions of the self while simultaneously reinforcing their notions of the African other' (Dunn, 2003, p.119).

In reference to the tactics which brought him to power initially and enabled this grip to be sustained for all of 32 years, it has been asserted that Mobutu's 'template for divide-and-rule governance' 'would define Congo for many years to come' (Deibert, 2013, p.29). Shortly after he became the country's leader, Mobutu banned all political party activity for 5 years in November 1965 and parliament was later dissolved entirely from March 1967 until 1970.

In late 1966, the newly militarised government oversaw the nationalisation of gold mines in Ituri province and the international conglomerate Union Minière whose operations had dated back to the days of the Congo Free State. This came shortly after the implementation of the Bakajika law through which the state established its rightful claim to all land and mineral rights in the country and as part of the same series of decisions all trade unions were subsumed to become a single government body. During initial negotiations the struggle between Mobutu and Union Minière resulted in a full-scale diplomatic war, with highly negative and hostile representations of him appearing in the Belgian press. This perception changed as the eventual settlement of Union Minière's nationalisation program turned out to be highly profitable for Belgian business interest.

However in 1967 a new conflict broke out as white mercenaries who supported the arrival of president Mobutu were leading a rebellion with the aim of creating a separate state out of the mineral rich area in the eastern part of the country. Behind the scenes they were allegedly being supported by the western mining conglomerates but the rebellion turned into horror. As the mercenaries fought their way into the town of Bukavu on the Rwandan border they tortured and killed their prisoners with extreme brutality before Mobutu's forces counterattacked and destroyed the rebellion. The mercenaries either fled or were captured and then disappeared. The behaviour of the mercenaries had enraged the Congolese soldiers who unleashed their hatred on the Europeans.

Within the first decade of Mobutu's presidency Gulf Oil, Standard Oil, Goodyear Tyres and Rubber, General Motors and Rockwell International all sought to establish themselves in Zaïre. It has subsequently been identified that Mobutu's emphasis on Zaïre's 'mineral resources and potential wealth was largely designed to increase foreign investment and raise the strategic importance of the country' (Dunn, 2003, p.122). By 1970 Mobutu's grip on power seemed ever ascendant and during the national elections of 1970 he, the incumbent was the only candidate.

Throughout his time as president, the US government donated vast sums of money to Mobutu's administration at various stages in an effort to protect their vested interests in the country, which were largely centred around natural resources. In a similar vein, in 1973 a group of Japanese banks made a series of loans to Zaïre in the hope of ensuring access to the country's raw materials. It has been noted that 'Mobutu's lavish egotism was bankrolled to a large degree by high copper prices between 1967 and 1974 and the fact

that, along with copper, for many years Zaïre was the world's leading producer of cobalt' (Deibert, 2013, p.33). Copper prices had reached an all-time high between 1968 and 1974 due to increased demand as a result of the Vietnam War.

Until 1980 Zaïre was also the world's largest producer of germanium, the Kipushi mine (formerly known as Prince Léopold Mine) located in the south of Katanga being the biggest. Germanium's most popular uses in the manufacture of domesticized products include fibreoptic systems, infa-red optics, electronics, solar electric applications and metallurgy (USGS, 2012). Although Congo / Zaïre's natural resources had to date been exported in huge quantities and utilised in the manufacture of various forms of technology, the economy around germanium may mark the point at which the country's resources were being used in the construction of forms of what could be described as 'media'.

From a stage of relative economic strength in 1975, Mobutu then presided over an economic crisis which was partly the result of a ruling class who were only interested in lining their own pockets. It is said to be the case that under Mobutu $40-60 million was generated each month from mining, yet this money did not go into the state treasury (Nzongola-Ntalaja, 2002, p.158). In 1976 several Belgian mining firms merged to form Société Minière du Kivu (Sominiki) focusing on gold, cassiterite and coltan. However, by 1985 Sominiki had largely disintegrated due to what is described as a 'textbook example of corrupt entrepreneurialism' (Deibert, 2013, p.37). Indicative of the same process of decline, in 1990 the Kamoto cobalt and copper mine in Katanga collapsed after years of neglect.

In 1989 Mobutu became the first African leader to visit President George Bush. The World Bank and International Monetary Fund reproduced the view that only Mobutu could bring stability and order to Zaïre, providing the regime with access to resources and legitimacy within the international community. Predominantly, the image of Zaïre portrayed in the west as being inherently chaotic due to its primitive nature provided the theoretical justification for the support of an authoritarian dictator. According to the country's constitution, Mobutu's term in office was supposed to come to an end in December 1991 but he refused to leave. Étienne Tshisekedi was elected in August 1992 in the most free and fair electoral process which had yet taken place in the country but the victory turned out to be hollow as Mobutu cancelled the National Sovereign Congress in December. A transitional charter which came with the election was ultimately undermined by Mobutu. It has been asserted that the international community did not provide adequate support for the desired democratic transition at this time (Nzongola-Ntalaja, 2002, p.199). Confusion and ambiguity characterised the political landscape during the following 2 years or so as Mobutu managed to retain a grip on power.

Ultimately the Mobutu reign disintegrated between 1990-1997 and 'the regime's loss of authority during the period of aborted transition to democracy resulted in greater erosion of the institutional capacity of the state' (Nzongola-Ntalaja, 2002, p.152). By the time Laurent Kabila's forces marched into Kinshasa in October 1996 the democracy movement

among the general public 'had lost confidence in the capacity of the transitional framework to perform successfully the tasks for which it was created, but was too weak to do anything about' (Nzongola-Ntalaja, 2002, p.208). On May 17th 1997 Laurent Kabila and his Rwandan backers dispatched Mobutu into exile.

Described as 'the most influential journalist writing about Congo' (Turner, 2007, p.11), Belgian author Colette Braeckman has written extensively about circumstances in Congo. In her 2009 book, Braeckman examines the role of imminent boom in the mining industries around materials such as cobalt, coltan and gold in the overthrow of president Mobutu in 1996 and 1997. This had followed Mobutu having issued an order that all ethnic Tutsis in what was at the time Zaïre, known as the Banyamulenge, were to leave the country or be punishable by death. The book follows in detail the period of history which has become pivotal in determining the extent to which populations in the eastern regions of DRC have been able to establish agency over the industries around the raw materials necessary in manufacture of today's telecommunication devices.

RWANDA GENOCIDE (1994 – 1995)

In 1994 the ruling Hutu government in Rwanda set out to exterminate the Tutsi minority. Most western reports described it as the sudden re-emergence of incomprehensible tribal hatreds. The New York Times said it was 'an uncontrollable spasm of lawlessness and terror in a failed African state with a centuries old history of tribal warfare'. But this wasn't true, the journalists were repeating the old imperial fantasy which said that the Tutsis and Hutus were ancient rival races. In reality the massacres were the horrifying result of the Belgian's policy of divide and rule that had begun less than 100 years before in Rwanda and it was this policy that had led to the vicious modern civil war that began the moment the Belgians left in 1959 and had now culminated in genocide. During the colonial era the Belgians had deliberately exaggerated and distorted the difference between the Hutus and the Tutsis and the identity cards that the Belgians had created that divided the two groups biologically now became passports to life or death.

Many have sought to relate the genocide in Rwanda in 1994 to an invasion by the RPF (Rwandan Patriotic Front), an army consisting mainly of Rwandans who had taken refuge in Uganda after earlier massacres, or to the death of Rwanda's president Juvénal Habyarimana as well as Burundi's president Cyprien Ntaryamira in a plane crash on 6 April 1994. The plane was shot out of the sky by a missile and was one of the key incidents which lead to the wave of murderous violence. This incident has subsequently been the focus of ongoing investigations in both France and Rwanda aimed at ascertaining the truth about what happened that day, the most recent example having been chaired by French magistrates JeanMarc Herbaut and Nathalie Poux and abandoned on December 21st 2018 due to a lack of evidence.

Notwithstanding, it has been identified that the massacres had been planned well before that and that these events only served as a starting point for the killings. A history of divisive colonial policies, the political context after decolonisation, and in the years which lead up to 1994 a carefully designed propaganda network inspired hatred against Tutsi people. The international community chose to ignore reports about the preparations and was, for various reasons, unwilling to react when the killings started (Gourevitch, 1998). With more than one million people massacred in the space of three months, the genocide which took place in Rwanda in 1994 was a key juncture in determining the path for the region and the prevailing levels of violence which then ensued across the border in Zaïre / DRC (Dunn, 2003, p.2). The actions of western governments in relation to this crisis has been described as immoral, feckless and narcissistic (Deibert, 2013, p.50). Furthermore, it has been asserted that 'Congo under a capable and responsible government could have stopped the genocide of 1994 in Rwanda' (Nzongola-Ntalaja, 2002, p.214).

1ST CONGO WAR (1996 – 1997) & 2ND CONGO WAR (1998 – 2003)

During the periods known as the first and second Congo wars between the years 1996-2003 it is estimated that in excess of 6 million people lost their lives either directly as a result of violence, malnutrition or the collapse of DRC's health services and economy (Turner, 2007, p.3). These figures were published via the work of the International Rescue Committee (IRC). The second Congo war has also subsequently been referred to by commentators as 'Africa's World War'. According to the text book definition this period of conflict can be defined as a civil war, however there were also a variety of international interests at work. These conflicts represent a continuation of Rwanda's Hutu-Tutsi conflict pursued within Zaïre / DRC and these were also resource wars, as published in abundant literature (Turner, 2007, p.8). A later UN report stated the apparently systematic nature of the massacres suggests that the numerous deaths cannot be attributed to the hazards of war or seen as equating to collateral damage and that the majority of the victims were children, women, elderly people and the sick.

Following mass migration out of Rwanda of at least 2 million people, a rebellion started to gather intensity in Eastern Zaïre in August 1996 when militias launched a multipronged attack against refugee camps. Rwandan and Ugandan forces became embroiled in a territorial dispute across the border, some of whom had received training from the US military to fight islamic fundamentalists in neighbouring Sudan. It has been noted that 'the alliance of convenience between Rwanda and Uganda showed serious fissures almost from the beginning. Although both countries had invaded Congo with a view to their own internal security, they had starkly different ideas of what that entailed, with the Rwandans having a far more expansionist mindset than Kampala' (Deibert, 2013, p.69). Additionally, traditional concepts of sovereignty and stateness may have only held limited currency in

the context of these conflicts (Dunn, 2003, p.150). It has been noted that the motivations of actors such as Rwandan leader Paul Kagame and Ugandan leader Yoweri Museveni at this time were in part about exploiting the mineral resources of Eastern DRC (Dunn, 2003, p.157) and furthermore the actions of international community at this time were largely motivated by ensuring access to mineral and other resources by transnational corporations.

This period of conflict is said to be attributable to 'the decay of the state and its instruments of rule' (Nzongola-Ntalaja, 2003, p.214) and moreover the power vacuum created by state decay as Mobutu began to lose his grip on power reinforced a determination to maximise resource extraction. The conflict of both Congo wars was centred around the Great Lakes region in the east, regions where mining of coltan and cassiterite were to take place on a huge scale during the years that followed.

It has been asserted 'the myth that what was going on in the Great Lakes region was a civil war gave great comfort to the aggressors' (Nzongola-Ntalaja, 2003, p.232) and excused inaction by organisations such as the UN who ultimately made no resolution until June 2000 when Rwandan and Ugandan troops were ordered to withdraw from DRC at which point 5,500 UN troops were then deployed to the region. The Lusaka agreement of July 1999 involved 6 countries; DRC, Angola, Namibia, Zimbabwe, Rwanda and Uganda, however it ultimately had almost no effect on the violence in North and South Kivu (Deibert, 2013, p.72). In 1998, US secretary Albright spoke of 'unlocking the Congo's vast potential'. Foreign gold and diamond corporations, especially American Mineral Fields Incorporated engaged in what could be described as another scramble for Africa's wealth. As one observer pointed out, war made good business sense for the mining corporations (Gray, 1998) (Dunn, 2003, p.167). Although the plunder of materials originating from within Zaïre and then DRC was then and is now utilised across a number of sectors, it is the mobile telecommunications industry which has been the main beneficiary in recent times. Discourses portraying the Congo as chaos and the Congolese as savages work to fix an identity in such a way as to explain the current situation but these discourses also remove any notions of western responsibility while allowing globalised business interests to continue to exploit the Congo's promised 'potential' through economic extraction in the name of 'development'.

By 1996, former ivory and gold trader Laurent Kabila had neither an autonomous and credible organisation nor a coherent political vision for the country. It is said he was propelled to power by a regional dynamic of which the Congolese people did not know the ins and outs (Nzongola-Ntalaja, 2003, p.225). Kabila renamed the country Democratic Republic of Congo and with an unfortunate irony, the activity of all political parties was suspended on the same day. It is said that Kabila's totalitarian project was diametrically opposed to social and political democracy that had been on the national agenda since 1956 (Nzongola-Ntalaja, 2003, p.246). The currency was also renamed as the Congolese Franc, with one Franc being equivalent to one hundred thousand Zaïres.

Kabila granted a monopoly on diamond sales to Israeli tycoon Dan Gertler which put him at odds with Congo's long standing Lebanese diamond traders. Following Kabila's assassination on January 16th 2001, fingers were pointed at some of these traders regarding their responsibility in the murder and 11 of them were dually assassinated. It is believed Kabila was murdered by a child soldier, the plight of whom he had earlier been somewhat dismissive of.

JOSEPH KABILA (2001 – 2019)

Only 29 years old at the time of his father's assassination, Joseph Kabila found himself at the helm of a nation nearly destroyed by decades of corrupt mismanagement and half a decade of nearly continuous war. In the east, the war continued and in Ituri it would only get worse. Conflict in the provinces of North and South Kivu at this time was largely of a territorial nature between armed groups seeking control of the mining industries where materials utilised in the booming global telecommunications industry were being sourced.

Upon taking office Joseph Kabila called for multilateral peace talks to end the war, with some success as a deal was brokered with Rwanda and Uganda in 2003 at a meeting in Sun City, South Africa. One of outcomes of the Sun City agreement was the establishment of the Commission Nationale de Demobilisation et Reinsertion (CONADER) which would eventually lead to the creation of a new army - today's Forces Armées de la République Démocratique du Congo (FARDC). CONADER's headquarters in Kinshasa would later go up in flames. In March 2004, Kabila survived a coup attempt by forces who were loyal to Mobutu Sese Seko in dramatic fashion, some of whom sought refuge among United Nations (MONUSCO) buildings before being arrested. In the same year, the National Congress for the Defence of the People (CNDP), believed to be backed by Rwanda as a way to tackle the Hutu group Democratic Forces for the Liberation of Rwanda (FDLR), rebelled against the government, claiming to protect the Banyamulenge (Congolese Tutsis).

In December 2005, a partial referendum approved a new constitution, and a presidential election was held on July 30th 2006, having been delayed from an earlier date in June. This election, hailed as the first democratic poll to take place in the country since independence in 1960, was held in two stages, the first being a multi-party vote the results of which were announced in August 2006, a run off was then held between the two candidates holding the highest percentage of votes from the first round which took place in October. Despite allegations of 'irregularities' surrounding the voting process, Kabila won the second round with 70%, defeating Jean-Pierre Bemba. Although the new constitution would stipulate that a debate be held between the two remaining candidates for the presidency, no debates took place with many declaring this unconstitutional. Bemba, who had been one of four vice presidents in the transitional government between 2003-2006, later appeared on trial in front of the International Criminal Court in the Hague, Netherlands on charges of

‘crimes against humanity: murder and rape; and three counts of war crimes: murder, rape and pillaging, allegedly committed between 2002 and 2003 in Central African Republic’ (ICC, 2018). On June 8th 2018 he was acquitted of these charges.

In 2006, Kabila responded to evidence of widespread sex crimes committed by the Congolese military by describing the acts as "simply unforgivable". He pointed out that 300 soldiers had been convicted of sex crimes, although he added that this was not enough.

Significant new transportation infrastructures such as new roads were built during Joseph Kabila’s presidency with the World Bank claiming to have invested in excess of US$9 billion in these areas. In 2008 a deal was signed between Kabila and the Chinese government promising 10 million tonnes of copper and several hundred million tonnes of cobalt. This deal in part resulted in the US being outstripped as Africa’s largest trading partner.

In 2010, article 226 of the constitution was published and presented to the government, proposing to turn the 11 existing provinces into 26. A law was passed in 2015 in order to implement such changes. On December 20th 2011 Kabila was elected for a second term, this time having run against Etienne Tshisekedi who had previously served as the country’s prime minister briefly on 3 occasions between 1991-1997. During the election campaign, Tshisekedi highlighted not only the lack of democracy, but also the lack of water and electricity as reasons to elect him. Declared election results showed Kabila had won 49% of the vote with Tshisekedi on 32.5%. Official observers reported that returns from almost 2,000 polling stations in areas where support for Tshisekedi was strong had been lost and not included in the official results. Allegations that the election had not been conducted properly loomed in the air as Kabila was sworn in officially for his second term.

In North Kivu in April 2012, the March 23 movement backed by Rwanda took control of the city of Goma before being defeated by the United Nations authorized Force Intervention Brigade (FIB). This defeat in late 2013 is said to have opened a window of opportunity for wider demobilization and de-escalation of armed conflict in this part of the country (Vogel and Musamba, 2016).

Following a ban on the export of minerals having been imposed in September 2010 by the government in Kinshasa as a result of the US Government’s Dodd-Frank act earlier in the same year, a ban which was lifted in March 2011, the year 2014 saw the proposal of 13 reform initiatives relating to mining industries, 10 of which focused on the 3Ts (tantalite, tungsten, tin) and three on gold. These initiatives were to become operational in Eastern DRC (Cuvelier et al., 2014, p.5) and aimed ‘to make the Congolese artisanal mining sector more transparent and to prevent conflict minerals’ (Cuvelier et al., 2014, p.17). Questions have subsequently been raised about the efficiency of reform initiatives which have been implemented in the artisanal mining sector. For instance, it has been argued that these initiatives have done little to address structural problems shaping the sector, such as corruption, the smuggling of minerals, and the involvement of armed groups and other powerful actors in the mining business.

On January 17th 2015, Congo's parliament passed an electoral law requiring a census before the next elections. A few days later on January 19th, protests led by students at the University of Kinshasa broke out following the announcement of a proposed law that would allow Kabila to remain in power until a national census could be conducted. Elections had previously been planned for 2016. By Wednesday January 21st clashes between police and protesters had claimed at least 42 lives, although the government claimed only 15 people had been killed.

Later in 2015 the DRC government initiated its third major national disarmament, demobilization and reintegration (DDR) programme (DDR III), in order to reintegrate Congolese ex-combatants into civilian life (Vogel and Musamba, 2016). Ex-combatants in Eastern DRC faced multiple obstacles to reintegration after returning from the battlefield including the risk of re-fuelling cycles of violence in the community. It has been noted that on reflection in some instances, shortcomings of DDR initiatives led to this becoming a cash for weapons scheme, 'rather than an attempt at sustainable demobilization and reintegration' (Vogel and Musamba, 2016). It has subsequently been recommended that comprehensive reintegration programmes should address trauma and combat related mental health and behaviour problems both at the individual and the community level. At this time, it was estimated that the Kivu provinces alone were host to more than 70 armed groups (Vogel and Musamba, 2016).

In recent years, the north-eastern province of Ituri situated to the north of North Kivu province has seen a surge in violence with armed groups such as the Allied Democratic Forces (ADF) growing to increasing prominence having initially represented a union of largely Ugandan forces including the Allied Democratic Movement, the National Army for the Liberation of Uganda (NALU), the Uganda Muslim Liberation Army, and militant members of the Tablighi Jamaat movement. From 2015, the ADF experienced a radicalisation after the imprisonment of its leader Jamil Mukulu and the rise of Musa Baluku in his place. On August 14th 2016 more than 75 civilians were killed by the ADF in the town of Beni, North Kivu in what became known as the Beni massacre. In 2021, the ADF were portrayed by some in the western media as the Central African branch of the Islamic State group. Much of the groups' activities are centred around natural resources such as gold mining and logging. A terrorist attack in Kampala in November 2021 prompted Ugandan troops to move in across the border, this had followed much discussion among the international community about military intervention against the ADF.

Many instances of kidnaping for ransom have taken place in recent years in Virunga National Park, North Kivu, bordering Uganda with 75 such instances recorded between May 2017 – May 2018 (Kivu Security Tracker, 2018). Moreover, a governance crisis in regions of the country such as Virunga National Park is said to have 'plagued the DRC forest sector since the 1980s', issues which have 'not been overcome by the intrusive 'good' governance interventions mobilized by international organisations' (Majambu et al, 2021). The lingering ongoing crisis in the forestry sector has been expressed as 'the result of several forms of opposition by State bureaucracies and political elites to the injunctions of

‘good’ governance promoted by international actors and their allies’ (Majumbu, Tsayem demaze and Ongolo, 2021).

Rooted in historical conflict and deep-seated contestation over land, local power, and identity, Ituri was a major scene of armed struggle during the Congo wars, when powerful armed groups such as the Union des Patriotes Congolais (UPC), the Front Nationaliste et Intégrationniste (FNI) and the Force des Résistance Patriotique de l’Ituri (FRPI) confronted one another, spurred on by the governments in Kigali, Kampala, and Kinshasa. While violence petered out in 2007, the underlying instability was never fully addressed, despite military intervention by the European Union, large amounts of humanitarian spending, and numerous prosecutions by the International Criminal Court (Kivu Security Tracker, 2021, p.15).

On September 19th 2016, massive protests rocked Kinshasa calling for Kabila to step down as legally mandated. Seventeen people were killed. Elections to determine a successor to Kabila had originally been scheduled for the November 27th 2016. On September 29th the nation's electoral authority announced that the election would not be held until early 2018. Following a further postponement, in November 2017 the Independent National Electoral Commission (CENI) announced that the elections would be held in December 2018. These elections were to be hailed as potentially the first in a generation to be free and fair. At this time, a world bank report estimated that 73% of the Congolese population, equalling 60 million people, lived on less than US$1.90 a day (the international poverty rate).

The election was eventually set to take place on December 23rd 2018, however controversy ensued around the proposed touch-screen tablet voting machines through which voters were set to participate, the first time in the country’s history whereby voting would take place electronically. As mentioned earlier, the majority of the devices were destroyed in a fire in a warehouse on the outskirts of the capital Kinshasa on December 13th. Following a donation by the South Korean government of replacement voting machines, the election eventually took place on December 30th, albeit with voting in 3 regions including Beni and Butembo in North Kivu province being postponed until March 2019. On January 10th Félix Tshisekedi, son of former prime minister and presidential candidate Etienne Tshisekedi, was pronounced as successor to Joseph Kabila.

At the time of the election in 2018 a major outbreak of the Ebola virus was taking place, with North Kivu at its epicentre. The outbreak resulted in the DRC-Rwanda border being closed for periods during 2019, affecting the movement of people and goods. This is believed to have been the 11th outbreak of the Ebola virus in the country since 1976 with the 12th then following between February and May 2021. With hindsight the international response to the Ebola outbreak is said to have been misguided ‘through its profligacy and hiring of armed escorts’ which ‘inadvertently fuelled violence’ (Kivu Security Tracker, 2021, p.8).

While the virus killed almost 2,300 people between August 2018 and June 2020, the Riposte, the humanitarian operation co-led by the Ministry of Health and the World Health Organization, was attacked at least 231 times during this period (Kivu Security Tracker, 2021). A further indication of attitudes towards United Nations backed representatives of the international community in Eastern DRC, a 2018 poll conducted by peacebuildingdata.org found that 15% of the local population in the provinces of South Kivu, North Kivu and Ituri trusted the MONUSCO presence, representing a fall of 11% compared with 2015 (Vinck et al., n.d). Concurrently, late 2019 saw a popular uprising to eject the United Nations peacekeeping presence from the east, 20 years after it had arrived in the region. Between 2015-2019, the MONUSCO mission saw a 50% reduction in funding largely due to government policy in the United States, leading some to question whether from New York to Beni a convergence of interests of various kinds of frustration with the mission was ultimately leading to its untimely demise.

FÉLIX TSHISEKEDI (2019-PRESENT)

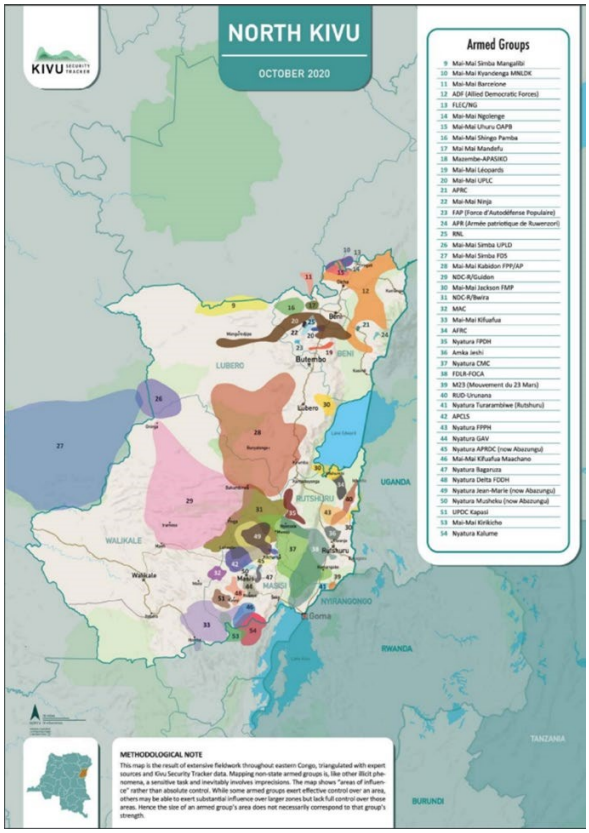
Following Félix Tshisekedi's inauguration as president in January 2019, political allies of Joseph Kabila maintained control of key ministries, the legislature, judiciary and security services. In March 2019, Tshisekedi started a 100-day emergency programme to kickstart his presidency. The programme was launched by the publication of a 78-page document that covered some of the most important priorities of the present government at the time. While many issues were covered, such as industry promotion and energy, much of the money was reserved for infrastructure: US$183.2 million.

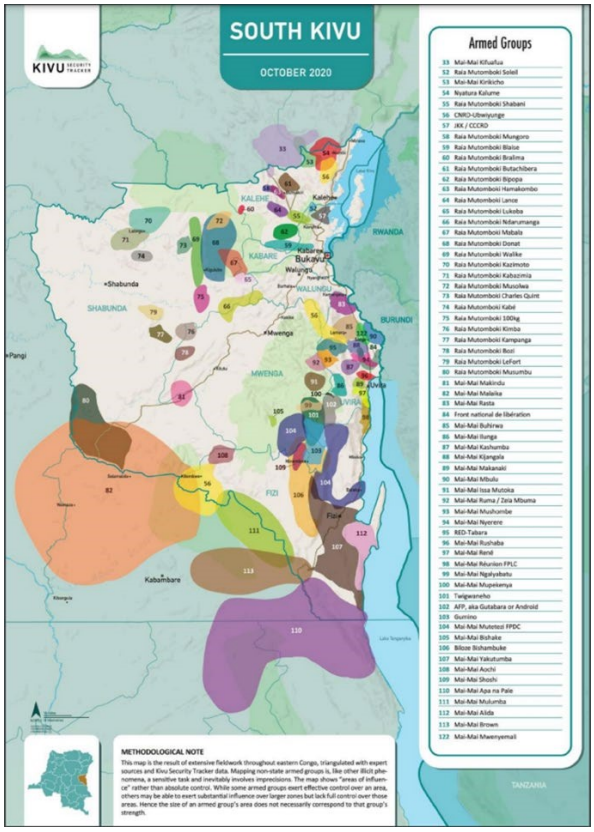
Despite appearing as allies it has been asserted that Kabila and Tshisekedi have in fact been engaged in a merciless war of influence since the election, epitomised by the death of one Kabila's key security personnel General Delphin Kahimbi who was found having been hanged at his home on February 28th 2020. In June 2020, chief of staff Vital Kamerhe was found guilty of embezzling public funds and he was sentenced to 20 years in prison.

In April 2021, the new government was formed without the supporters of Kabila as Tshisekedi had succeeded in ousting the last remaining loyal elements of the government. In May 2021 after rising insecurity, President Tshisekedi declared a "state of siege" or state of emergency in North Kivu, as well as Ituri province. The first such declaration since the country's independence saw the military and police take over positions from civilian authorities leading some to see this as a powerplay since the civilian officials were part of the opposition to the president. A similar declaration was avoided for South Kivu, in a move believed to have been aimed at avoiding antagonizing armed groups with ties to regional powers such as Rwanda. The state of siege is also said to have coincided with a deterioration of the situation in South Kivu, said to be possibly linked to tensions between Rwanda and Burundi.

Following the declaration of a state of siege, recorded levels of violence increased in North Kivu, including the deadliest night ever recorded by the Kivu Security Tracker on May 30th 2021 when 55 civilians were killed. During the month of May, two figureheads of Islamic community in North Kivu were also assassinated. In 2021, conflict in the Kivus continued to be characterized by its dramatic fragmentation and inertia with many of the 120 or so armed groups having either existed themselves for many years or materialised as the result of the formation of splinter factions from other longstanding groups.

The maps below denote where armed groups were believed to be operating in October 2020:





(Source: Kivu Security Tracker, 2021)

In May 2021, approximately 1 million of Goma's residents were told to vacate their homes as a result of the eruption of Mount Nyiragongo. In addition to the flow of matter from the volcano across the land, scientists were also very concerned by reports that underground magma had been flowing towards Lake Kivu, with the risk of what is known as a limnic eruption believed to be potentially imminent. Researchers have long been concerned that seismic activity at Lake Kivu could have the potential to cause in the region of 60 billion cubic meters of methane and 300 billion cubic meters of carbon dioxide to be released from beneath the lake, with potentially catastrophic consequences comparable to the disaster at Lake Nyos in Cameroon in August 1986.

Amidst circumstances around the global Covid-19 pandemic resulting in the draining of a large proportion of humanitarian funding, only 34% of requested annual aid had reached

DRC in 2020, all the while conflicts continue to simmer, with a record high of 5.5 million people displaced across the country. The world bank estimated growth in DRC was 4.4% in 2019, a figure which is said to have contracted to 0.8% in 2020 (World Bank, 2021).

As a result of a series of legislature changes being implemented as well as changes among personnel in the government including the resignation of Prime Minister Sylvestre Ilunga Ilunkamba on January 29th, the year 2021 saw Tshisekedi consolidate his grip on power in DRC.

A translated extract of a speech delivered by Tshisekedi at the United Nations on September 21st 2021 reads:

"Africa doesn't need handouts! She fights to conquer spaces of freedom and action in a world always in competition, in order to forge a better destiny and make a greater contribution to the general progress of humanity. Africa needs constructive and win-win partnerships highlighting its fabulous natural resources, equip itself with development and improve the living conditions of its populations. Obviously, achieving these goals requires strong democratic institutions and stable, adequate public policies, good governance and regional integration. Neither the capacities nor the dynamism of the populations and, even less, Africa does not lack natural resources to do this. Overall, substantial progress has been made over the past two decades in terms of consolidation of democratic processes, growth economic and poverty reduction, despite the ruthless annoyance international relations as well as the harmful consequences of climatic changes."

CHAPTER 3: GEOLOGY OF MEDIA FORMS

INTRODUCTION

Building from the work of theorists who have identified the role of physical materials within forms of media such as Jussi Parikka, Matthew Fuller and Ewan Sutherland, a focus on particular resources has the potential to underpin the study of media materiality. With this in mind, a contextualisation of the terms 'media archaeology', 'media ecology' and 'media geology' will be necessary in establishing the relationship between the components which are assembled and housed within any media form and what these components are comprised of. Although these terms could be described as esoteric in that they pertain to the work of a small number of writers, each of them offers a different footing in conceptualising the media landscape. Closer attention will be paid to this comparison later in this chapter. To date much of the discourse around such terminology has been characterised by an approach relating the sociological and cultural effects of digital media upon populations with methods of production and processes of institutionalisation or commercialisation (Parikka, 2012, p.2).

As a prediction for what would transpire as a manifestation during the digital age, it was highlighted that 'this will be a city unrooted to any definite spot on the surface of the earth, shaped by connectivity and bandwidth constraints rather than by accessibility and land values, largely asynchronous in its operation, and inhabited by disembodied and fragmented subjects who exist as aliases and agents' (Mitchell, 1998, p.24). One may be able to visualise the world of media as a kind of rhizomatic ecosystem which facilitates the instantaneous flow of information. Notwithstanding, the physical composition of a particular medium is an appropriate anchor conceptually, providing a foothold in understanding the materiality of media, with an ongoing grapple for natural resources situated at the root of this industry. The people of Eastern DRC have constantly had to improvise production systems in order to survive and in order to meet the insatiable global demand for telecommunications products (Mantz, 2008, p.34).

An assemblage of human relations has also been expressed as being a set of 'global shared experiences of deterritorialization, multiplicity and simulacrality', fuelled by computerisation and whereby the fact that a significant proportion of raw materials originate from DRC means that 'the cultural dispositions associated with postmodernism (subjectivity, ambiguity, flexibility, multivocality, and the generative power of consumption as a form of agency and politics) are dependent on genocide, ecocide and incarceration' (Smith and Mantz, 2006, p.76). DRC's 'mineral affluence is balanced by a global greed for gadgets in which death becomes a currency (or in more crudely economic terms, an 'externality') for the efficient flow of capital to digital distributors and investors' (Mantz, 2008, p.37).

This is not to say that the meaning of a particular media form can be easily defined through the process of manufacture. Moreover, modern day telecommunications devices are playing an increasingly central role in the lives of populations with numerous implications. Perspective exists within the studies of media ecology and media archaeology whereby it is possible to accurately place the raw materials which are extracted and later integrated within the most popular distributors and receivers of media today as part of a physical assemblage. An attention to materiality is found to be 'most fruitful where it is often deemed irrelevant, in the "immaterial" domains of electronic media' (Fuller, 2005, p.2). Additionally, consideration around the construction of hardware which exists 'in the midst of the increasing invisibility of consumer objects in digital culture is an important political task for media-archaeological research' (Parikka, 2012, p.64).

As the capacities of telecommunications devices have continued to develop, the staggered and incremental release of technological products onto the consumer market highlights ongoing methods of conditioning which are designed to maximise profitability on the part of companies who are now among some of the largest global economic entities. The pace at which new and improved products are dispensed has implications at different stages throughout the supply chain. When it comes to the materials which are eventually assembled to become components housed within forms of mobile telecommunications, the industry retains a vested interest in perpetuating global economic inequalities as issues such as stockpiling come into focus. These supply chains are multi-faceted profit-making industries which often involve the transportation of goods between numerous locations before components can become part of a final product ready for the consumer. At each stage of these processes profit is made based on an ethos of sourcing materials for each as cheaply as possible before they are sold on at a mark-up. This trajectory multiplied several times over ultimately means that the labour involved in gathering raw material at source is not subject to proportionality economically. In the context of DRC, ever since the domestication of the mobile phone and the internet, workers have been subject to global demands for particular resources as emphasis has continued to shift determined by market forces. As forms of technology have continued to facilitate an inequitable division of labour, an economic system which lacks transparency continues to offer very little mobility and the human cost of this industry continues to fall on deaf ears.

Whether it be in the form of a computer, a mobile phone or a games console, as we move further into the 21st century the capabilities of a variety of tools such as the telephone, the television or the radio have now tended become housed within one single device, 'the capacity for any content to be translated across a wide variety of mediums' (Jenkins and Zhang, 2016) being symbolic of a fluidity within media's environs. As participation in wireless forms of telecommunications has grown globally, part of what has been termed a process of democratisation, a wider centralisation among media has simultaneously been taking place due to factors such as increasing uniformity in the theory which enables information to be distributed as well as a tendency towards monopolisation of the marketplace. Processes of familiarisation among users and consumers of digital media have been described as being of a nature whereby 'the moment one accepts new media,

one is firmly located within a technological progressivism that thrives on obsolescence and that prevents active thinking about technology-knowledge-power' (Chun, 2016, p.3).

Within the context of media theory, the transfer of one regime or modality to another is often encountered in uses of McLuhan's notion of the rear-view mirror, whereby the first wave of every new media develops following the norms of the media that preceded it (Fuller, 2005, p.81), described as 'the bias and blindness induced in any society by its pre-existent technology' (McLuhan, 1964, p.304). In relation to the software update and as a comment on the psychology of supersession among media forms, it has been noted that 'things and people not updating are things and people lost or in distress, for users have become creatures of the update. To be is to be updated: to update and to be subjected to the update' (Chun, 2016, p.2). In this sense, the notion of newness 'functions predominantly as a commercial imperative: it demands that we keep upgrading our computers, cell phones, and communication and data storage devices in order to avoid obsolescence' (Kember and Zylinska, 2012, p.4). The drip-drop of new products whose abilities appear as a development from that which existed previously ultimately results in the sustenance and perpetuation of inherent economic and societal disparities on a global scale.

This continual process of supersession is also epitomised by the unsustainable notion of continual economic growth, 'a life-colonising force' which uses 'an arsenal of a variety of means, sometimes brutal, sometimes seductive and appealing,' for the sole purpose of the reproduction of its monetary value (DeAngelis, 2007, p.6). Companies such as 'Apple' are today continuing to release products which are not modular in terms of their physicality and the capabilities of which render their predecessors as obsolete. Standardised fittings for the audio or visual capacities of devices are being replaced as the consumer is required to purchase new products in order to retain currency and validity. Update culture exists in the context of physicality and the economic circumstances from which it is produced. A closer look at phenomena such as e-waste provides a useful perspective, whereby the ultimate destination of products becomes visible.

In light of a chronology of events around the proliferation of mobile technologies and the intensity of armed conflict taking place in DRC, a correlation can be drawn between the two albeit in a slightly disjointed way. This chapter seeks to explore and document this correlation as to date there exists a dearth of academic writing which does so. As will be examined later in this text via case studies of particular materials, a boom in the manufacture of devices which are able to receive and distribute media in today's landscape has also been paralleled with the extraction of raw materials via mining and associated conflict. Although tracing the supply chain of these materials may lead to further ambiguities in establishing this connection, the sheer scale of quantity of devices which have been manufactured and distributed around the world as well as the reported loss of life on the ground in DRC from the mid-1990s onwards provides an indication.

According to figures published by the International Rescue Committee (IRC), between the years 1996-2003 it is estimated that in excess of 6 million people lost their lives either

directly as a result of violence, malnutrition or the collapse of DRC's health services and economy (Turner, 2007, p.3). Historically, DRC's official state export figures have failed to reflect reality in terms of the mining industry due to factors such as the systemic smuggling of materials out of the country in order that they be declared exports of other nations such as Rwanda. Transparency around the industry of minerals utilised in digitalised media forms is also difficult to ascertain due to the complexities of global supply chains. The materiality of a piece of earth which once lay dormant in the ground before being converted through a complex series of processes into a component of a mobile phone or a laptop provides a rational basis for the conception of the connection between instilled habitual media usage and armed conflict, the scale of which is unparalleled in modern history and difficult to comprehend.

The customary engagement with screen-based devices has grown to play an increasingly pivotal role in the lives of many today. As has been expressed in relation to experiential aspects of this phenomenon 'habit, with all its contradictions, is central to grasping the paradoxes of new media: its enduring ephemerality, its visible invisibility, its exposing empowerment, its networked individuation, and its obsolescent ubiquity' (Chun, 2016, p.15). The manufacture of a product such as an 'I-phone' is contingent upon a set of processes which may ultimately obscure any connection with the sourcing of raw materials used in its manufacture. One aim of this research will be to look behind the veneer of such products and establish facts about the origins of what physically lies within. In working towards possible solutions to this ongoing crisis it is also important to recognise the economics involved in supply chains (Sutherland, 2011). Although materials sourced from within DRC are often not solely found as naturally occurring in this part of the world, the fact that they can be sourced in such abundant quantities for the cheapest possible price means that the multinational companies involved have continued to take advantage (Diemel, 2018).

The sustainability of an industry which requires the use of finite materials as part of the manufacturing process is also an important aspect in attempting to further evaluate circumstances around the proliferation of mobile technologies. For example, one of the main ingredients in the manufacture of the touch sensitive screen is indium tin oxide. Predominantly sourced as raw material from within areas of Siberia, as the use of touchscreen technologies has increased exponentially in recent years, reports have continued to circulate expressing concern that deposits are being depleted. With digital media increasingly providing the infrastructure for monetary transactions to take place around the world, circumstances around the sourcing of the elements required for the financial industry to operate are often overlooked as 'the connections between material media and the resources they are made with have become new grounds for analysis and critique' (Rust, Monani and Cubitt, 2015). As was once asserted, 'the dependence of the most powerful broadcasting company on the electrical industry, or of film on the banks, characterizes the whole sphere, the individual sectors of which are themselves economically intertwined' (Adorno, 1944, p.43).

THE ECOSYSTEM OF A MEDIUM

In an effort to view the anthropocene of today's telecommunications environment holistically, it is necessary to recognise the differing interpretations that exist in its conceptualisation. For example, it has been recognised that the field of media ecology as pioneered by authors such as Marshall McLuhan and Neil Postman 'conceptualises media themselves as an eco-system, with little to no account for the natural world' (Barker and McKeown, 2015, p.25). It has however also been identified that 'a crucial relationship between material efficacy and conceptual immateriality underpins the cultural politics of informatic culture' (Franklin, 2012, p.445). A prevailing lack of recognition within discourse of the physicality of apparently invisible forms of interconnectivity within which marketed consumable products perform mediations as gateways to streams of information is identifiable. Although use of the term 'ecology' in this context does aptly describe an environment in which wireless forms of media are continually being transmitted all around us, it can also be placed here in terms of the presence of physical materials housed within the infrastructure of the medium. A delineation of what constitutes a medium is important when considering where media's influence starts and ends. For example, one could refer to any device with a screen-based display or capable of performing computational tasks as constituting a medium in and of itself.

Within the mechanism of this system of distribution, the term 'telematics', defined as being any device which merges telecommunications and informatics, provides an appropriate footing in viewing the medium of wireless communications as an entirety. Within this setting such devices are able to pick up, transduce and measure signals from around the world and tune human users into a domain. The term 'cybernetics', defined as 'the science of communications and automatic control systems in both machines and living things' indicates that perhaps the human being has become part of this ecumene. Another term, homeostasis describes aptly 'the automatic process of self-regulation of living organisms to maintain a dynamic balance' (DeAngelis, 2007, p.79). On this note it has been asserted that 'if life itself is to be perceived as, or, more accurately, reduced to a medium, we need to critically examine the complex and dynamic processes of mediation that are in operation at the biological, social, and political levels in the world, while also remaining aware of the limitations of the stand-alone human that can provide such a rational critique' (Kember and Zylinska, 2012, p.1).

The term 'rhizome' as identified in the opening passages of Deleuze and Guattari's 1987 book *A Thousand Plateaus: Capitalism and Schizophrenia* has provided a backdrop for subsequent discourse focused on the conceptualisation of a now wirelessly interconnected world. Pertaining to this context, the question may be asked as to how ecological systems have manifested themselves via media technology. In one representation, software has come to exemplify the natural world in computer code as sensitive media continues to pick up and transform signals from the outside world, 'unearthing' them from associations with an imagined natural environment (Barker and McKeown, 2015, p.22). This phenomenon has also been described whereby 'to oppose the cosmic frost infiltrating the human sphere

through the open windows of the enlightenment, modern humanity makes use of a deliberate greenhouse effect: it attempts to balance out its shellessness in space, following the shattering of the celestial domes, through an artificial civilizatory world (Sloterdijk and Heinrichs, 2004, p.24). The origins of such rhizomatic forms in media have been characterised in another light as 'the military-industrial complex behind the emergence of network culture' (Parikka, 2012, p.2).

In reframing evaluations of the medium of telecommunications via recognition of the physicality of constituent parts which are assembled through manufacturing processes, a rationale can be found whereby the mass of any given device is the conceptual starting point. From this viewpoint it is then possible to deduce the quantities of particular materials present within any given product, information which has the potential to lead to greater understanding of the global supply chains involved. Notwithstanding, a lack of transparency tends to characterise how big tech companies competing for market dominance disclose information about what their products are made of and where these materials originate from. For example, if one is to purchase a mobile phone from a retailer there will not be much information to hand about the ingredients involved, partly due to the numerous processes involved in its production.

Netherlands based mobile phone manufacturer 'Fairphone' claims to be more ethical than others in the market, the latest model 'Fairphone 3' is promoted as 'a smartphone made with care for people and the planet'. One aspect of this is that Fairphone's products are designed in a modular way meaning that parts can be replaced more easily than other manufacturers. The company started in 2013 as a small start-up business comprised of a few skilled technicians and visionaries before receiving significant financial backing from investors such as the Dutch royal family. Another company formed in 2021 and operating with a similar ethos in the manufacture of laptops rather than phones is 'Framework' whose products are designed to facilitate the replacement and adaptation of components.

In assessing the extent to which the tech industry has become implicated in territorial conflicts within DRC it will be necessary to identify materials sourced from the region and provide an outline of the wider circumstances around each of them. Although a greater awareness exists in relation to columbite tantalite or 'coltan' (mainly used in the construction of transistor capacitors) or cobalt (used in batteries), mining in DRC of materials such as cassiterite, wolframite, germanium and gold are also important to examine. Whilst retaining a geographical view of the eastern regions of DRC, the intention here is to also evidence the extent to which the recent history of this part of the world has been affected by the mining of these materials (Ayres, 2013). In seeking a circumstance whereby the Congolese people would have greater agency over these industries, it is important to recognise the size of the task at hand in consideration of the history of the region and the way in which global economic inequalities have been perpetuated ever since. It is also important to ask why the work of non-governmental organisations and the presence of peacekeepers in the region seem to only have had limited impact in addressing these issues and why security council reports have not impacted on

organisations such as the International Telecommunication Union (ITU) (Sutherland, 2011, p.11).

With regard to any of the raw materials from which media forms are comprised, geological artefacts are put into manufacturing processes via supply chains and transportation, ultimately leading to the establishment of what is a man-made eco-system of information. 'Yet even as the internet and other products of this global revolution fuel social change and increase communications' (Rust, Monani and Cubitt, 2015, p.1), 'broadcasting and cellular networks require the extraction and manufacturing of raw materials from the earth by human bodies and machines and our radio spectrum for transmission is also occupied by cosmic radiation and the electrical fallout from lightning' (Rust, Monani and Cubitt, 2015, p.4), processes which all but contribute to what is a global environmental crisis. In examining more closely the semantics of the word 'geology', it has also been proposed that 'if we abandon the absurd notion that geology is somehow immune from the violence and dispossession enacted through extraction of mineral resources, then geology in its fully geosocial registers comes to the fore as a force of transformation' (Yusoff, 2018, p.23).

A UN report published in February 2020 estimated the global mass of e-waste, predominantly comprising discarded mobile phones and laptops to stand at 53.8 million metric tonnes, a figure set to reach 74 million metric tonnes by 2030 (United Nations University, 2020). Due to the way in which products are manufactured, components that could potentially be redeemed and recycled tend to ultimately be stuck within devices, a pattern which is also perpetuated by the perception on the part of the consumer that items are disposable. Manufacturers attempt to create perfect consumer objects which are announced, launched and put out into the world before being discarded. The question of whether products with a longer lifespan are ultimately not profitable for manufacturers has been described by the founder of laptop manufacturer 'Framework' as 'a business philosophy problem' (Patel, 2021). In a recent radio interview Nirav Patel went on to describe how products can be conceptualised as objects in an eco-system of which customers are members and that priorities among manufacturers should emphasise how a healthy eco-system can be built. Rather than products becoming abandoned, included in part of this business model is the additional economic activity that comes with upgrades, repairs and re-use of modules, all of which are said to benefit consumers and the environment by resulting in less e-waste going out into the world, as well as benefiting the manufacturer themselves as they become what are described as 'stewards' of that eco-system.

In one light, 'the organic becoming technology is now a poor prosthesis in the age of electronics and computation' (Zielinski, 2006, p.4) as 'all of the great inventions that form the basis of technology, such as clockwork, rotation in mechanics, fixed wings in aeronautics, or digital calculators in electronics, were developed within a relationship of tension to the relative inertia of the organic and what is possible for humans' (Zielinski, 2006, p.6). However, this dialectic has also been expressed in the sense that 'media,

society, and the environment are inextricably entangled together, both in how media texts represent the environment (even absence suggests a representational practice of erasure) and in the inevitable ways that media texts and systems are materially embedded in natural resource use and abuse' (Rust, Monani and Cubitt, 2015, p.2). Ultimately when these industries around natural resources are added to an economic system which is in many cases founded upon colonialist practices, the tendency is for those workers living in less industrialised regions of the world to have little choice but to become subservient to consumers living in industrialised regions. A machine moves into focus, reifying the assertion that 'technology is not human; in a specific sense, it is deeply inhuman' (Zielinski, 2006, p.6).

TECHNOLOGY'S LIFE CYCLE

In one light, the populations' love for media and media technology has become part of a global environmental crisis because 'media technologies rely on an enormous amount of energy consumption – from the extraction of raw materials used in manufacturing and the energy grids that power our devices to the landfills and electronic waste facilities where our discarded technologies inevitably end up' (Rust, Monani and Cubitt, 2015, p.1). It has also been identified that the 'global information and communications technology (ICT) industry accounts for approximately 2 per cent of global carbon dioxide (CO2) emissions, a figure equivalent to aviation' (Business Wire, 2007) which does not 'include consumer electronics other than cell phones and PCs, only global commercial and governmental IT and telecommunications infrastructure' (De Angelis, 2017, p.70).

Whilst considering factors such as continuality and the cycles involved in the creation and disposal of media forms, Siegfried Zielinski's 2006 book *Deep Time of the Media* provides the reader with a valuable perspective. In some ways consistent with discourses which recognise the sociological effects of the population's gravitation towards the screen such as the phenomena of 'feedback loops', Zielinski encourages consideration of some of the underlying processes involved in the distribution of media today. Providing a foothold in attempting to reach behind a phenomenal world brought into visibility by screen-based representations of reality transmitted via sonification techniques, Zielinski writes that we must seek 'a reversal with respect to time, which - in an era characterized by high-speed technologies and their permeation of teaching, research, and design - has arguably become the most prized commodity of all' (Zielinski, 2006, p.11). The concept of 'deep time' as articulated in the book is generally rooted conceptually via the experiences of endusers of such products rather than via the perspective of the physical matter used in their construction.

Although an abundance of the ingredients used in the manufacturing of distributors and receivers or wireless information are found in Africa and more specifically DRC, these are also supply chains which encompass many regions of the globe from the sourcing of

minerals to their refinement, from the construction of components to their assembly in manufacture. A viewpoint which relates the continuality of time with the geographical origin of materials brings to light cyclic patterns, with the finite lifespan of technological products coming into focus. One is able to identify an inevitability whereby matter once mined from the ground and then assembled to become living media will ultimately become re-integrated as part of the earth's crust as dead media. In establishing a setting where such processes take place both philosophically and literally, 'media archaeology sees media culture as sedimented and layered, a fold of time and materiality where the past might be suddenly discovered anew, and the new technologies grow obsolete increasingly fast' (Parikka, 2012, p.3). Additionally, 'Anthropocene monumentality' has been identified as 'a way to unpack the language that geology carries and a way to push a conversation that admonishes the idea of the neutrality of geology as a language of the rocks and deep time, which is immune or innocent of its current deadly configurations' (Yusoff, 2018, p.23).

In an attempt to view processes involved in the manufacture of today's media technology forms holistically, obsolescence could be an appropriate adjunction as the start and end point of a cycle when considering the physical matter involved. A quantity of a particular substance may have remained dormant in the ground for hundreds of thousands of years before being extracted and resituated to become part of an 'I-phone' for example. When located and mined at source one can identify that this material does not itself possess an intrinsic monetary or economic value as these attributes are later assigned as it becomes absorbed into the marketplace. In highlighting aspects of racial injustice which have become the backdrop for inequitable economic practices to transpire, critique of a culture of extraction and the application of geological imperatives has been expressed in the sense that 'extractable matter must be both passive (awaiting extraction and possessing of properties) and able to be activated through the mastery of white men' (Yusoff, 2018, p.14).

Through these stages the same piece of matter is profited from monetarily several times over by a variety of different actors. In reference to such processes it has been asserted that 'the transformation of values into prices is one vital aspect of capital's appearance-disappearance process' (Caffentzis, 2013, p.133). In summary, a particular object even if considered essential to human species existence would surely be considered 'an aspect of human wealth but this fact does not confer value on it' (Caffentzis, 2013, p.132). In tracking the supply chains of particular materials housed within what are now everyday appliances, forms of sociological and economic disproportionality and inequality come into focus.

Following a period of history in which resources from DRC were continually looted whilst its population were subject to extreme forms of exploitation, materials from this region have played an integral role at each stage of the incremental development of mobile technologies in recent decades. As much of these developments have taken place out of sight and therefore out of mind from the viewpoint of the consumer, it can be difficult to

gain independence of perspective. Early media theorists such as McLuhan described how continuality within the media industry is founded upon the proliferation of the medium itself rather than the content transmitted via this medium in such a way that 'what you print is nothing compared to the effect of the printed word' (McLuhan, 1977). The continuation of what is an exploitative economy around natural resources both underpins and provides the infrastructure through which digital media can transmit its message.

As part of an evaluation of the societal effect of a capitalist ethos, it has been noted that an important task lies in 'the investigation of the social and economic laws that govern the deployment of labor-power among the different sectors of social production and thus to bring to light the capitalist processes of valorization' (Negri, 1985). It has been noted in a more contemporary context that 'the social cyborg's labor-time is independent of its productivity but it is thoroughly integrated into the terrain of production' (Caffentzis, 2013, p.76). The flow of resources from specific locations in Eastern DRC continues to comprise and facilitate the infrastructure of a global economy in which the significance of the geographic location becomes increasingly secondary as a result of a greater proportion of monetary exchange taking place via the medium of telephony.

A disproportionate global division of labour, defined as 'the labor that produces the informational and cultural content of the commodity' (Lazzarato, 1996, p.1), has become situated within screen-based media while a wider disenfranchisement of workforces has taken place. DRC is a country with an incredible wealth of natural resources yet its population is among the poorest in the world, a phenomenon which has been referred to as 'the resource curse' (Lalji, 2007). A term which has been adopted in areas of postcolonial discourse, the resource curse continues to be re-affirmed in the context of resource-rich countries whose economy is not as strong as those lacking in natural resources. The resource curse gives reason for the empirical correlation between resource-rich countries and reduced investment in human capital, increased domestic political corruption, and perilous reductions in economic diversification with the ultimate result of stunted long-term economic growth of an ostensibly fortunate nation.

As much as populations continue to buy into new and improved items of technology, the aesthetics of such products are in many ways at odds with their ethics. A comparison between the effect of a boom in telecommunications and the repercussions felt in the east of DRC highlights the scope of this industry on a global scale. It has been highlighted that 'the very capital that owns the ethereal information machines which supplant industrial production is also involved in the enclosure of lands throughout the planet, provoking famine, disease, low intensity war, and collective misery in the process' (Caffentzis, 2013, p.78). Consequently, these 'new enclosures' are said to accompany the rise of automatic processes as 'in industry, the computer requires the sweatshop, and the cyborg's existence is premised on the slave' (Caffentzis, 2013, p.79). The conceptual lexicon of 'enclosures' is expanded upon in discussing 'primitive accumulation', highlighting that 'the capital-relation can be nothing other than the process which divorces the worker from the ownership of the conditions of his own labour' (Marx, 1867, p.874). As an extension of this,

it has been identified that ‘a careful examination of Marx's definition of primitive accumulation allows us to argue that although enclosures, or primitive accumulation, define a question of genealogy, for capital the problem of genealogy presents itself continuously’ (DeAngelis, 2007, p.136).

As an ominous prediction for how the nature of work would be set to change as a result of the proliferation of automated methods it was noted that computers, robots and electronic networks spanning the globe were ‘going to subsume more and more of the economic process, leaving less and less room for direct hands-on human participation in making, moving, selling, and servicing’ (Rifkin, 1995, p.162). For certain regions of the world sometimes labelled as ‘developed’, this assertion has proven to be true in the years which have followed. However, as progressions in the mobile technology industry accelerate towards the arrival of 5G technology and the world’s more powerful nations grapple for influence over this burgeoning market, what will all of this mean for the people of these affected regions?

MEDIA MATERIALITY

In anchoring media theory via a perspective which recognises the presence of physical materials, one can look back to the earliest forms of media to view a lineage of supersession which has taken place. Whether it be via historical forms of scripture such as parchment or cuneiform written methods using stone, or the way in which plant-based matter enabled the manufacturing of paper to take place bringing rise to the printed word, at each stage human beings’ desire to record and share has been facilitated by ingredients found among the world around us. ‘Similarly, broadcasting and cellular networks require the extraction and manufacturing of raw materials from the earth by human bodies and machines’ (Rust, Monani and Cubitt, 2015).

In contextualising what is meant by the term ‘The Materiality of Media’, one can look back at how the work of McLuhan whose book *Understanding Media: The Extensions of Man*, published in 1964 as well as the maxim ‘the medium is the message’ have become influential in the years which have followed. Speaking in an interview on Australian television in 1977, McLuhan asserts that “there is a huge technology involved in TV, which surrounds you physically, and the effect of that huge service environment on you personally is vast. The effect of the program is incidental”, a useful perspective in attempting to evaluate what was a relatively new form of media at this time. In an earlier television interview broadcast in 1967 on the BBC, when asked ‘what message the medium has on the world this afternoon?’ McLuhan states that ‘a huge mosaic has been created in which, in effect, an x-ray of world cultures, not a story-line, not a perspective, not a point of view, but a kind of x-ray through this mosaic, is created in which everybody can participate’. To consider the role of each component within this ‘mosaic’ provides a footing

through which the concept of an assemblage comprised of a 'constellation of singularities' comes into focus (Deleuze and Guattari, 1987, p.409).

A comprehensive critique of media culture which is in many ways ahead of its time, there are passages within *Understanding Media: The Extensions of Man* which provide even today's reader with valuable insight. 'McLuhan was one of the early media theorists interested in expanding the notion of 'media' in a variety of ways in which different spatial and temporal constellations, from architecture to clocks, could be seen and conceived as 'media'' (Parikka, 2012, p.64). Notions such as the 'media environment' are introduced, providing the foundation upon which the studies of media ecology, media archaeology and media geology have subsequently been built. The book's chapters are organised into two parts, the first of which explores a variety of aspects of media culture and the affect experienced by audiences whilst the second part addresses each of the current media forms as they stood at the time of writing. The ability to see the effect of media figuratively and with an objectivity rather than through engagement with a broadcasted content or message becomes an integral theme throughout the book. In anchoring forms of media in the physical realm, McLuhan writes that;

> 'Technological media are staples or natural resources, exactly as are coal and cotton and oil. Anybody will concede that a society whose economy is dependent upon one or two major staples like cotton, or grain, or lumber, or fish, or cattle is going to have some obvious social patterns of organisation as a result. Stress on a few major staples creates extreme instability in the economy but great endurance in the population' (McLuhan, 1964, p.22).

Whether in relation to the ubiquity of devices which constitute the infrastructure of today's telecommunications industry or more precisely the ubiquity of the materials which are used to construct these devices, the viewpoint expressed by McLuhan has the ability to provide objectivity to this discussion in a global context. In the opening chapter of *Understanding Media: The Extensions of Man,* McLuhan responds to a quote taken from early broadcaster and businessman General David Sarnoff stating that;

> 'We are too prone to make technological instruments the scapegoats for the sins of those who wield them. The products of modern science are not in themselves good or bad; it is the way they are used that determines their value' (McLuhan, 1964, p.11).

This argument is debunked as the author writes that 'firearms are in themselves neither good or bad; it is the way they are used that determines their value' (McLuhan, 1964, p.11). Notwithstanding, in illuminating some of the implications of the increased uniformity of computer usage in daily life for many people and how this may have reshaped the agency of the computer user, an analogy is found; 'a bureaucrat armed with a computer is the unacknowledged legislator of our age, and a terrible burden to bear. We cannot dismiss the possibility that, if Adolf Eichmann had been able to say that it was not

he but a battery of computers that directed the Jews to the appropriate crematoria, he might never have been asked to answer for his actions' (Postman, 1992, p.115).

Although the comparison between the genocide inflicted upon the Jewish population in Nazi Germany during the Second World War and the unrelenting territorial conflicts which have taken place in more recent years in DRC may be tenuous, the death toll in both contexts are on a similar scale with several million lives lost in each of these respective circumstances (Turner, 2007). These armed conflicts within DRC have largely been of a territorial nature while the economic and cultural machine behind the telecommunications industry continues to benefit monetarily from this instability.

The standardisation and uniformity of computerised media among the economic and social environments of today has elevated the significance of the medium of screen-based devices as these items have grown to play an increasingly prominent role in people's lives. In this sense, a conformity to such means of communication has meant that housed within the physicality of the distributors and receivers of digital media are forms of economic inequality which have their roots in colonialism. The application of the term 'control technology' in this setting may aptly describe the role of computers in mediating interactions between human participants as their input becomes digested via mathematically deterministic processes. At a much earlier stage in the progression towards the digitalisation of culture, it was noted that 'such "naturalness", complicated by the ever more pervasive and exorbitant claims of the specific medium, constitutes the new style, "a system of nonculture to which one might even concede a certain 'unity of style' if it made sense to speak of a stylised barbarism" (Adorno, 1944, p.46).

Notwithstanding, although interaction between human being and machine in this setting may be characterised by processes of control in terms of intention, here the use of the term control may be more appropriate as associated to scientific research. In this example a person or thing can be used as a standard of comparison for checking the results of a survey or experiment. As part of a discussion around the implications of this uniformity, the metaphor of the control room in which the participant may find themselves is described as having become possible 'due to a general adoption of technological tendencies – virtualization, remote control, simulation, real-time processing, networked computing, graphical user interfaces – across many fields of activity' (Deane, 2005, p.1).

A book which provides insight as to what the impending computer revolution might have meant for future generations is James Beniger's *The Control Revolution: Technological and Economic Origins of the Information Society*. Published in 1986, the book anticipates some of the ways in which society would be set to change with a desire to retain control becoming 'directly proportional to the development of its information technologies' (Beniger, 1986, p.9). The author also identifies some of the limitations of what is described as a pervasive culture which does 'nothing more than convert information from one form to another' (Beniger, 1986, p.31). The reductive nature of information processing as it takes on an increasingly central role in human interaction is also embodied when 'computer technology functions more as a new mode of transportation than as a new

means of substantive communication' (Postman, 1992, p.118). After all, what a computer does best is to make mathematical calculations. As mediums have evolved along with processes involved in media transmission, it has subsequently been noted that 'now we understand media as particular concentrations of flows of minerals and energy' (Cubitt, 2015, p.9).

In what could be viewed as a contextualisation of an evolving media environment, control technologies such as the computer are expressed as being not 'causes but as consequences of societal change, as natural extensions of the Control Revolution already in progress for more than a century' (Beniger, 1986, p.7). Information is characterised in this volume as the base of modern economies, a phenomenon which is highlighted as a dichotomy because there is no apparent materiality to this realm of information; 'how did information, embracing both goods and services, come to dominate the world's largest and most advanced economies? Material culture has also been crucial throughout human history' (Beniger, 1986, p.431). As an extension of 'the medium is the message' concept coined by McLuhan and a consideration of what might constitute the materiality of this medium, the computer has also been described as 'almost all process. There are, for example, no "great computerers," as there are great writers, painters, or musicians. There are "great programs" and "great programmers," but their greatness lies in their ingenuity either in simulating a human function or in creating new possibilities of calculation, speed, and volume' (Postman, 1992, p.118).

THE WAR MACHINE IN MEDIA

Defined as being 'a pure form of exteriority, whereas the State apparatus constitutes the form of interiority we habitually take as a model, or according to which we are in the habit of thinking' (Deleuze and Guattari, 1987, p.354), the 'war machine' as referred to in *'A Thousand Plateaus: Capitalism and Schizophrenia'* comes into focus, housed within the physicality of media as well as via the message transmitted within it. Across generations audiences have been subject to numerous public relations campaigns initiated by governments in order to generate a consensus in favour of military activity. Whether it be in regard to the alleged possession of the Iraqi state of 'weapons of mass destruction' as a form of justification for military conflict in 2003 or the apparent need to neutralise the threat of Islamic fundamentalism in Mali as proposed by the French state in 2013, a media machine which predicates war is observable among states in the West across successive generations. Closer examination of each of these circumstances tends to reveal motivations indicative of a political agenda or one related to natural resources, with oil and uranium being the focus in these two respective examples. Meanwhile outside of a mainstream media discourse within which a 'war machine' has had its influence on public opinion, circumstances around the sourcing of the necessary materials for this industry to exist have contributed to the perpetuation of the deadliest war in modern times.

In relation to the most popular forms of media today and what is described as ‘a perpetual field of interaction’, Deleuze and Guattari here assert that ‘the war machine's form of exteriority is such that it exists only in its own metamorphoses; it exists in an industrial innovation as well as in a technological invention, in a commercial circuit as well as in a religious creation, in all flows and currents that only secondarily allow themselves to be appropriated by the State’ (Deleuze and Guattari, 1987, p.360). It has been identified that the theoretical stance of Deleuze offers an advance on that of McLuhan by conceiving of media as a machinic assemblage, the coupling of flows and their interruptions, a development of McLuhan’s more totalizing claims about media considered as stable categories which have been criticized as technologically determinist (Jenkins and Zhang, 2016).

The discussion outlined in Chapter Twelve of Deleuze and Guattari’s 1987 book is thought provoking when superimposed with the recent history of DRC. As a caveat it is important to retain consideration for the relevance of the notion of this nation as a state entity. The border lines as we view them on the map today are the result of a tumultuous history in which colonialists sought to impose their rule and may not always bear a relationship to what is perceived by the local population, a process which may aptly be described as deterritorialisation. Remits of the nation state are delineated where ‘the state is sovereignty. But sovereignty only reigns over what it is capable of internalizing, of appropriating locally’ (Deleuze and Guattari, 1987, p.360). With regional power and governance having been situated in the hands of armed groups acting independently of the nation state of DRC in provinces such as North Kivu, South Kivu, Ituri or Katanga, a more complex situation with regard to sovereignty is observable. As the plight of naturally occurring resources has played such a central role in relation to developments in DRC over the last 150 years, the question of the extent to which the state has been able to appropriate its own materials monetarily is pertinent. In many instances economic agency over DRC’s resources can still today be found to be located in other parts of the world with official export figures often not reflecting the reality on the ground. The deterritorialisation as referred to in Deleuze and Guattari’s book is given further credence in the writings of Michel Foucault who notes that ‘territory is no doubt a geographical notion, but it's first of all a juridico-political one: the area controlled by a certain kind of power’ (Foucault, 1980, p.68).

Whilst relating the motivations behind many of the key developments in the history of media technologies which were in many cases initially utilised for military purposes, a discussion about the difference between what may constitute a weapon or conversely a tool can be explored philosophically (Deleuze and Guattari, 1987, p.395). A trope in which media technologies are re-appropriated by the public following their initial use militarily is given further appraisal as ‘the contemporary cultural condition is often described as an essential coupling of war and media and the cybernetic logistics of command, control, communications and intelligence, extended from strictly military networks to also include the entertainment media’ (Parikka, 2005).

The message of the media industry itself has largely been incommensurate in relation to the situation in DRC. It is startling that in an age when populations are afforded greater access to a wider variety of forms of information than at any previous time, the 'bloodiest war since the Second World War' (Turner, 2007, p.1) has gone largely unreported. In looking more closely at the way in which this dichotomy has transpired it is necessary to ask relevant questions. For example, is this the result of an act of sublimating attention away from what is actually happening? Or does the responsibility lie with the media industry itself, whose content may be considered a culture and a medium in and of itself?

In some ways marking the point chronologically at which the proliferation of mobile technologies began to grow exponentially globally, between late 1994 and early 1995 the world watched on as the media reported extensively on what was happening in Rwanda as the country fell into the grip of a murderous wave of violence. However, as this violence continued over the border in the eastern regions of the nation then known as Zaïre, claiming the lives of several million Congolese over the years which followed, the intensity of media coverage subsided. In 2008, despite eastern areas of DRC being patrolled by the world's largest UN peacekeeping force (some 17,000 UN representatives), the western media significantly underplayed the war and its aftermath (Lalji, 2007). These wars coincided with an exponential growth in the manufacture of mobile devices which were to be distributed globally and made with raw materials which had been mined from within this geographic region as well as elsewhere.

CONSTELLATION OF SINGULARITIES

In respect of the materiality of media, Deleuze and Guattari's 'Treatise on Nomadology: The War Machine' chapter provides a strong contribution to discourse around metallurgy in particular. The reader is introduced to concepts such as machinic phylum and the constellation of singularities which are assembled to become forms of media. These singularities may also be described as spatiotemporal haecceities with machinic phylum itself defined as being 'materiality, natural or artificial, and both simultaneously; it is matter in movement, in flux, in variation, matter as a conveyor of singularities and traits of expression' (Deleuze and Guattari, 1987, p.409). The authors also assert that 'machinic phylum is metallurgical, or at least has a metallic head, as its itinerant probe-head or guidance device' (Deleuze and Guattari, 1987, p.411). In relation to processes prior to, during and post the manufacture of today's media devices, the notion of a constellation of singularities is applicable at each stage, potentially linking the physical location of matter with its metallurgical properties.

An appraisal of the term machinic phylum in relation to the medium of radio is provided by Fuller, along with recognition of the plight of the raw materials involved; 'the way mobile phones are used in the context of London pirate radio—an urban culture, illegal in the

capital of a collapsed empire refounded as an integrated circuit for finance, is, on close analysis of parts (which include the rare metal tantalum), linked directly to the fomentation of a war that provides the raw material for components' (Fuller, 2005, p.51).

In describing a modality and a backdrop for the development of holistic theories of assemblage, Manuel DeLanda describes machinic phylum as 'the over-all set of self-organising processes in the universe' (DeLanda, 1991, p.6). He also points out that 'these include all processes in which a group of previously disconnected elements suddenly reaches a critical point at which they begin to "cooperate" to form a higher level entity' (DeLanda, 1991, p.6). Discourse around what this 'co-operation' of previously disconnected elements may symbolise culturally is locatable within the Actor-Network Theory (ANT) as proposed by Bruno Latour.

> 'For sociologists of associations, what is new is not the multiplicity of objects any course of action mobilizes along its trail—no one ever denied they were there by the thousands; what is new is that objects are suddenly highlighted not only as being full-blown actors, but also as what explains the contrasted landscape we started with, the over-arching powers of society, the huge asymmetries, the crushing exercise of power.' (Latour 2005, 72)

However, unlike the relationalist ontology described in Latour's Actor Network Theory, where each entity is defined by its interactions with other entities, by its capacity to affect and be affected by other entities, DeLanda's assemblages consist of parts that remain autonomous and independent of their network of relations. Conceptualisations of assemblages and the ways in which these might be useful in the context of the manufacturing of today's media devices will be examined more closely in the following chapter.

Although the aesthetics of devices such as the smart phone or the laptop may not encourage consideration for what lies beneath the surface, these are also products comprised of naturally occurring elements. An ostensibly immaterial sphere of instantaneously accessible information might be best plotted as part of a continuum of time, relating where the materials inside devices have come from and where they will end up. The origins and destinations of such substances may be determined by their metallurgical properties, such that 'what moves to the forefront is a "territorial" organization, in the sense that all the segments, whether of lineage, land, or number, are taken up by an astronomical space or a geometrical extension that overcodes them' (Deleuze and Guattari 1987, 388). To put this quotation into context, here the authors are referring to the segmentarity of society and how the notion of property creates a cognitive dissonance between people and the land which they inhabit. As an extension to this area of theory, Felix Guattari (Guattari, 2000) proposes that this geometrical extension consists of three axes – the environment, social relations and human subjectivity in his book *The Three Ecologies*. It is stated within the book that 'now more than ever, nature cannot be separated from culture; in order to comprehend the interactions between ecosystems, the mechanosphere and the social and individual universes of reference, we must learn to

think 'transversally'' (Guattari, 2000, p.43). Where the term ‘ecology’ is defined as the branch of biology that deals with the relations of organisms to one another and to their physical surroundings, it is possible to accurately place theorists such as McLuhan, Deleuze, Guattari, Latour and Fuller as media ecologists rather than media archaeologists or media geologists.

Deleuze and Guattari also write that within the mechanism of this geometrical extension are the ‘principal elements of a state apparatus that proceeds by a one-two, distributes binary distinctions, and forms a milieu of interiority’ (Deleuze and Guattari, 1987, p.352). The metaphor of the board game ‘Go’, comprised of small disks with a different colour on each side is referred to as a way of conceptualising this binary apposition, a fitting analogy for the way in which information is physically encoded and distributed digitally. In relation to the site of this mechanism, it has been identified that ‘the field of new media is arguably also marred by a number of “false divisions” — or what cultural theorists trained in poststructuralist thought tend to refer to as “binary oppositions”’ (Kember and Zylinska, 2012, p.2). These divisions have all but shaped debates in new media studies and even when shortcomings are diagnosed, it has proven difficult to avoid them. These difficulties are said to be attributable to ‘the residual effects of disciplinarity and the associated requirement to take a set of key concepts within a given discipline and then elevate them to a transcendental position, as a result of which everything else gets questioned or even dismantled except for these foundational concepts (for example, “data ”and “information” in computer science; “subjectivity” in psychology; “society” in sociology’ (Kember and Zylinska, 2012, p.3).

MEDIA ECOLOGY

Felix Guattari writes that ‘the only true response to the ecological crisis is on a global scale, provided that it brings about an authentic political, social and cultural revolution, reshaping the objectives of the production of both material and immaterial assets’. He goes on to identify that ‘this is obvious from the absurd and burdensome economic supervisions of the Third World, which lead some of its regions into an absolute and irreversible pauperization’ (Guattari, 2000, p.28).

In an effort to define the term ‘media ecology’ at what was a relatively early point in its conceptualisation, Fuller’s book *Media Ecologies: Materialist Energies in Art and Technoculture* (2005) builds upon the work of theorists such as Manuel DeLanda as well as Deleuze and Guattari. Whilst working through the definition of the term ‘media environments’ as referred to in the earlier work of McLuhan, the book provides an appraisal and a re-definition of this concept in respect of circumstances at the time of publication. In anchoring these terms via the perspective of the post-manufacture effects of media forms as experienced by users of technology, Fuller writes that ‘media ecology’ or what could be termed ‘information ecology’ is often deployed as a euphemism for the

allocation of informational roles in organizations and in computer-supported collaborative work. Baring comparison to the rhizome versus the tree example as highlighted in Chapter 1 of *A Thousand Plateaus: Capitalism and Schizophrenia* which some may read as inherently a debate about hierarchical versus horizontalised forms, Fuller also describes how 'media ecology' 'is often used as a 'saccharine term for the 'natural' structuring of the microscopic to macroscopic dimensions of class composition and command in a workforce' (Fuller, 2005, p.3).

As part of a further contextualisation of the term 'ecomedia' it has been noted that 'ecomedia studies can be understood as a historically situated, ideologically motivated, and ethically informed approach to the intersections of media, society, and the environment' (Rust, Monani and Cubitt, 2015). The use of the term 'media ecology' in the work of media commentator Neil Postman is identified as describing a form of environmentalism which uses the study of media to sustain a relatively stable notion of human culture (Fuller, 2005, p.4). Postman writes that 'a new technology does not add or subtract something. It changes everything', citing as an example of this rationale; 'if you remove the caterpillars from a given habitat, you are not left with the same environment minus caterpillars: you have a new environment' (Postman, 1992, p.19). This use of the term ecology in a media context is further elaborated upon in identifying that 'after television, the United States was not America plus television; television gave a new coloration to every political campaign, to every home, to every school, to every church, to every industry' (Postman, 1992, p.20). Writing during a slightly different historical period and on the other side of the Atlantic, the term is contextualised in a broader sense in Fuller's book, whereby '"ecology" is used here because it is one of the most expressive language currently has to indicate the massive and dynamic interrelation of processes and objects, beings and things, patterns and matter' (Fuller, 2005, p.2).

Moreover, as progressions in the field of information technology have come to define the communications industry, it may be appropriate to view progressions in the 'mediascape' (Appadurai, 1990) as ultimately reaching a point of submersion in which the effects of this 'service environment' as referred to by McLuhan are profound. This environment has also been actualised as a network of 'huge worldwide machines branched out over the entire ecumenon at a given moment, which enjoy a large measure of autonomy in relation to the State' (Deleuze and Guattari, 1987: 360). Despite their respective contributions having taken place at differing points on the timeline of evolutions in popularised media forms, both Deleuze and McLuhan have been described as media ecologists. 'Like Deleuze, McLuhan is well aware that, to generate an effect, a medium first needs to be taken up by a social matrix' (Jenkins and Zhang, 2016). If we are to take the objectivity within McLuhan's concept of a medium and its respective message intrinsically sharing a co-existence, one is able to view literally the object which constitutes the medium and evaluate circumstances around it via the perspective of its physical existence as an assemblage of materials.

Despite a broad decentralisation having taken place as a result of an upsurge in wireless communications, it has long been noted that 'the bulk of the infrastructure of the Internet— including its key bottlenecks—remains in the hands of a very few corporate individuals' and that 'utilitopianism—utopia achieved by utilitarian means, as in that of the digital "commons"—works, it produces effects, but never unilaterally' (Fuller, 2005, p.129). As part of what has been termed a process of democratisation, the previously diametrically opposed ideologies of communism and capitalism as locatable within a Cold War dichotomy have now become represented within the mediation of the screen. During the late 1990s as the community of peer-to-peer networks began to open up new avenues politically for those seeking to redress some of the inherent power imbalances both economically and in the world of media, territorial conflicts were raging in DRC. A progression away from the significance of the geographic location within methods of communication on one hand was marked on the other with a very strong emphasis on the physicality of land and the contents beneath its surface. Additionally, participation in remote means of communication can be said to be fundamentally divisive in light of the question of whether any given individual has the opportunity to participate or not. With more than 50% of all internet content having been published in English rather than another language, a disproportionate representation of global culture can also be found to be inherent within this medium. As the proliferation of the medium of the internet underwent exponential growth from the mid-1990s onwards, movement towards democratisation has moreover been replaced by a further pattern of centralisation with a handful of companies retaining the majority of influence.

Indicative of centrifugal processes involved in the supply chain of materials used in the manufacture of wireless technology as they continue to make their way from under the ground in DRC as well as other regions before being distributed elsewhere, it was noted that 'mines are a source of flow, mixture, and escape with few equivalents in history. Even when they are well controlled by an empire that owns them (as in the Chinese and Roman empires), there is a major movement of clandestine exploitation' (Deleuze and Guattari, 1987, p.413).

MEDIA ARCHAEOLOGY

In an effort to contextualise the moment at which the study of media archaeology may have found itself, it has been noted that 'the exploration of media archaeology's position within media studies lies not only in the question why media archaeology should be employed but also in whether or not it is possible to create a more structured and workable method or approach i.e. how to employ it' (Zwaan, 2014, p.10). In looking more closely at the construction of today's media devices it has been noted that 'there is room to move past the current focus on mediated images and conduct a deeper form of

discourse analysis that focuses on the material processes that give form to the so-called objects of nature' (Barker and McKeown, 2015, p.26).

If one is to view the current media anthropocene as a form of ecology in a holistic sense, it may be possible to conceptualise this setting as being implicitly part of one singular culture. However, rather than view such progressions via an allegorical base for example as in the term 'media archaeology', such considerations might be more appropriately anchored via the tangible presence of physical materials. Where many of the sociological effects of screen-based devices may be characterised as being of a cognitive nature in the sense that much of what happens takes place internally inside the participant's brain rather than externally as viewable in the world around us, another strand of the term 'media archaeology' comes into focus. In this psychological context, the notion of 'emergent properties' as defined in new materialist theory as well as complexity science rises to prominence. Establishing the link between the psychological and the biological and in reference to the role of the human, in this case represented as 'the organism', Parikka states 'this ecological perspective does not, then, rely on formal characteristics of life, but is a tracing of the lineages of the virtual machinic phylum of digital network culture and also a tracing of the paths of organisms that move on this plane: a biophilosophy' (Parikka, 2005).

Notwithstanding, the relationship between what could be conceived of as a network of thought or consciousness among users of digital technology and the assemblage of components which physically comprise this network can be expressed as a singular cultural form. In one light, this 'organism' could also be more aptly representative of a mineral or a metal metaphorically, as is epitomised in the statement; 'life is not to be judged as a quality of a particular substance (the hegemony of a carbon-based understanding of life) but as a model of the interconnectedness, emergence and behaviour of the constituent components of a(ny) living system' (Parikka, 2005). Throughout Parikka's publications as a series, the reader is able to gather a sense of the development which has taken place in discourses of media ecology and media archaeology. Parikka also explores in detail some of the effects of digital culture and cybernetics as experienced sociologically, factors which are described as constituting their own eco-system. The work of Belinda Barnet and her essay on the question of technological evolution and life are highlighted, declaring that 'what is at hand is the need to grant 'the technical object its own materiality, its own limits and resistances, which allows us to think of technical objects in their historical differentiations'' (Parikka, 2005).

In thematising participation and conformity to modern media forms among populations as being in some ways organic and akin to the way in which species of insects organise themselves almost as one mass, Parikka's 2010 book *Insect Media: An Archaeology of Animals and Technology* provides useful insight into the implications of new societal landscapes resultant from developments in media forms. Parikka writes that 'as new media technologies such as telegraphy or various new modes of transportation seemed to territorialise the human being into a new assemblage of communication, perception, and

thought, the idea of looking for the "origins" of technology in primitive life offered one way of grasping the uncanny affects inherent in technical media' (Parikka, 2010, p.27). As part of a philosophical discussion which focuses on the significance of technological developments today and the extent to which consumers may or may not retain agency over the ways in which evolutions are taking place, the book also explores concepts such as machinic connectionism. Parikka asserts that 'technical machines are inseparable from their relations with biochemical, biosocial, and bioeconomical assemblages' (Parikka, 2010, p.76).

Consideration of the cultural significance of digital devices in the form of assemblages presents an ability to provide insight in evaluating the implications resultant from their existence and ubiquity. On a geopolitical basis, the events of history in their continuality have rendered a particular form of imbalance and inequality as resident within forms of digital communications. As these inequalities have largely been perpetuated by economic factors and a global financial system, it may be possible to assert that any potential methods of adjustment will be limited to this particular setting. However, the remits of the world of finance have the potential to be boundless as 'when we are talking about capital we are talking about a social force that aspires to colonise the whole of life practices' (DeAngelis, 2007, p.43). Whilst facilitating and driving processes associated to globalisation, these are culturally imperialist systems which are not based in ethics but are capable of quantification and accumulation. It has also been identified that the 'simplest way to represent the value practices of capital is to portray the sequence of transformations that must take place in order to preserve and reproduce its being' (DeAngelis, 2007, p.43).

In attempting to delineate the scope of media archaeology within an academic context, it has been noted that 'whether media archaeology can be, as Parikka stated, an innovative 21st century discipline, or a method, an approach or perspective, depends first and foremost on whether it can become clear how one does media archaeology' (Zwaan, 2014, p.89). In the opening passages of the 2012 book *What is Media Archaeology?*, Parikka identifies canonical discourse in this area to have stemmed from the work of a number of theorists such as Erkki Huhtamo, Siegfried Zielinski, Thomas Elsaesser, Friedrich Kittler, Anne Friedberg, Tom Gunning, Lev Manovichand Laurent Mannoni as well as several even earlier writers such as Walter Benjamin, Siegfried Giedion, Aby Warburg, Marshall McLuhan and Michel Foucault. As a conceptual starting point in considering the origins of media forms, the question is posed 'what if we start to read media technology in the same way that Foucault exposed cultural practices and discourses to an analysis of how they were born and made possible in certain settings?' (Parikka, 2012, p.6). Building on this, the archaeology component of the term 'media archaeology' is defined as the 'digging into the background reasons why a certain object, statement, discourse or, for instance in our case, media apparatus or use habit is able to be born and be picked up and sustain itself in a cultural situation' (Parikka, 2012, p.6).

Within this definition proposed by Parikka, there are two somewhat divergent yet coexisting strands from which theorists and researchers are able to draw. Firstly, a rationale which finds its embodiment in the form of the physical media apparatus itself, comprised of all the naturally occurring ingredients which are assembled through manufacturing arrives in focus. By contrast, the reader is also able to interpret some of the more conceptual effects experienced culturally among populations as a result of the ubiquity of items of media technology. The term 'digging' here may mean a process of reaching behind the two-dimensional surface of the screen in order to identify the kinds of resultant experiences taking place socially, politically or ethically for example. Notwithstanding, due to the integral and homogenising role of the most popular media forms in day-to-day life, it can be difficult to gain enough perspective to view these processes objectively and thus discourse around media culture is important. As was identified at a much earlier point in the progression towards commodification; 'culture today is infecting everything with sameness' (Adorno, 1944, p.41). The same author writes that 'all mass culture under monopoly is identical, and the contours of its skeleton, the conceptual armature fabricated by monopoly, are beginning to stand out' (Adorno, 1944, p.42).

Engagement with screen-based devices is primarily something experienced by the individual in any physical setting in today's circumstance, bringing to light the question of the role of media forms. A predominant tendency towards processes of individualism among societies in which forms of wireless telecommunication have been integrated to a greater degree has also been identified in abundant literature and academic discourse in recent years (Kember and Zylinska, 2012, p.130). It has been noted that 'the questions we can ask about the media events and their effects change from whether, or to what extent, media events integrate (or disintegrate) society — as if the latter were something separate, simply existing out there— to how media produce or enact the social' (Kember and Zylinska, 2012, p.31). Parikka writes that 'media archaeology has potential as an innovative 21st century arts and humanities discipline that investigates non-human temporalities and does not succumb to individualizing stories of heroes, but wants to address those material and cultural contexts and forces that are beyond our control – but might suffer from our effects. The environment is clearly one example' (Parikka, 2012, p.167).

CHAPTER 4: ASSEMBLAGES

INTRODUCTION

Implications of an increasing ubiquity of wireless telecommunications devices for people in DRC as well as in a global context could be said to be most appropriately anchored via the physical manifestations associated with their proliferation. Whether in the form of finite materials used in manufacturing processes, the conditioning of audiences in communicating via digital media or ultimately the obsolescence of products which were at one time perceived to be ground-breaking in their capabilities, each stage of this cycle can be viewed as an assemblage in and of itself. In terms of the materiality from which modern media is comprised, a life cycle comes into focus whereby archaeological artefacts once found under the ground are eventually inevitably re-integrated to the earth. Although this lifespan is somewhat hard to quantify in terms of its duration, pertaining to the variability of metallurgical characteristics, it is more possible to identify the stages which take place along the way. Importantly, at each of these stages the theory of assemblage which has been developed by writers such as Gilles Deleuze and more recently Manuel DeLanda retains its relevance as a holistic perspective whereby the materiality of constituent parts provides the rational basis for the conception of any given whole, irrespective of whether the whole has been formed as a result of human endeavour or not. As an extension of this, in the context of the physical components which comprise the receivers and distributors of media today, 'while the decomposition of an assemblage into its different parts, and the assignment of a material or expressive role to each component, exemplifies the analytic side of the approach, the concept of territorialisation plays a synthetic role, since it is in part through the more or less permanent articulations produced by this process that a whole emerges from its parts and maintains its identity' (DeLanda, 2006, p.14)

Theories of assemblage have been described as theories of immanence, a concept which comes into focus when considering the role of time. Any assemblage may only exist for a limited period, with components existing in differing forms before and afterwards as has been identified; 'an assemblage thus not only has a distinctive history of formation but a finite life span' (Bennett, 2010, p.24). These are also viewpoints which find a way of looking at and taking account for everything in the universe within a concept that is not contradictory to scientific theory. What have formerly been regarded as "monolithic entities" such as capitalism or the market must be recognized as an assemblage of individual entities, each of which are "valid historical actors" such as local marketplaces, as well as regional, national, and continental markets (DeLanda, 2016, p.15).

A study conducted in 2010 by the non-governmental organisation Resolve in partnership with the Global E-Sustainability Initiative and the Electronics Industry Citizenship Coalition found that there are broadly 8 stages linking mines in Eastern DRC to final products. Significantly, at the point of each transition between these formations are what can be described as emergent properties, namely in the form of monetary profit, a derivation

from the relations of exteriority among the materials involved. Delineation of the remit of assemblage theory in this context has been expressed in the sense that 'assemblages are made up of parts which are self-subsistent and articulated by relations of exteriority, so that a part may be detached and made a component of another assemblage' (DeLanda, 2006, p.18). The stages outlined here apply to the supply chains of materials such as coltan, cassiterite, tungsten and gold:

1. Artisanal and small-scale mining (ASM) or commercial-scale mining
2. A négociant may buy minerals.
3. Trading houses or comptoirs based in Goma and Bukavu buy and sell (sometimes exporting) minerals.
4. Traders (exporters) sell minerals to processors that are typically located in other countries. (Smuggling as well as legal exports take place.)
5. Minerals go through one or more processing steps at a smelter or other refiner. (For example, tantalum is chemically processed and refined into tantalum powder or wire.) Minerals originating from many mines and countries are typically mixed when processed.
6. Manufacturers use the refined metal to create components such as capacitors (from tantalum), solder (from tin), and batteries (from cobalt).
7. Product manufacturers or original design manufacturers (ODMs) assemble the components into products (such as hard drives, notebooks, power supplies).
8. Product companies or OEMs may do final assembly and sell their products to end-use customers. Alternately, the final product may go through a business customer that markets and sells the product to the consumer.

(Resolve, 2010, p.10)

Between several of these stages there is the potential for another stage to be inserted where stockpiling practices take place due to market forces. Furthermore, a lack of transparency and traceability tends to characterise supply chains, presenting difficulties in working towards solutions, particularly as initiatives in reviewing mining contracts in DRC have been taking place against a backdrop of decades of extensive corruption, mismanagement and illegal exploitation of the country's natural resources (Global Witness, 2007). The term "illegal exploitation", meaning the organised removal of Congo's natural resources from the country without legitimacy or due return is said to have come into prominence in the debates around the war of 1998-2003 during the coltan boom (Johnson, 2005, p.15). The 'financing of conflict from mineral profits has led to sustained international pressure to use domestic and regional law to hold importers and importing countries accountable' (International Peace Information Service, 2012, p.6).

The capabilities of digital media products and the medium of telecommunications can affect the perception and significance of location, rendering a form of deterritorialisation which has been described as part of a process of urbanisation (DeLanda, 2006). Nevertheless, location-based decisions have been found to be fundamental to supply chain

decision-making, design, and management. According to a standardisation among initiatives aimed at greater fairness in the industry, processed material can only be deemed "conflict free" if all material entering a processing facility is tracked or batched and handled separately from materials of different origin (Resolve, 2010, p.3). To complete the cycle, a few more stages can be added to this model:

9. Consumption – use of a device in every-day life
10. Obsolescence – staggered and incremental release of products rendering the capabilities of their predecessors to no longer meet standards
11. Landfill / recycle – at this final stage, the lifespan of forms of digital media is either extended to be again incorporated around point number 8 in this list or alternatively, terminated

Disruptions at any stage along this life cycle have affected the reliability of markets, as a result of factors such as the US Government's Dodd-Frank act, natural disasters, technical failures and political instability. Intentional supply disruptions using exports or pricing as a political instrument, unequal market conditions causing an uneven economic playing field as well as governance issues related to the resource sector have also had their affect at various stages in recent history. That said, the path of digital minerals has more widely been ensured with little or no regard for populations in the regions where they are sourced. In working towards making improvements to the trade in digital minerals, it has been identified that instead of trying to stop or interrupt trade, formalising a large percentage of it would contribute to achieving long-term security (Garrett, 2009, p.5).

Importantly in gaining some perspective as to the role of materials among the physical manifestation of today's media forms, it has been identified that 'the formative power in the media are the media themselves, that raises a host of large matters that can only be mentioned here, although they deserve volumes' (McLuhan, 1964, p.22). The ubiquity of DRC's minerals as part of this assemblage and the economic circumstances around this have also been expressed in the sense that 'an organisation that only creates one product of service is more dependent on its customers than an organisation that has a variety of outputs that are disposed of in a variety of markets. Similarly, organisations which require one primary input for their operations will be more dependent on the sources of supply for that input than organisations that use multiple inputs, each in relatively small proportions' (Pfeffer and Salancik, 2003, p.46). The sheer proliferation of computerised devices as a result of an acceleration in manufacturing processes has, in the years which have followed, proven to be concurrent with what is known as Moore's Law (1965). Notwithstanding, the idea that the number of transistors on a micro-chip would double every two years has taken place as a result of human endeavour and decision making rather than by what could be termed natural forces. In simple terms, concerns about this form of resource dependence have been expressed in the sense that 'if it breaks down, a computer may turn into a horrendously complex mediator' (Latour, 2005, p.39).

The complexity and interconnectivity of some of today's product supply chains have been vividly illustrated through the effects of recent natural disasters, including earthquakes,

tsunamis, and even hurricanes, which have severed critical nodes and/or links and have disrupted the production and transportation of products, with major economic implications.

Indeed, when supply chain disruptions occur, 'the ramifications can propagate and impact the health and well-being of the citizenry thousands of miles away from the initially affected location' (Nagurney, 2012, p.2). In simple terms, 'if international companies simply walk away from Congo and the market for all its minerals dries up, this could make the situation on the ground worse' (Enough Project, 2009, p.10). A parallel can be found among this assemblage of economic relations, conceptualised by the formation of rhizomatic networks in the theory of media-ecology and in the context of the functionality of computers.

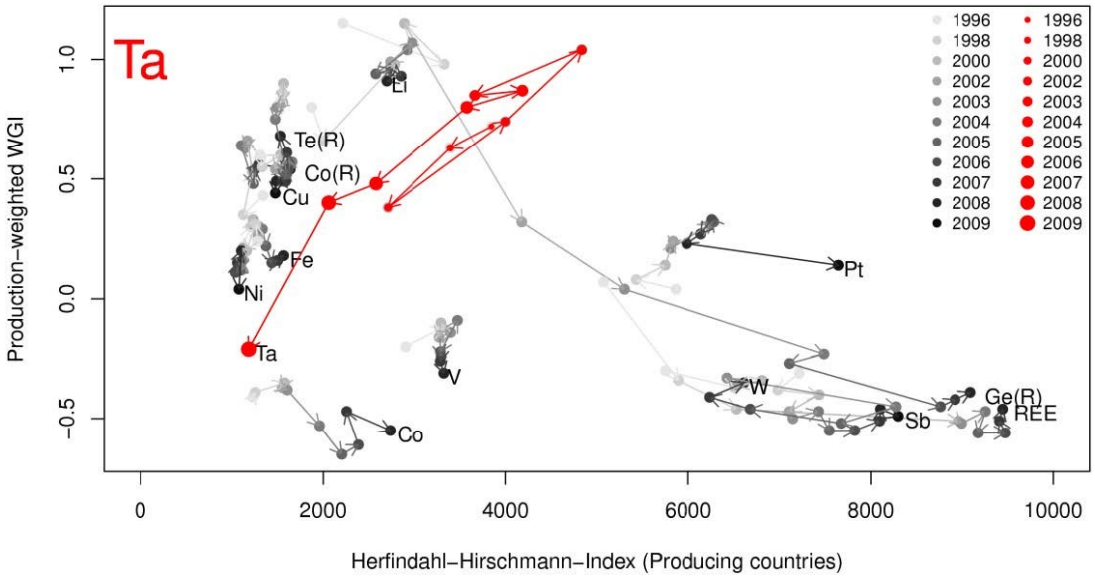
The interconnectivity resultant from the abilities of communication technologies has been highlighted as a good example of that which is deterritorialising, in the sense that the significance of geographic location is removed across several aspects 'ranging from writing and a reliable postal service, to telegraphs, telephones and computers, all of which blur the spatial boundaries of social entities by eliminating the need for co-presence' (DeLanda, 2006, p.13). Although the notion of deterritorialisation is also very much relevant in the context of DRC in relation to the effects of external interests and the ongoing repercussions of colonialism which have in many cases literally removed the ground from underneath people, in another light this form of deterritorialisation could be said to be epitomised by the problems associated with the monetisation of pieces of rock or geological artefacts.

In examining the denotations involved in the term 'geology', it has been proposed that 'if we abandon the absurd notion that geology is somehow immune from the violence and dispossession enacted through extraction of mineral resources, then geology in its fully geosocial registers comes to the fore as a force of transformation' (Yusoff, 2018, p.23). Concurrently, the question has been posed 'since geology is a hinge that joins indigenous genocide, slavery, and settler colonialism through an indifferent structure of extraction, indifferent to the specifies of people and places, how does the refusal of responsibility in the mapping of pasts and futures of geology leave the present unchecked?' (Yusoff, 2018, p.110).

An analysis of the history of the energy and mineral-mining sectors illustrate market cycles and the corresponding political cycles of attention, concern and tension around the topic of resource availability. Such cycles also cause shifts in the balance of bargaining power between consumer and producer countries, as well as between host governments and companies involved in resource extraction, denoted by what has been described as the 'obsolescing bargain principle' (Buijs and Sievers, 2012, p.2). Related to this, industry cycles also go quite far in explaining the periodic resurgence of resource nationalism, as increasing monetary value of extracted resources inherently leads to a greater politicisation of control over them.

As markets have continued to evolve along with the science behind the manufacture of communications devices, emphases can be found to vary among different materials at different times. The metallurgical properties and abilities of materials can underpin and permeate much of the manoeuvring in these economies, the remits of which are anchored in physicality despite appearing to be boundless. Information stored on servers connected by the apparatus of wireless telecommunications infrastrcutures all but characterises the site of knowledge about materials as the research behind their abilities becomes its own dimensional discourse forming what could be described as an assemblage within an assemblage or an example of micro-macro entities (DeLanda, 2006).

With a view to future provisions of digital infrastructures, surveys conducted in recent years by bodies such as the US Geological Organisation, the UK Government, the European Union, World Bank and so on have attempted to quantify exactly how much of 'critical resources' are source-able from particular regions of the world. These areas of research have gone on to influence economic and international policy on the part of the organisations involved. The graph below shows the evolution of tantalum, highlighted among some other minerals, in terms of producing country concentration (measured by the Herfindahl-Hirschmann-Index) and the political and economic stability of producer countries (measured by production weighted World Governance Indicators) between 1996 and 2009.



(Source: Buijs and Sievers, 2012, p.9)

Notably with regard to the supply chains involved and denoting some of the considerations which hold the industry together, 'criticality of supply' is the central part of all studies and discussions on raw materials security. This includes aspects such as the import dependence of consumer countries, the concentration of production in certain countries or companies, the availability of secondary raw materials and substitutes, price volatility, success of exploration and new projects coming into production. Included in this definition are the (geo)political risks associated with concentrated production taking place in countries of

'strategic distrust' (which could be termed 'political criticality') or in unstable countries (Buijs and Sievers, 2012, p.12).

In examining more closely the relationship between a boom in the manufacture of telecommunications devices and patterns of territorial conflict in DRC, relevant applications of the notion of an assemblage are manifold. Whether it be in reference to the geological artefacts that are eventually physically absorbed to become part of the medium, the array of different economic actors involved in the process, the role that the eventual products of manufacture play in the lives of populations or the geopolitical power imbalance which these materials are representative of, it can be said that 'assemblages, being wholes whose properties emerge from the interactions between parts, can be used to model any of these intermediate entities' (DeLanda, 2006, p.6). In a geographical context it has been identified that 'nation-states are assemblages of cities, the geographical regions organised by cities, and the provinces that several such regions form' (DeLanda, 2006, p.6), an outlook which pertains ever greater relevance as the reach of a world of information transmitted by wireless telecommunications grows to unprecedented levels of subsummation. However, as discussed in the previous chapter, the notion of a coherent nation state or what some analysts have referred to as an 'enclosure' is problematic in the context of DRC, given the very troubled history and the fact that its borders are largely a consequence of colonialism.

Whilst developing the earlier work of theorists such as Gilles Deleuze or Félix Guattari, the more recent publications of Manuel DeLanda offer an advance on this area of theory. However as is stated in the introduction of his 2006 book *A New Philosophy of Society*, cultural specificities can also be present within this theory of the whole as he writes; 'I make, on the other hand, no effort to be multi-cultural: all my examples come from either Europe or the USA' (DeLanda, 2006, p.6), as he goes on to state his belief that properties of social assemblages remain approximately invariant across different cultures. A critique of what is an abstract concept of the 'outside' has been expressed in the sense that 'concrete struggles of the poor that turn poverty into conditions of production of community, social cooperation and dignity, can be locally criminalised: after all they threaten macroeconomic stability, they threaten "property rights and rule of laws", and they threaten infrastructures qua vehicle of capital accumulation' (De Angelis, 2012, p.2). Furthermore, it is important to retain objectivity with regard to the role of what could described as colonial languages such as English and French which 'should be moved away from the core of the matter, a place it has wrongly occupied for many decades now' (DeLanda, 2006, p.16).

ASSEMBLAGE DEFINTIONS

As what could be described as a seminal moment in discourse around the philosophical notion of assemblages, it was once noted that 'we will call an assemblage every constellation of singularities and traits deducted from the flow—selected, organized,

stratified—in such a way as to converge (consistency) artificially and naturally; an assemblage, in this sense, is a veritable invention' (Deleuze and Guattari, 1987, p.406). The notion of a 'constellation of singularities' as outlined here is applicable across a number of different aspects including the way different assemblages relate to each other. One may ask however whether this is only possible via that which is horizontalized or inherently two-dimensional as can be found to be the case in relation to the screen as an entity and its role as a mediator. The fact that any assemblage is referred to here as an invention is also significant in that this would seem to imply some form of intention on the part of human agency rather than via what could be described as natural processes. Other important terms in the writing of Deleuze and Guattari, whose 1987 book is regarded as influential in the development of theories of assemblage include the concepts of coding, decoding and overcoding, territorialisation and deterritorialization. A key differential is also identified between strata, characterised by a multiplicity of potentially disparate elements, and assemblages which have the ability to account for the holistic unit, establishing the connections between certain multiplicities (Deleuze and Guattari, 1987, p.23).

The individuation of assemblages deriving from the individuation of populations interacting via digital mediums has also been highlighted as having some positive repercussions, for example in the sense that the prominence of hierarchical social structures has become reduced compared with what went before as part of a wider horizontalization. A platform such as Facebook for example can be seen in a positive light as 'just a tool for communication, networking, and fostering the democratic process' (Kember and Zylinska, 2012, p.157). Expressed in another light 'the striking preponderance of screens embedded within screens in the control rooms of these narratives is a techno-aesthetic manifestation of the spatial and logical paradoxes of emergency jurisprudence and, more broadly, of the strange location of political subjectivity in the matrix of technoculture' (Deane, 2005). Where much of what takes place as part of the process of engaging with digital technology is significant in terms of the cognitive processes involved, such tendencies have been expressed in the sense that 'the computer mind does not allow us to grasp the brain-somatic encounter with sensory environments beyond a locationist image of thought, that is to say, a perception of the world established in an inner brain state looking outward' (Sampson, 2016, p.9).

Theorists have addressed the notion of interiority versus exteriority, the latter potentially resulting in emergent properties as a result of the way things relate to each other, a perspective which is expanded upon in Bruno Latour's Actor Network Theory (ANT) for example (Latour, 2005), a branch of the assemblage theory applied in a sociological context. The notion of emergent properties has also been articulated in the sense that 'their ability to make something happen (a newly inflected materialism, a blackout, a hurricane. a war on terror) is distinct from the sum of the vital force of each materiality considered alone' (Bennett, 2010, p.24). Appositely, relations of interiority are characterised whereby 'component parts are constituted by the very relations they have to other parts in the whole' (DeLanda, 2006, p.9). It has also been identified that without

relations of interiority, a whole cannot have emergent properties, becoming a mere aggregation of the properties of its components (DeLanda, 2006, p.10).

Manuel DeLanda proposes that assemblages can act autonomously in a similar way; 'when a nested set of assemblages has many levels, we need to be able to keep track at what level of the nested set a given deterritorialisation or decoding is taking place, then follow its cascading effects' (DeLanda, 2016, p.83). The relationalist ontology described in Latour's ANT where each entity is defined by its interactions with other entities—by its capacity to affect and be affected by other entities has been highlighted in contrast to DeLanda's assemblages which are said to 'consist of parts that remain autonomous and independent of their network of relations' (Ball, 2018, p.241). As part of a comprehensive contextualisation of the term, DeLanda outlines how the assemblage can be a useful way of a conceptualising or conceiving of entities from the material to the ethereal. In this light, referring to an object as an assemblage can be a way of freezing it in time with processes of formation and subsequently deformation inevitably part of a continuality. Notwithstanding, DeLanda describes social assemblages as being of a temporal nature in relation to the duration of events capable of changing them.

Building from some of the concepts outlined in Deleuze and Guattari's 1987 book *A Thousand Plateaus: Capitalism and Schizophrenia* such as overcoding and deterritorialisation, chapter 1 of *'Assemblage Theory'* (2016) examines how rhizomatic human interactions via wireless technologies in the modern day can be considered to constitute assemblages. One way that DeLanda seeks to correct or improve upon Deleuze and Guattari's assemblage theory is to argue that assemblages and their components possess mind-independent agency, bringing forth the concept of the proliferation of smart phones or laptops as being an autonomous culture, underpinned by binary information theory, which is acting independently and without human agency. This notion has also been expanded on by theorists like Jussi Parikka and his work exploring the autonomy of computer viruses. Parikka highlights computer viruses as tending to be comprised of three parts: '1) the copying routine which controls the self-reproduction of a virus; 2) a trigger, which triggers the viral code into active mode. This can be, as for instance with earlier viruses, a certain date or a certain number of computer boot sequences; 3) a payload, which is often the level users perceive' (Parikka, 2007, p.300). As part of an analysis of the human-machine relationship, Parikka highlights how 'DeLanda sees this automation of tasks from the human to the machine as a key culmination in the birth of software' (Parikka, 2007, p.297). Another contextualisation describes assemblages as 'ad hoc groupings of diverse elements, of vibrant materials of all sorts', Bennett goes on to state that 'assemblages are living, throbbing confederations that are able to function despite the persistent presence of energies that confound them from within' (Bennett, 2010, p.24).

To anchor the concept of the assemblage in the material realm and in the context of media more specifically, this is a rationale which provides an ability to view a smartphone for example as an object comprised of physical materials with their own mass, the sum of the mass of the materials from which it is comprised. For example, the I-phone 13 released in

2021 weighing 174 grams will be comprised of quantities of materials from which it is manufactured, silicon, plastic, iron, aluminium, copper, lead, zinc, tin, nickel, barium and so on. In relation to each of these materials, it has been identified that 'studies of critical minerals are intended to be tools in helping to identify problems or tensions that might arise over the access to resources. Yet we have seen that criticality studies carry certain important limitations which should be properly acknowledged in order to obtain a sensible understanding of the energy and mineral resource markets' (Buijs and Sievers, 2012, p.18).

In another light, it has been noted that the electrical power grid offers a good example of a microcosmic analogy, as an assemblage that it is a material cluster of charged parts that have indeed affiliated yet remained in sufficient proximity and coordination to produce distinctive effects (Bennett, 2010, p.24). The elements of this assemblage, whilst including 'humans and their (social, legal, linguistic) constructions, also include some very active and powerful nonhumans: electrons, trees, wind, fire, electromagnetic fields' (Bennett 2010, p.24). In highlighting some of the market forces affecting supply chains of materials used in products such as the 'I-phone', it has been described how 'much of the concern about minerals is driven by fears about the availability of 'technology minerals' such as rare earths (or, historically, cobalt and platinum group metals), coupled with a concern about meeting future high demand levels' (Buijs and Sievers, 2012, p.18).

In reference to the commodification of culture as highlighted in the work of Adorno for example in the 1930s and furthermore the emergent properties in the form of monetisation of raw materials through assemblage processes in transportation and manufacture, it has been asserted that 'objects do not go into their concepts without leaving a remainder' (Bennett, 2010, p.14) and thus life will always exceed our knowledge and control. Attention has also been paid where 'the relative magnitude of an exchange as a determinant of the importance of a resource' may retain relevance 'if measurable by assessing the proportion of total inputs or the proportion of total outputs accounted for by the exchange' (Pfeffer and Salancik, 2003, p.46). In theorising a vital materiality and the active participation of non-human forces in human events, chapter 4 of Bennett's 2010 book focuses on the life of metal, making an allegorical connection between the way metals are sourced and the life they lead almost as if they were organisms themselves, addressing the question of whether materiality itself can be described as having an inherent vitality. The term assemblage is contextualised in the book as relating to globalisation and the conjunction of that which is 'both intimately interconnected and highly conflictual' (Bennett, 2010, p.23). This philosophical approach also bears a strong relationship to the work of media archaeologists and media ecologists as outlined in the previous chapter.

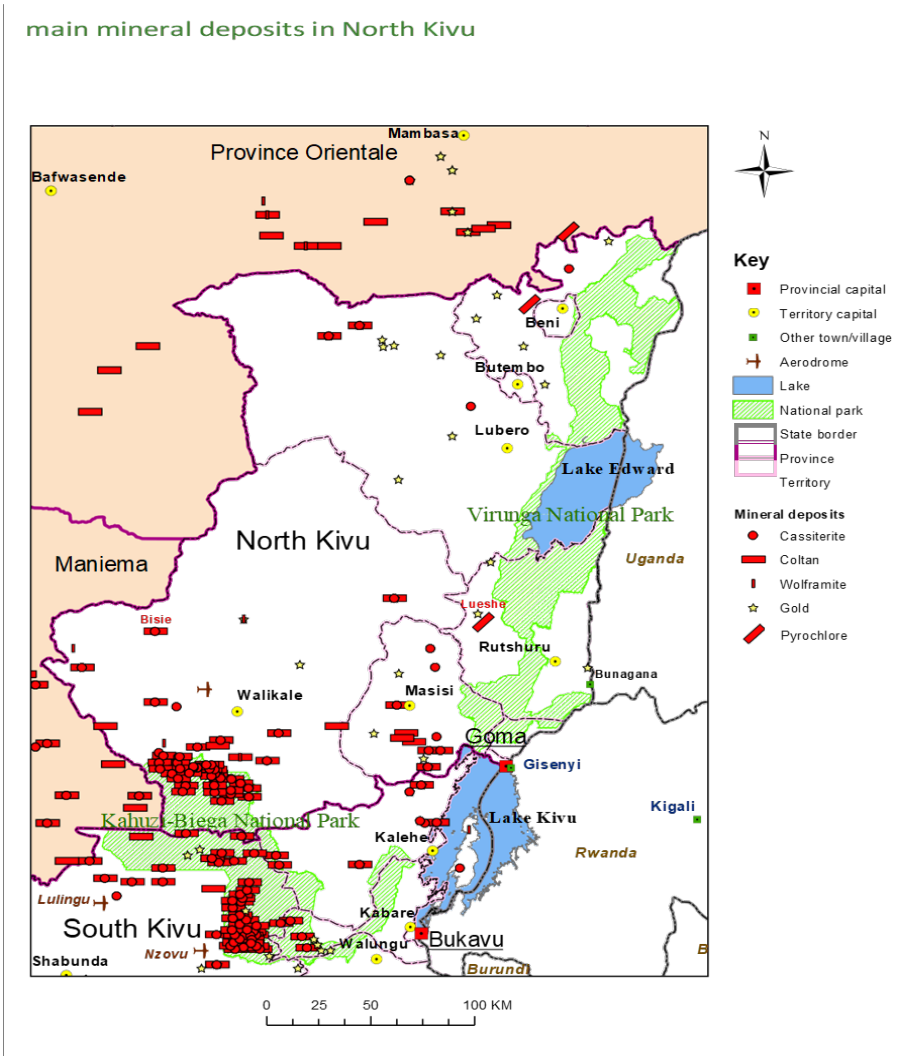
To return to the question of human versus machinic agency and in relation to the formation and materiality of modern media forms, the notion of 'machinic phylum', defined as 'materiality, natural or artificial, and both simultaneously', 'matter in movement, in flux, in variation, matter as a conveyor of singularities and traits of expression' comes into focus as an adjunction (Deleuze and Guattari, 1987, p.409). As has

been subsequently identified ‘an assemblage owes its agentic capacity to the vitality of the materialities that constitute it’ (Bennett, 2010, p.34). Consideration of the physical composition of telecommunications devices today has the ability to reveal the implications behind their manifestation and proliferation.

As the question is stated in chapter 12 of ‘*A Thousand Plateaus: Capitalism and Schizophrenia’*, ‘how are we to define this matter-movement, this matter-energy, this matterflow, this matter in variation that enters assemblages and leaves them?’ (Deleuze and Guattari, 1987, p.407). An overview of the life cycles involved in rendering the materiality of digital technology brings this concept to light, almost as if an inanimate gravitational force was pulling together all of the necessary components to physically create pieces of modern media, as is stated in the book ‘we may speak of a machinic phylum, or technological lineage, wherever we find a constellation of singularities, prolongable by certain operations, which converge, and make the operations converge, upon one or several assignable traits of expression’ (Deleuze and Guattari, 1987, p.406). In highlighting the multi-dimensional nature of these processes, the authors describe how variation ‘creates the technical assemblages, whereas the assemblages invent the various phyla. A technological lineage changes significantly according to whether one draws it upon the phylum or inscribes it in the assemblages; but the two are inseparable’ (Deleuze and Guattari, 1987, p.407).

When what could be described as archaeological artefacts sourced from under the ground within the nation today known as Democratic Republic of Congo make their way from their original locations towards their eventual destinations across the 11 stages outlined above, it is observable that what drives this motion overarchingly is the motivation of human actors to make monetary profit at each stage. Deriving from similar processes with regard to natural resources which took place during what is known as the colonial era, some of which have been outlined in the previous chapter, the application of monetary value to what were for example originally pieces of rock may stand as the single biggest agential factor in unifying once disparately located materials. The application of a theory rather than a universal, an inherent paradox can be found at the site of the facilitation of global transactions via the medium of telecommunications in consideration of the physicality of its devices.

GEOLOGICAL ASSEMBLAGES



(Source: International Peace Information Service - ipisresearch.be)

As has been examined in a previous chapter of this text on DRC history, materials mined in this region and eventually used in the manufacture of various forms of technology have been in demand extensively throughout the course of the 20th century and into the 21st. Whether it be the rubber trade in the 1910s, palm oil in the 1920s, uranium in the 1930s or coltan in the 1990s, in the context of global supply chains this pattern has become cultural on the part of organisations seeking to generate profit from raw materials. The rate at which raw materials are sourced as well as the quantity or mass used in manufacturing processes have largely been dictated by market forces as is indicated when one considers that 'cassiterite and coltan were discovered in the Kivu region in 1910' (International Peace Information Service, 2012, p.16), yet it wasn't until many years later that the mining of these two materials began to take place on an industrial level. In relation to the mining of tantalum, it has been noted that 'it was actually already before digital culture that this specific mineral (often mined in the war-ridden territories of Congo) became mapped as part of the geophysical politics of the twentieth century' (Parikka, 2015, p.iix) as the United

States Bureau of mines labelled this material as ‘among the most vital in 1952 to the United States defense program’ (Klare, 2012, p.29).

In relation to the 11 supply chain stages outlined ealier, the notion of a geological assemblage is most relevant at the beginning and end of the process (points 1 and 11) when these materials are integrated with the earth. The characteristics of what were once pieces of rock lying in situ under the ground or on the earth’s surface and human beings’ desire to harness these abilities for manufacturing processes can be found to be coexistent in the physical manifestation of digital media forms. On one level, the phenomenon of the natural occurrence of such geological artefacts as they are found as part of the earth’s surface can aptly be described as an assemblage, albeit one which is fundamentally independent from the agency or intent of human beings. The process which links this primary stage to what follows vis a vis forms of rock being turned into metals has been described as a study ‘in which the grounds of media are ungrounded through the actual geologies of mining, materiality, and the ecosophic quest becoming also geosophic’ (Parikka, 2015, p.23).

Although the 3 case studies included in this text feature coltan, cobalt and cassiterite because they are key ingredients in the manufacture of modern media devices such as the smart phone or the laptop, there are several other materials sourced from within DRC which would warrant their own case study chapter in the context of digital media, for example germanium, tungsten or gold. As has been highlighted at earlier points for example ‘between 1950 and 1980, while the Kipushi deposit was worked at full capacity, DRC was the world’s largest germanium producer’ (Global Witness, 2007, p.14). The most common use of germanium is as a semiconductor, it is also used in transistors and in integrated circuits and as an alloying agent and a catalyst. Another key use of germanium is in infrared spectroscopes and infrared detectors and in products such as remote controls for televisions. Tungsten or wolframite is a key ingredient in mobile phones as it is used in the manufacture of motors which enable devices to vibrate. In simple terms, the geological strata of metals or sedimentary deposits found within the country has a strong relationship to the physical manifestation of telecommunications devices. This is not as if it wouldn’t be possible for industry to source each of these materials from other regions of the world, however the reason DRC has played such a prominent role is because of inequalities and inconsistencies in global economic systems which mean that these materials are sourced cheaper here than other places.

As emphasis in the global economy has continued to evolve and the majority of materials used in the manufacture of media forms are understood as being metals, discourse around the term ‘metallurgy’ has become increasingly relevant. That said and in a holistic sense, it has been identified that ‘as expressed in panmetallism, metal is coextensive to the whole of matter, and the whole of matter to metallurgy’ (Deleuze and Guattari, 1987, p.411). In reference to phenomenological processes involved in the instantaneous distribution and reception of information via digital technologies ‘it is as if metal and metallurgy imposed upon and raised to consciousness something that is only hidden or buried in the other

matters and operations' (Deleuze and Guattari, 1987, p.410). Furthermore, the 'constellation of singularities' as referred to in '*A Thousand Plateaus: Capitalism and Schizophrenia'* is very much applicable at the point of raw materials being sourced from the earth, their location and formation unbeknown until the tools of miners physically reach them. Despite attempts at gathering geological data about which materials can be sourced where and in what quantities on the part of organisations such as US Geological Survey in 2010 for example, much of this work has been done by artisanal miners, toiling for long hours in the heat without adequate equipment only to be paid a comparative pittance for their work.

Awareness of the circumstances around the mining of digital minerals has grown in more recent years and manufacturers have consistently sighted difficulties in tracing the origin of materials across complex supply chains. The degree to which this is true depends on the case of each material. However, indicative of the geological variety found within the raw material itself in the case of what are known as the 3TGs (tantalum, tin, tungsten and gold), it has been highlighted that 'contrary to what some companies allege, we found that it is fairly straightforward to tell from where the minerals originate, as both dealers at the buying houses and government mining inspectors demonstrated to us. Each sack of minerals had different coloration and texture, depending on which mine it came from' (Prendergast and Lezhnev, 2009, p.3). Although the electronics industry is not the only sector which utilises these materials, it is certainly the largest. Other industries with a significant stake include tin can manufacturers, industrial tool and light bulb companies for tungsten, and aero-space and defense contractors, as well as the banking and jewellery industries in the case of gold (Prendergast and Lezhnev, 2009, p.7).

If one is to consider the life span of digital media products and the materials from which they are manufactured as a cycle in itself, the question still remains of what came before these rock formations and what will come afterwards once these materials again become integrated in the earth's crust. Understanding of these prior stages is subject to speculation as theorists grapple with the question of how geological artefacts are formed through world events such as ice-ages, in attempting to transcend the finite nature of a human life which fundamentally has a beginning and an end. An indication of the way in which industries around particular materials are subject to different circumstances at different times and how a culture of exploitation of DRC's resources has become endemic on the part of the global economic system is highlighted when considering that at one stage in the 1930s countries such as the USA and Russia are said to have believed that the only place uranium could be sourced was the Shinkolobwe mine in Katanga province. Yet 'the Shinkolobwe mine, which supplied the radioactive materials to produce the atomic bombs during World War II, partially flooded in 1956 and no official production has been recorded from the mine' (Global Witness, 2007, p.38). In search of a reason why such short-termism has been able to persist and continue to significantly affect the lives of people in the regions of DRC where such raw materials are mined, it has been suggested that one should 'look to long-term strings of events: to selfish intentions, to energy policy offering lucrative opportunities for energy trading while generating a tragedy of the

commons, and to a psychic resistance to acknowledging a link between American energy use, American imperialism, and anti-Americanism; but look also to the stubborn directionality of a high-consumption social infrastructure, to unstable electron flows, to conative wildfires, to exurban housing pressures, and to the assemblages they form' (Bennett, 2010, p.37).

DRC's wealth of resources has been characterised a resource curse in the sense that this is one of the richest areas of the world in terms of geological artefacts, yet it is one of the poorest monetarily. Various 'resource curse' theories attribute conflict to competition over proceeds from the trade in the region's minerals, perhaps none more pertinent than the resource dependence theory (RDT) proposed by Pfeffer and Salancik (1978). Described as the fundamental unit behind intercorporate relations, a network of interdependencies when coupled with uncertainties about the actions of vested parties are said to result in patterns of dependence which produce interorganizational as well as intraorganizational power, where such power has some effect on organisational behaviour. Moreover 'a resource may be critical to the organisation even though it comprises a small proportion of the total input. Few offices could function without electric power, even though the utility may be a relatively small component of the organisation's expenditures' (Pfeffer and Salancik, 2003, p.46). Concurrently, 'changes in the way an organisation operates are bound to affect some departments more than others, or withdraw resources from one department to endow another, and this will generate internal resistance which must be overcome through negotiation' (DeLanda, 2006, p.42).

In simple terms in the context of DRC, the resource curse phenomenon has been expressed to the extent that 'mineral exploitation has impeded long-term economic development' (Geenen, 2012, p.8). These minerals are commonly referred to as 'conflict minerals', as their control, exploitation, trade, taxation, or protection contribute to, or benefit from the context of, armed conflict. To provide an indication of the geography involved, the table below denotes in which provinces of the country particular materials are sourced (in 2015 the country's 11 provinces were replaced as 26):

PROVINCE	METAL
Bandundu	Diamonds, gold, petroleum
Bas Congo	Bauxite, oil shales, limestones, phosphates, vanadium, diamonds, gold
Equateur	Iron, copper and associates, gold, diamonds
Orientale	Gold, diamonds, iron
Kasai Oriental	Diamonds, iron, silver, nickel, tin
Kasai Occidental	Diamonds, gold, manganese, chrome, nickel

Katanga	Copper and associates, cobalt, manganese, limestone, uranium, coal
North Kivu	Gold, niobium, tantalite, cassiterite, beryl, tungsten, monzanite
South Kivu	Gold, niobium, tantalite, cassiterite, sapphire
Maniema	Tin, diamonds, cassiterite, coltan

(Source: World Bank, 2008, p.14)

Another consideration in relation to these mining industries in a geological context are the long-term environmental consequences such as the effect on biodiversity, deforestation or extinction of species. Ironically and paradoxically it is believed that charcoal accounts for 85% of domestic energy use in DRC (Milburn, 2014, p.873), yet one can say with some certainty that materials from DRC are found in the pocket of almost every user of wireless technology in the modern day.

ASSEMBLAGES OF TELECOMMUNICATIONS

Whether it be in relation to interconnectivity, the facilitation of economic activity or in manufacturing processes, there are a number of dimensions to the assemblage involved in today's world of telecommunications, yet a unity can be found to exist among the binary theories which underpin digital ecologies. Set within the scientific capabilities of devices and the triangulation of wireless information between them, abilities which have continued to evolve and develop throughout the course of recent history from the radio receiver to the television set, to the advent of the mobile phone and laptop generation, the physicality of such objects and the materials from which they are comprised would seem an appropriate anchor of comprehension. Moreover, a progression is observable whereby the abilities of a variety of products have been encapsulated in one centralised form. Among the supply chain stages highlighted earlier, the telecommunications assemblage culminates in manufacturing processes which bring together previously disparate elements to form one entity (points 7 to 9).

The ability to communicate across long distances instantaneously could be said to constitute the emergent properties of the telecommunications device itself as an assemblage. In summary, large tech firms have been expressed as 'having internalised a large number of economic functions' and 'have for that reason acquired a certain freedom of geographic location. This mobility makes these firms highly deterritorialised even when they exist as national corporations, a deterritorialistion that is greatly intensified when globalisation liberates them from the constraints of a national territory' (DeLanda, 2006, p.81). Discourse around the branch of assemblage theory which accounts for participation among telecommunications media is also linked to the concept of the reach of wireless information constituting a process of urbanisation among what has been described as a

'posthuman' landscape (Shaw, 2017). As part of what has been dubbed an era of 'post-truth' (McIntyre, 2018), the role of digitalised or computerised devices becomes almost inseparable in bringing about circumstances whereby there exists no direct relationship between what is real and what is indisputable. 'Everywhere, the empirical multiplicity of former 'natural' agencies overflows the narrow boundary of matters of fact. There exists no direct relation between being real and being indisputable' (Latour, 2005, p.111).

Wireless telecommunications may be considered a medium in and of themselves and indeed its receivers and distributors of information as mediators. In this light, attention has been paid to the fact that 'mediators transform, translate, distort, and modify the meaning or the elements they are supposed to carry' (Latour, 2005, p.39). Furthermore, 'no matter how complicated an intermediary is, it may, for all practical purposes, count for just one—or even for nothing at all because it can be easily forgotten. No matter how apparently simple a mediator may look, it may become complex; it may lead in multiple directions which will modify all the contradictory accounts attributed to its role' (Latour, 2005, p.39). Despite the vast lineages of technological advancement which have provided the backdrop of knowledge required in order for personal telecommunications devices to have become increasingly ubiquitous on a global scale, there are also notable identifiable limitations when it comes to their capabilities as communicators. Expressed in another way 'a technological invention that allows a conversation to take place at a distance affects its identity not by changing it into some other form of social encounter but by blurring its spatial boundaries, forcing participants to compensate for the lack of co-presence in a variety of ways' (DeLanda, 2005, p.55).

To consider the theoretical basis for telecommunications to take place among the digital realm on a physical level, the reduction or encoding of all possibilities to becomes a series of black and whites, ones and zeros, yesses and no's, has made it possible to mechanise the distribution of information in a practical sense. This phenomenon is conceptualised through the analogy of the game 'Go' in the writing of Deleuze and Guattari in stating that 'go pieces are elements of a nonsubjectified machine assemblage with no intrinsic properties, only situational ones' (Deleuze and Guattari, 1987, p.353). This comparison is expanded upon as the text continues; 'a Go piece has only a milieu of exteriority, or extrinsic relations with nebulas or constellations, according to which it fulfills functions of insertion or situation, such as bordering, encircling, shattering' (Deleuze and Guattari, 1987, p.353). In the same way that viewing an informational world via the theory which underpins it enables us to view this as a medium holistically and therefore as an assemblage (i.e. its constituent parts), the implications of such progressions in telecommunications in recent years can be correlated with territorial disputes in DRC with respect to the materials involved.

The concept of deterritorialisation as highlighted in *A Thousand Plateaus: Capitalism and Schizophrenia (1987)* pertains to a duality in the context of the relationship between the use of DRC's minerals in telecommunications devices. In one light in relation to the notion of capital, 'land as the object of agriculture in fact implies a deterritorialization' (Deleuze

and Guattari, 1987, p.441). But in another, the matter-movement, matter-energy or matter-flow as constituted among the technological lineage amounts to a 'destratified, deterritorialized matter' (Deleuze and Guattari, 1987, p.407). Furthermore, 'if a network property fails to coincide with formal authority, the result may be conflict and stalemate in the mobilisation of resources' (DeLanda, 2006, p.42) and ultimately 'conflict has the effect of exaggerating the distinction between 'us' and 'them', that is, it sharpens the boundaries between insiders and outsiders' (DeLanda, 2006, p.58).

As was touched upon briefly in the previous section, the notion of traceability with regard to the origin of natural resources has become increasingly prominent, both in the context of the United States government's geological survey for example in locating potential quantities of desired materials as well as at the later stage of the users of devices themselves being traceable among an assemblage of geographic locations or internet protocol addresses. Studies have shown remote sensing techniques to be an efficient tool for geological mapping (Rawashdeh, Saleh and Hamzah, 2006).

In late 2021 and in a political move designed to restore American leadership in the manufacture of semi-conductors, the United States government passed what is known as the 'U.S. Innovation and Competition Act', highlighting the slavery of workers in China's Xinjiang province and prompting chip manufacturer Intel to apologise to its Chinese customers (Sweeney, 2021). Traceability has also been identified as potentially the most effective way to improve circumstances for mine workers in DRC as has been pointed out; 'achieving traceability of minerals is critical in these efforts; however, it has proved extremely difficult because minerals supply chains 'may span thousands of miles across the globe, involve numerous suppliers, retailers, and consumers, and be underpinned by multinational transportation and telecommunication networks' (Taka, 2016, p.42). In recent years, a number of initiatives have been implemented aimed at bringing about greater accountability among supply chains of digital minerals via greater officialdom or the labelling of bags for example as 'electronics industries were the first to be blamed for using conflict minerals and their corporate responsibility questioned by civil society organizations' (Taka, 2016, p.38). These circumstances will be examined in greater detail vis a vis the cases of specific materials in the following case study chapters.

An inherent irony can be found whereby technologies such as those utilised by the United States Geological Survey have largely not been afforded to mine workers in DRC despite the devices which make this possible having been likely to have been constructed from materials sourced from within the region. Remote sensing technologies have continued to be used in other ways such as via global positioning satellites or motivated by prevention of terrorist attacks for example through the recognition of particular hazardous materials. The relationship between the physical and the social in the context of traceability has been expressed whereby 'it is true that, at first sight, the difficulty of registering the role of objects comes from the apparent incommensurability of their modes of action with traditionally conceived social ties' (Latour, 2005, p.74).

ASSEMBLAGE NETWORKS OF ECONOMY

As has been explored earlier in this chapter, in an attempt to view the world of wireless interconnectivity and resultant forms of economic activity and communication between individuals, the scale and sphere of influence of which are increasingly boundless, the physicality of the devices themselves which make all of this possible can be understood as an assemblage. Consistent with this and yet in another light, participation among these networks on the part of citizens also constitutes its own assemblage, one which has been described as rhizomatic, for example, if we are to picture the lines of telephony on the surface of the earth but also one which is ultimately housed within the two-dimensionality of the screen as a plural entity. Behind this display itself are the assemblages of the supply chains of raw materials and components, the building blocks behind this physical manifestation. In reference to the supply chain stages outlined above, economic assemblages are applicable at several points as in some cases the same material mineral may be profited from several times over in moving from one location to another.

Issues around the finiteness of the materials involved in these industries and therefore their longevity and sustainability has been addressed in the sense that 'the stability and resiliency of supply chains, as well as their adaptability and responsiveness to events in a global environment of increasing risk and uncertainty, can only be rigorously examined from the view of supply chains as network systems' (Nagurney, 2012, p.3). Attention has also been paid to the fact that 'policies surrounding supply chain networks today may have major implications not only economically, but also socially, politically, and security-wise' (Nagurney, 2012, p.3).

As we move further into the 21st century, wireless networks of communication increasingly constitute economic infrastructures. In a global context, fairness among these networks has been hard to come by due to innumerate predetermining factors including histories of exploitation of natural resources during the colonial era, some aspects of which are still being felt today. Concurrently, 'some of the ranking or sorting processes that maintain the differential access to economic and cultural capital are resource dependence relations that exist not between people but between institutional organisations' (DeLanda, 2006, p.65). In the case of DRC and to highlight the extent to which this country's resources have been exploited by those in other parts of the world, one can return to look at the economic circumstances at earlier stages. For example, it is thought that 'in the early 1970s, about 70 per cent of state revenues came from copper (Gécamines) and mineral resources represented over 80 per cent of national exports' (Geenen, 2012, p.8). The copper piping which connects domesticised items such as gas boilers or the plumbing in our bathrooms may indeed have come from mines in the province of Katanga. That said and despite a trope which has proven to repeat itself whereby the Congolese population are largely not in receipt of such forms of wealth despite it literally having come from underneath their feet in many cases, it is still thought to be the case on the part of the international community that 'generally, the mining sector is seen by the government and by foreign

donors as the best opportunity for the DRC to develop its economy and start to rebuild the country after the war' (Global Witness, 2007, p.12).

The pluralistic use of the term 'develop' here is also somewhat problematic as it pertains to the notion that some parts of the world are 'developed' and others are 'developing'. It has also been noted that the population in nations outside of the west have historically viewed capitalism as 'a private club, a discriminatory system that benefits only the west and the elites who live inside the bell jars of poorer countries' (Desoto, 2000, p.219). To elaborate on this, it has been pointed out that 'observing levels of hierarchy among systems leads us to ask a fundamental question. If capitalism is a system, what is it a component of?' (De Angelis, 2007, p.36). Here the concept of the assemblage is applicable in the sense that to the capitalist, any given quantity of any given material is reducible to its monetary value. Contextualised as being 'a form of social cooperation', the term capitalism has been defined as being 'loosely as a social system of production, distribution, and exchange based on the profit motive and a concentration of control of the means of producing, distributing and exchanging in few hands' (De Angelis, 2007, p.36). Despite the attempts of colonial entities historically, these ideas are not universal rather they are cultural as after all a piece of rock taken from under the ground does not possesses intrinsic monetary value, rather this value is added to it through processes of perception which in the context of theories of assemblage amount to its emergent properties. When looking at the origins and history of how monetary value has been attached to raw materials, it has been stated that 'the central belief of this doctrine was that the wealth of a nation was based on the amount of precious metals (gold and silver) that had accumulated within its borders. This monetary policy, it is clear today, is based on mistaken beliefs about the causal relations between economic factors' (DeLanda, 2006, p.113).

In recent history in the eastern regions of DRC such as North Kivu, it has been identified that 'the control, exploitation, trade, taxation, or protection of 'conflict resources' has both contributed to armed conflict as well as benefitting from the context of armed conflict' (Taka, 2016, p.40). An economic interdependency between miners and armed groups is reinforced where 'the fighting between foreign armies and their Congolese proxies is centred around the control over the regional trade in resources' (Raeymaekers, 2002, p.7). In a more general context, it has been identified that 'any process which calls into question the extent of legitimate authority, such as a clash between organisations with overlapping jurisdictions can, can destabilise their boundaries, and if the conflict is not resolved, compromise their identity' (DeLanda, 2006, p.74). As ever and particularly with regard to Eastern DRC and the Great Lakes region more generally, it is important to bear in mind the problematic nature behind the formation of Congo's identity with regard to the imposed politics of borderlands and the history behind the creation of these borders.

In relation to circumstances around the sourcing of coltan in particular, the brutal armed conflict which erupted in Zaïre in 1996 and continued over the ten years that followed created an environment of chaos and confusion in which illegal and unaccountable

practices flourished as the strategic importance of coltan for the high-tech industry prompted military actors to engage themselves into this lucrative business. In the years which have followed, many commentators have criticized a lack of governance in bringing about greater formalisation to such industries on the part of the administration of the DRC central government, based a mere 2,500km away in Kinshasa as exemplified in the statement that 'the central government's lack of control over the eastern part of the country, including the artisanal mining sector, offers an opportunity for all armed actors to profit from the mineral wealth' (International Peace Information Service, 2012, p.19). Even in more recent times, factors such as the 'extortionate price for a mining licence from national government means that 90% of the mining goes unregistered' (Taka, 2016, p.39), potentially providing some validity to this criticism. However, a lack of understanding of the history outside of colonialism of this region becomes obvious in such analyses and various historical events have shown a pattern whereby 'when the state takes tighter control over the informal sector, more powerful actors are more likely to benefit' (Geenen, 2012, p.16).

Moreover, the result of the industries around digital minerals 'has been that vast profits have flowed out of the country, and into the pockets of corrupt leaders and businessmen, while the Congolese population continues to be subjected to extreme poverty' (Global Witness, 2007, p.3). In relation to the assemblage of global economics behind this, attention has been paid where 'this demand for these "technology minerals" has been growing since the 1990s although it can be fluctuated sharply from technological advancement in an industry and cause boom and bust' (Taka, 2016, p.40). After all, these are markets which have been subject to whims and manoeuvrings the same as any market as part of a plane of consistency has been historically. Many of the very large price spikes which have occurred in recent decades in mineral markets have been caused by a sudden expansion in the demand for a mineral with very specific properties due to some technological innovation (often in the electronics industry) (Buijs and Sievers, 2012, p.11). For example, 'artisanal producers of coltan were severely impacted by the rapid decline in the price of this commodity (used in cell phones) early in this decade' (World Bank, 2008, p.2).

The application of a variety of economic models aimed at greater fairness have been considered in relation to these circumstances, for example in the form a price equilibrium model. In this case, 'not only is production of the commodity in question considered at multiple locations or supply markets, with appropriate underlying functions, but also the consumption of the commodity at the demand markets, subject to appropriate functions (either demand or demand price) as well as the cost associated with transporting the commodity between pairs of the spatially separated supply and demand markets' (Nagurney, 2012, p.4). However, in order for such ideas to be implemented effectively, a requirement for greater economic infrastructures as exemplified in the context of what are referred to as more industrialised countries becomes apparent.

To return for a moment to the geological assemblage in which digital minerals are located and the monetisation of this section of land, a specific lens forces its way to prominence as if it were universal. Asserted as if this could be the answer to some of the issues around the sourcing of these materials and specifically in relation to management of mining sites around DRC, it has been said that 'rent-seeking culture, is at the heart of the challenge that the Government must overcome to ensure sustained sector growth with good governance' (World Bank, 2008, p.1). This quote is taken from a report which, despite being influential for instance in the implementation of the United States Government's Dodd-Frank act of 2010 which effectively prohibited mining in parts of DRC, largely fails to acknowledge the role of the wider industries these mining activities are a part of. In general, this 2008 World Bank publication seems to be designed for an audience interested in getting involved in exploiting DRC's resources as it outlines guidelines which multinationals ought to be aware of. Despite bringing to light greater transparency with regard to the monetary situation in DRC from the point of viewpoint of western capitalist infrastructures, the report places emphasis on the issue of taxation from central government and the ways in which this system could be improved. As the report elaborates along these lines there appears to be very little mention of violence or loss of life as experienced by people on the ground in these regions.

Some initiatives aimed at greater fairness among the industry of digital minerals have attempted to address the issue of property rights as a way of enabling the population to be included in economic activity around the resources sourced from within the country. Inherent within such ideas is a distinction between private property rights as assigned to individuals, and common property rights which are assigned to the state with the basic condition for economic growth thought to be in guaranteeing people full property rights, which are transferable and protected by state law (Geenen, 2012, p.3). Where the mining sector in DRC was previously dominated by public enterprises particularly in the province of Katanga, the aim in more recent times on the part of central government has been identified as to 'attract private investments in exploration and exploitation' (Geenen, 2012, p.10). It has therefore been recommended that 'the Congolese government should adopt the role of a regulator or facilitator – by granting mining titles - instead of an operator' (Geenen, 2012, p.10). However, this is of course easier said than done in a country which has a land mass one quarter the size of the United States and which has a diverse population of over 90 million and where inter-regional travel is often only possible by air. The notion of corporate social responsibility (CSR) has become an important part of collaborative activities between firms and NGOs in DRC with what have been termed philanthropic activities undertaken on one hand, and integrative initiatives on the other. Some research has shown such models to be difficult to apply even in what are referred to as 'normal or typical' CSR projects (Jamali and Keshishian, 2009), let alone in conflict settings, where partnerships' objectives often seem much broader and also in community terms beyond the organisational realms (Kolk and Lenfant, 2013, p.9). In an effort to bring some objectivity to a global economic system which is implicated in such injustices, it has been noted that 'when we talk about the articulation between social doing and values, we

are talking about human co-production (a broad concept of human production, not tied to receiving a pay check, and one that includes direct reproduction of life), of how social coproduction is articulated, of how relations among the co-producers are reproduced while they reproduce the conditions of their livelihoods' (De Angelis, 2007, p.34).

Other ideas in working towards a more equitable circumstance with regard to the sourcing of minerals from within DRC have been based on the notion of 'business for peace'. This covers the more generic contributions of business to further the cause of peace regardless of whether they are directly involved in a conflict zone. The business-peace nexus has been examined through various lenses. For example, in some instances 'one has concentrated on business in conflict zones, with a clear emphasis on embracing 'do no harm policies or implementing codes of conduct or multi-stakeholder schemes to certify 'conflict' commodities' (Kolk and Lenfant, 2013, p.5). Other aspects have focused 'on the role of the private sector in contributing to economic development as a prerequisite for stability and peace, or through studying the role of a particular industry (such as tourism, sports, or mining)' (Kolk and Lenfant, 2013, p.5). Despite the potentially oxymoronic nature of the term, 'business for peace', it has been explored from a variety of disciplines, particularly political science and international relations and management, business ethics and business and society perspectives.

ASSEMBLAGE NETWORKS OF PEOPLE

To consider the experience of a mobile phone user in DRC and how this experience differs from that of someone in a European country for example may bring to light inherent inequalities with regard to levels of participation among the medium of wireless telecommunications. In reference to the supply chain stages involved in the transportation of minerals from DRC as outlined in the opening section of this chapter, assemblages involving people are applicable at almost every stage from mining to manufacturing processes and ultimately the consumer. As a footnote however, a distinction can be made between those stages at the beginning and the end of this cycle characterised as being of geological nature, highlighting the finiteness of the lifespan of devices as consistent with that of a human life. Somewhat enigmatically and ironically, a description of an anecdotal yet symbolic account of an advertising campaign in DRC in 2006 by British mobile telecommunications giant Vodafone who control a significant portion of the African

wireless market reads; ‘playing on Congolese cultural ideas about human interconnectedness and unity, a billboard which could be found at key intersections in the eastern cities of Goma and Bukavu featured coltan miners happily harvesting away the ore in a harmonious commodity supply chain. The slogan read ‘one nation, one network’ [une nation, un r´eseau]. The Vodafone slogan appears ordinary and unexceptional unless one is aware of the extraordinary political economic context of coltan’ (Mantz, 2008, p.37). In a similar vein, yet 15 years later and following the company having rebranded itself, the image adjacent is taken from a Vodacom advertising campaign from 2021, the slogan here reading ‘une nation, un rêve de gloire, un grand réseau’ – one nation, a dream of glory, a big network.

Notwithstanding and in today’s context, a study of levels of Vodacom network coverage in DRC versus the example of that of Vodafone in Italy shows graphically that despite all of the technological advancement in the development of second generation to fifth generation mobile technologies this is still a starkly uneven playing field. This is of course particularly ironic given the role of materials which originate from DRC in among global telecommunications infrastructures.

Italy - DRC - Vodafone network coverage comparison in 2021:

(Source: https://www.nperf.com/)

In an effort to unpack some of the reasons why many people in DRC are among the poorest in the world monetarily and in some ways consistent with the line of criticism often exemplified in the analysis of non-governmental organisations, much of which points the finger of blame at the national government based in Kinshasa, it has been identified that ‘generations of mismanagement and the arbitrary use of state power for personal or communal gain have left deep scars on Congolese society and a particular individualistic

logic to economic and political relations' (Garrett, 2009, p.8). Where much has been made of the effect of an increasing proportion of communications among the global population now taking place remotely, a phenomenon which has been accelerated during the coronavirus pandemic, a parallel can be drawn between tendencies towards individualisation and the way in which the prior influence of Congolese national institutions have now diminished, particularly in the context of mining in the south of the country. It has been said that this fragmentation is a 'result of a historical evolution during which the Congolese institutional structures crumbled and were replaced entirely with personal networks' and that 'in the present lawless environment, only the most ruthless risk-takers succeed' (Kennes, 2005, p.152).

Previously a stronghold in the unionisation of mine workers stemming from movements prior to the country gaining independence from Belgium which contributed to a wave of secessionism whereby Katanga itself briefly claimed independence in the early 1960s, disunification among this politicised workforce is also a phenomenon which has been paralleled in many other parts of the world in the post-industrialised era. The computer revolution and the development of unprecedented capabilities in wireless telecommunications have resulted in a new complexion with respect to the worker. Objectively, these now domesticised capabilities are probably the closest human beings have come to being able to communicate telepathically, with some commentators having heralded this the age of democratisation as all participants are ostensibly equal among the physicality of screen-based devices. The participation of individuals to the medium via these apparatuses is itself a particularly pertinent assemblage and one which is becoming increasingly difficult to walk away from in the context of today.

The link between the mineral trade and the activities of numerous armed groups in DRC has been well documented since the beginning of this century. Reports that describe the conflict have sought to uncover the motives of the warring parties and make recommendations. Documentation has been published by various actors including advocacy groups, local civil society, international organisations and academics with analyses and recommendations tending to vary considerably. It is said that 'the Democratic Republic of the Congo, scene of the deadliest conflict since World War II, remains the most dangerous place in the world to be a woman or a girl—in significant part because of the international demand for electronic products that requires minerals found in the Eastern Congo' (Enough Project, 2009, p.1). In relation to the second Congo war (1998-2003), it has been stated that 'over time, it has become clear that the DRC's natural resources were not the cause of the conflict' but that 'these resources were an important factor in prolonging the war, and still contribute to insecurity in the eastern part of the country' (International Peace Information Service, 2012, p.17).

Studies have also examined in detail the motivations of armed groups in the east of the country such as the CNDP (National Congress for the Defence of the People), FDLR (Forces Démocratiques de Libération du Rwanda), FARDC (Armed Forces of the Democratic

Republic of the Congo) as well as local defence militias known as the Mayi-Mayi (Spittaels and Hilgert, 2008). It has been said that the formation of armed groups in Eastern DRC can be attributed to 'a set of diverse and complex factors, often rooted in local dynamics' including 'perceived exclusion on the basis of ethnicity or regional origin, conflicts over land ownership, absence of security, and the inability of government institutions to ensure the rule of law' (Global Witness, 2009, p.18).

Another question which goes some way to addressing the root causes of the various conflicts experienced within the country over the course of several decades is with regard to where the weapons involved have originated from as part of what has been a 'war economy' (Raeymaekers, 2002, p.8). Countries or nations who are said to have legally provided the Great Lakes region with weapons or military assistance between 1998-2002 'include the Russian Federation (to Angola and Uganda), Kazakhstan, Belarus, Ukraine, Slovakia (all to Angola), France and Italy (to Uganda), South Africa (to Rwanda, Burundi, Namibia, Zimbabwe and Angola), China (to Kinshasa, Uganda and Rwanda), Poland (to Uganda and the DRC), North-Korea (to the DRC) and the US (to Zimbabwe, Angola and Rwanda)' (Raeymaekers, 2002, p.26). In simple terms, it is clear that the ongoing cycle of violence on the ground can be attributed to the seeking of control of territory. Migration has also been a very significant factor in recent times within DRC as people flee violent conflict, all of which has consistently amounted to one of the world's worst humanitarian crises with more than five million lives lost and causing approximately 2.2 million internally displaced persons as well as many Congolese refugees (Taka, 2017).

The World Bank report issued in 2008 estimated that 'between 500,000 and 2,000,000 artisanal miners' were currently at work in DRC affecting 'the livelihood of between 8 and 10 million out of 60 million Congolese citizens' (World Bank, 2008, p.142). The report also highlights that at the time of writing, children comprised around 40% of all artisanal miners or were present with their family on artisanal mining sites and that in many situations, alternatives to mining such as schools did not exist or were too distant (World Bank, 2008, p.144). It was also identified at this time that the average wage for a miner was between $1 and $5 a day (Prendergast and Lezhnev, 2009, p.2). A definition of the term 'artisanal' in this context is said to be contingent on three main factors; the use of techniques that are capital and technology-poor, activity which is developed by individuals alone or in small groups which perform only one activity in the value chain and thirdly a lack of relationship with state regulations (Josep and Taka, 2012, p.139). In an attempt to delineate the remit of artisanal mining in DRC and not necessarily specifically in relation to telecoms industry, it has been noted 'the artisans' activity spreads from the northeast to the southeast of the country: they mine gold mainly in Orientale Province (Ituri), North and South Kivu; cassiterite in the Kivus; diamonds in East and West Kasai; and copper and cobalt in the south-eastern province of Katanga (Josep and Taka, 2012, p.138).

OBSOLESCENCE

Where considerations relating to sustainability have risen to prominence in recent years, particularly in regions of the world which could be defined as post-industrial, the life cycle of technological products has also come into view. Statistics around quantities of e-waste comprised of discarded items which were once at the cutting edge of capabilities show an exponential increase with 53.9 million metric tonnes generated worldwide in 2019, a figure which stood at 33.8 million in the year 2010 (Toner Buzz, 2021). A major contributor to this phenomenon throughout the course of the history of telecommunications devices across the 20th century and into the 21st, in many cases utilised by a few people among military organisations before being made available to the general public has been a short-termist viewpoint primarily motivated by profitability. In one light, the formula behind the development of new media can be summarised whereby 'to be is to be updated', a tendency which has also been expressed as an equation; 'Habit + Crisis = Update' (Chun, 2016, p.171). One generation of computer hardware and software has followed another at ever shorter intervals including 'inventions that appeared suddenly and disappeared just as quickly, which dead-ended and were never developed further; models that never left the drawing board; or actual products that were bought and used and subsequently vanished into thin air' (Zielinski, 2006, p.2). In reference to the supply chain stages outlined at the beginning of this chapter, obsolescence is encountered as the penultimate juncture in the lifespan of telecommunications devices.

Statistics relating to the recycling of electronic products have been highlighted as conflictual in that they may 'represent an aggregation of different categories of sources such as "home" or in-house scrap, "new" or post-industrial scrap, and "old" or post-consumer scrap' (Resolve, 2010, p.9). In terms of the materials featured among the case studies in this paper, at the time of publication, research showed that approximately as much as 25% of cobalt was being recycled, 30% of tin and 20% of tantalum (Resolve, 2010, p.9). Despite some initiatives which have focused on the replaceability of components amounting to modular methods of design such as Netherlands based mobile phone brand 'Fairphone' or laptop manufacturer 'Framework', the physical materials comprising the vast majority of devices used in an every-day domesticised context will inevitably end up being re-integrated to the earth's surface, marking a full-cycle to the lifespan of digital technology in the re-formation of a post-human geological assemblage. Among the infinite history of this matter itself, the human being's use of it will have ultimately been just a blip on a timeline which has no beginning or end with new media merely existing at 'the bleeding edge of obsolescence' (Chun, 2016, p.171). As the coverage and reach of wireless communications has grown to territorialise much of the earth, a wave of desuetude has been left behind, from transistor radios to early television sets and answering machines.

Where many of the early developments in the internet era were characterised by an open-source ethic which for a time presented the possibility of a more equitable power balance between citizens and the authorities which govern them, much of the more recent progression which has taken place has been of a more proprietary nature with possibilities

dwindling in the quest to remain anonymous as societies hurtle towards increasingly Orwellian circumstances as facilitated by wireless telecommunications.

The implications of accelerated forms of consumerism as facilitated by the increasing ubiquity of wireless telecommunications globally and the resultant forms of obsolescence are manifold. 'In DRC, abandoned mines contribute to a negative legacy of environmental degradation left by past mining activities before rigorous mine closure regulations were developed' (Otamonga and Poté, 2019, p.2). Mining communities can be adversely affected and provided with no benefit during or after mining with mines in many cases becoming abandoned when its managers have not followed 'acceptable mine closure procedures' such as 'returning the land and watercourse to a certain standard of productive or sustainable normal use' (Otamonga and Poté, 2019, p.2). The most serious environmental concerns at abandoned mines include acid rock drainage from underground workings, open pit faces, waste rock piles, and tailings storage areas that were left exposed to the elements or inadequately reclaimed, resulting in the contamination of water with dissolved metals and acidity.

GEOPOLITICAL ASSEMBLAGES

To view the geographic path taken by what have termed 'digital' minerals such as coltan, cobalt and cassiterite as well as those used in other forms of technology such as germanium, tungsten and gold reveals a global web of economic activity involving numerous states and private companies. In relation to discourse around theories of assemblage in a philosophical context, geopolitical factors have been contextualised as properties of 'territorial states as entities' rather than the organisational hierarchies that govern them (DeLanda, 2006, p.113). In reference to the overarching stages among supply chains of digital minerals originating from DRC as outlined in the opening section of the chapter, the notion of a geopolitical assemblage can be seen to retain its relevance at each of the stages involving transportation (namely stages 1, 4 and 9) among a broadly territorialised landscape globally. In highlighting the relationship between people and geological artefacts, it has been noted that 'while high density itself transforms networks into enforcement mechanisms, the presence of conflict increases the activities dedicated to policing a community's borders, not only the physical boundaries of a neighbourhood or town, but the degree to which a community controls its members behaviour and promotes internal homogeneity' (DeLanda, 2006, p.58).

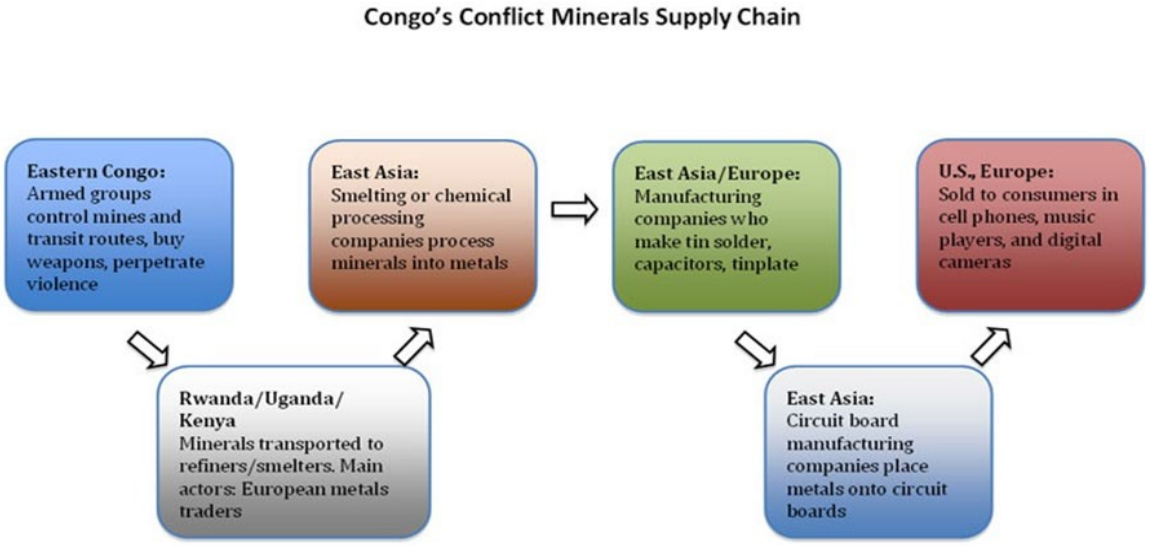
In seeking a circumstance whereby the Congolese people would have greater agency over mining industries it is important to recognise the size of the task at hand in consideration of the history of the region and the way in which global economic inequalities have been perpetuated ever since. It is also important to ask why the work of nongovernmental organisations and presence of United Nations peacekeepers in the region seems to only have had limited impact in addressing these issues and why numerous security council

reports have historically not impacted on organisations such as the International Telecommunication Union (ITU) (Sutherland, 2011, p.11).

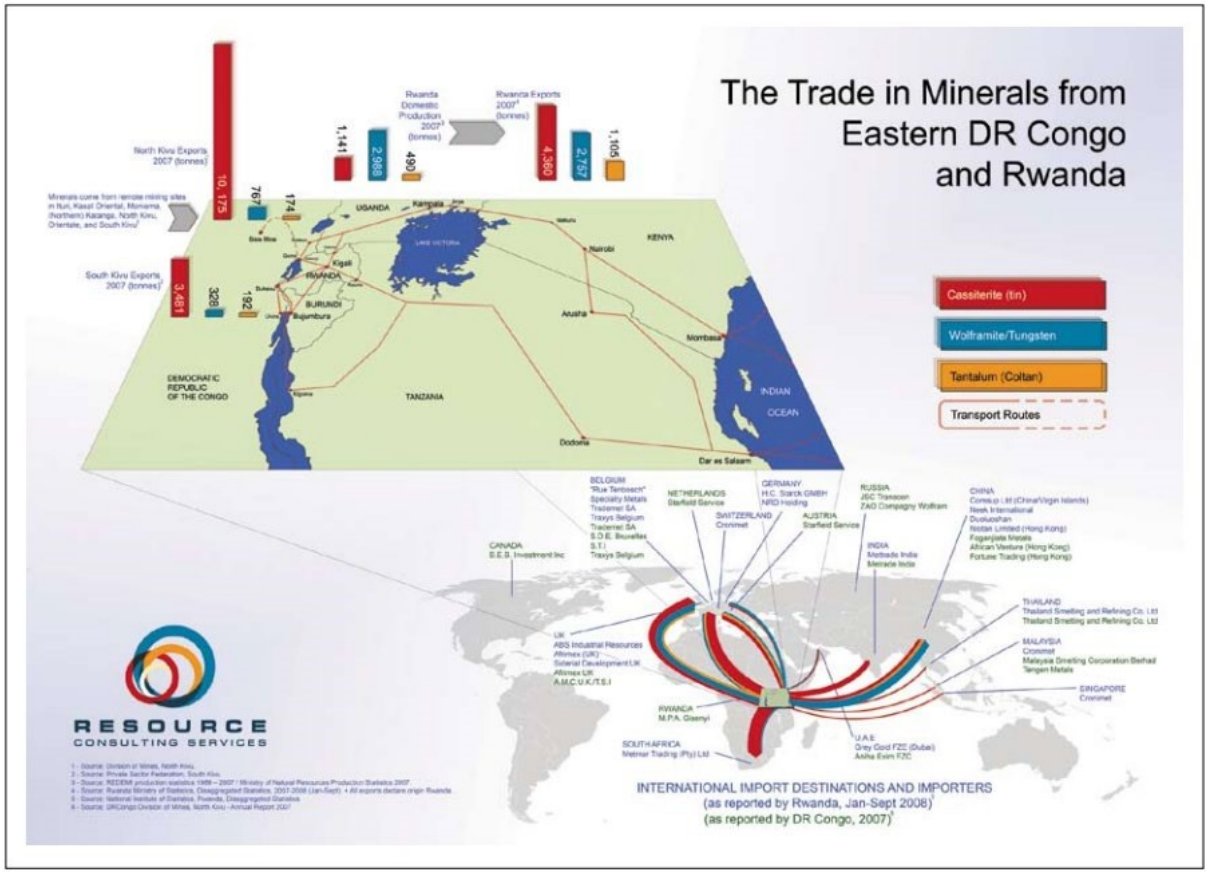
A closer look at these circumstances also reveals that the relationship between DRC and the world of international mining (and politics) cannot be understood within a simplistic conspiracy theory (Kennes, 2005, p.152). Consideration also needs to be paid to the ways in which physical manifestations of digital media products have perpetuated pre-existing inequalities on a global scale. Efforts to establish cleaner and more ethical supply chains of materials such as coltan and cassiterite which originate from Eastern DRC are taking place against a backdrop of entrenched military control and impunity (Global Witness, 2013, p.1). The cause of these conflicts has been expressed explicitly as being 'about the desire to control Eastern DRC's rich mineral deposits' (Global Witness, 2009, p.17).

In relation to circumstances around materials mined in the eastern provinces of North and South Kivu such as coltan, cassiterite and tungsten, numerous reports have noted a tendency whereby these materials are often transported over the border into neighbouring countries such as Burundi and Rwanda where they become registered as official exports. For instance, according to a 2011 study for the International Conference on the Great Lakes Region, 80% of gold produced in DRC was being illegally exported at this time. In the case of gold extraction, attention has been paid where members of the Congolese army have been running taxation rackets in gold mines and along gold trading routes, despite Congolese laws and military directives that specifically prohibit their involvement in the trade (Global Witness, 2013, p.3). Global Witness field investigations in March 2013 revealed how gold produced in Eastern DRC 'that benefits abusive armed groups and high-ranking members of the Congolese and Burundian state armies is laundered through Burundi's domestic gold sector and exported to Dubai' (Global Witness, 2013, p.1).

Indeed, at the time of writing it was declared that 'the majority of the minerals produced in North and South Kivu leave the DRC through Rwanda or Burundi' (Global Witness, 2009, p.6). Circumstances around these transportation routes have changed slightly in recent years for reasons including the implementation of legislation around the US Government's Dodd-Frank act in 2010, the expulsion of the UN presence in Burundi in 2014 as well as the closure of the DRC-Rwanda border in 2018 due to the Ebola outbreak. The sheer quantities of materials which have been exported this way render this a key cog in the global telecommunications industry. The two tables depicted below provide a graphic illustration of this direction of travel, particularly in relation to the supply chain of coltan.



(Source: Enough Project, 2009, p.4)



(Source: Garrett, 2009, p.24)

In a wider sense and one which is not specific to the trade in conflict minerals, it is important to note that not all supply chains are commercial and in fact, given that the number of disasters is growing, as is the number of people affected by them, humanitarian supply chains have emerged as essential elements in disaster recovery in recent times.

Unlike commercial or corporate supply chains, humanitarian supply chains are not managed using profit maximization as a decision-making criterion (since donors, for example, would not approve) but rather cost minimization subject to demand satisfaction under uncertainty is relevant. In addition, such supply chains may need to be constructed quickly and with the cognizant decision-makers working under conditions of damaged, if not destroyed, infrastructure, and limited information (Nagurney, 2012, p.5). Notwithstanding, in the context of the Covid-19 pandemic at the end of 2021, the proportion of DRC's population which has received the vaccine against the disease stood at less than 1% meaning making it the country which ranked the lowest in this regard statistically (Reuters, n.d.), a statistic which is indicative of the geopolitical circumstances which have been affecting the country.

Providing an indication of the significance of conflicts which have taken place close to the site of mining operations in the east of the country, attention has been paid to the fact that 'from the beginning of the 1990's the province of North Kivu entered a cycle of insecurity which started with bloody inter-ethnic conflicts in the territories of Masisi and Rutshuru, and which culminated in the successive wars of 1996 which ended with the fall of Mobutu' (Pole, 2010, p.6). This was also the period during which deposits of coltan were discovered in the territory of Masisi, resulting in a boom in the mining of this material taking place in the year 2000.

However, for all of the negative repercussions, to some extent the trade in materials used in the manufacture of telecommunications has contributed to sustaining the population in the region. In many resource-rich countries, mineral resources are central to development both because they sustain livelihoods, and because they are the principal source of revenue for states to finance security, social services and infrastructure, as well as the principal source for investment in agriculture and other activities which contribute to the economy. In one sense, this positive view of natural resources complements the vibrancy and resilience of Eastern DR Congo's mineral trade, which has managed to remain active and vital in providing 'up to one million livelihoods regionally through the most difficult political times' (Garrett and Mitchell, 2009, p.5).

As has been highlighted earlier in this chapter, a proportion of the analyses undertaken by non-governmental organisations as well as those representing the interests of western states has at times pointed the finger of blame at the central DRC government. Some of the work behind these publications has been based on the notion that the materials themselves are not the source of conflict, rather that corruption among the Kinshasa based government as well as high ranking military officials is to blame. The DRC government has been criticized for its 'inability to maintain the monopoly of violence' (Garrett, 2009, p.5), with some possible reasons for this highlighted in the sense that 'achieving this requires a political process that will inspire the creation of political institutions that can transform incentive systems for economic actors' (Garrett, 2009, p.5). It has also been identified that these institutions are currently structured in ways that weaken the state further as they allow for security around natural resource deposits to be negotiated locally.

Conversely, an adjective which tends to appear with regularity in describing the work of miners in the region is the term 'artisanal'. After all, this is 'a mineral-rich country that has faced a lasting conflict fuelled by the scramble for mineral resources, and where a major part of the current mineral production is artisanal and 'informal'', meaning 'that it takes place beyond state control' (Geenen, 2012, p.2). In recognition of this tendency, some initiatives have been established in order to act as an intermediary between the state and miners on the ground. One such initiative, known as 'PROMINES' was set up as an integrated, multisectoral programme of the DRC Government, funded by the World Bank and the UK Department for International Development (DFID). 'As a multifaceted programme, it covered broad research areas, linking best practices in the artisanal mining sector with good governance and development' (International Peace Information Service, 2012, p.28).

Given the quantity and scale of those organisations and states who may be appropriately characterised as benefactors of this industry and given the timeline of historical events it seems necessary to highlight that a process of merely criticising the DRC government for what has taken place around conflict minerals lacks a deeper understanding of the nuances and forces involved. Another term which appears with regularity is 'illegal exploitation', meaning the organised removal of Congo's natural resources from the country without legitimacy or due return. This is said to have come 'into prominence in the debates around the war of 1998-2003' (Johnson, 2005, p.15).

The early pages of the World Bank's 2008 report provides a general overview of an economic development plan associated to the mining industry in DRC. Among the documentation in this publication is an account of a series of agreements signed by the DRC government in January 2008 with a group of Chinese enterprises, 'including the Exim Bank of China, for investments in infrastructure in return for access to mineral deposits' (World Bank, 2008, p.7). These agreements were said to 'pertain to financing of general infrastructure development in Congo in the amount of US$6 billion, in two tranches, in return for rights to exploit the Mashamba, Dikuluwe, and other mineral deposits' (World Bank, 2008, p.7). Although it is likely that the US$6 billion investment in infrastructure as documented here would not be remotely equitable to the profits gathered from the technological devices eventually manufactured as a result of this mineral exploitation, at the very least there is an element of transparency here. Furthermore, as much as materials originating from DRC have played a prominent role among the physicality of telecommunications devices in recent years, these products have tended to be assembled and manufactured in China in particular.

Several notable milestones around mining legislation in DRC have had their influence on the economy around digital minerals in recent decades. The mining act of 2001, ironically initially drafted by the World Bank (Naugurney, 2006, p.3) which replaced that of 1982, supposedly brought about a revised code which encouraged 'private sector development of the mineral industry', as a report published by the US Geological Survey asserted the principal role of the government to be to encourage and regulate the development of the

industry (Yager, 2012). However, during the years of the Congolese rebellion between 1996 and 2003, implementation of the Lusaka Accord of July 1999 effectively allowed different rebel groups that had divided the country between themselves to effectively constitute themselves as states, with the right to maximize their profits in the territories under their control. 'The coltan boom between 1998 and 2001, or that of cassiterite in the years that followed, without a doubt constituted the nerve center of the war for the different rebel groups.' (Pole, 2010, p.8).

In 2007, following a review conducted by the Minister of Mines in DRC, a governmental commission was established with the goal of reviewing mining contracts signed between private companies and the state or public enterprises. Prior to this, it was thought that more than half of DRC's natural resource exports went undeclared because of tax evasion and lack of governance (Nagurney, 2006, p.3). It has subsequently been asserted that the integrity of the review was questionable due to factors such as that the commission was 'composed entirely of members of the government and civil servants including, among others, representatives of the Presidency, the Prime Minister's office, the Ministry of Mines, the Ministry of Finance and various other ministries' (Global Witness, 2007, p.5). In 2010 and in conjunction with implementation of the US government's Dodd-Frank Wall Street Reform and Consumer Protection Act, the DRC government implemented a 6 month ban on mining in September 2010. Following this and the UN Security Council Resolution 1952 (2010), the DRC government incorporated a directive made in September 2011 obliging all mining and mineral trading companies to perform supply chain due diligence (Taka, 2014, p.12).

The US government's Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 has proven to be a pivotal moment in relation to the supply chains of coltan, cassiterite, tungsten and gold. As a result of it, a de-facto mining ban was implemented by the DRC government. While the Dodd-Frank Act did not prohibit companies from sourcing conflict minerals, it required at least 6,000 publicly traded companies in the US to trace the origins of minerals in their products and perform supply chain due diligence on their extensive global supply chains (Taka, 2014, p.7). Following the implementation of this legislation, it has been noted that 'more recently, increasing awareness on how these minerals finance and sustain the protracted armed conflict in Eastern DRC, combined with a newly established UN business and human rights framework, initiated a paradigm shift in responsible supply chain management' (Taka, 2016, p.39). These initiatives have progressed towards making things legally binding with regard to supply chains.

In the same year as the Dodd-Frank act, a substantial report was also issued by the European Union which defined many of the material exports from DRC as 'critical'. Based on criteria such as 'risks of supply shortages and the economic impact thereof' and 'environmental country risk' (based on risks due to weak environmental performance of producer countries that might endanger the supply of raw materials)', the report identified the following as critical minerals; antimony, beryllium, cobalt, fluorspar, gallium, germanium, graphite, indium, magnesium, niobium, platinum-group metals, rare earths,

tantalum and tungsten (European Union, 2010). As the demand for these minerals remains strong to this day, the conflict minerals issue has drawn attention globally and prompted numerous investigations and campaigns.

As a legacy of former colonialist Belgium, attention has been paid where 'in view of the fact that Belgian-registered companies account for the largest proportion of mineral imports from North and South Kivu, the Belgian government has a particular responsibility to provide guidance to companies and make clear its resolve to put an end to trading practices which are fuelling armed conflict and grave human rights abuses' (Global Witness, 2009, p.81). In summary, Belgium appears to have been one of the more active nations in relation to exerting pressure on the UN to take action. In addition, 'the Dutch government has been more active in engaging companies on the question of responsible sourcing'. It has been documented that 'Dutch ministers for trade and for development cooperation met companies to discuss possible links between coltan used in mobile telephones sold in the Netherlands and the illegal trade in these minerals in the DRC' (Global Witness, 2009, p.85).

Reports such as 'Trading Conflict for Development: Utilising the Trade in Minerals from Eastern DR Congo for Development' (Garrett and Mitchell, 2009) suggested one site of formalisation should take place via the Rwandan government in order to gain greater transparency of goods. However, much of the motivation behind published research was mainly about ensuring goods would continue to flow out of the country. Simultaneously, supply chains of weapons constituting the means for forms of conflict to continue were being reinforced by middlemen and brokers, benefitting monetarily from 'the liberalisation of the market, along with the opening of massive Cold-War surpluses' which 'contributed to a massive increase in gun running practices' (Raeymaekers, 2002, p.27).

The actions of the international community have historically been limited by factors such as 'the civilian victims attributed to armed groups, the enslavement of miners and their inhuman working conditions, the impunity, and the absence of social dividends', 'the management of natural resources, taking into account also the environmental as well as the social impact', 'the market, rather than the armed groups, regulating the trade' (Pole, 2010, p.11). Moreover, 'impunity has been the rule: there have been very few cases of successful prosecution for war crimes, crimes against humanity or other grave human rights abuses against civilians carried out during the conflict' (Pole, 2010, p.19). In recent years a few cases have been brought to the International Criminal Court such as that of Bosco Ntaganda, allegedly the former Deputy Chief of the General Staff of the Patriotic Forces for the Liberation of the Congo (FPLC). He was convicted in 2019 and sentenced to 30 years in prison having handed himself in at the US embassy in Rwanda in March 2013. On 8 March 2021 the ICC ruled that Ntaganda's victims should be compensated with US$30 million, the highest amount ever rewarded. Since Ntaganda did not have the money to pay, the court was to use its own funds to compensate the victims.

Much of the international response to the conflict in the east of DRC has been characterised through the frame of 'development'. The inadequacy of the response of the

international community has been expressed as being of a nature whereby 'the economic dimension of the conflict is obstructing development efforts' (Global Witness, 2009, p.8). International donor governments, notably the US and the UK, have been spending about US$2 billion on aid to DRC every year, money which has underwritten a range of state agencies and government programmes, not least reform of the security services, as well providing the donors with substantial influence with the former government of President Kabila (Global Witness, 2010, p.22).

This assemblage of influences from various parties both within the region and globally has been taking place with a backdrop of vested interests, many of which have been related to the assembly of telecommunications devices. Moving beyond the conventional divisions between states and armies, 'the plundering of Congo's resources has been orchestrated by increasingly privatised networks in which the armies of occupying countries play but a partly role' (Raeymaekers, 2002, p.10). Aside from state actors and militarised organisations working at territorialising the land where many of these resources have been sourced, the influence of the private sector looms large in these affairs.

In general, 'it has been a huge challenge for policy makers and the private sector to turn Eastern DRC's mineral deposits into a sustainable mining sector that contributes to development' (Garrett, 2009, p.5). One example of an initiative which aimed to address some of the inherent ethical issues surrounding the industry was initiated by computer chip manufacturer 'Intel' between 2009-2011. The company 'claimed to have travelled over 193 000 km and visited 30 smelters in pursuit of a conflict-free supply chain' and 'had mapped out 92% of its tantalum, tin, tungsten and gold supply lines by the end of 2011' (Taka, 2014, p.12). During a period in which awareness of issues around the sourcing of coltan in particular was growing, a similar pilot scheme was undertaken in July 2011 by 'Motorola Solutions Inc' and 'AVX Corporation' with the launch of the Solution for Hope Project which aimed to secure conflict-free tantalum from DRC (Taka, 2014, p.10). However, on reflection the effectiveness of such schemes has been questionable as they have been taking place on a backdrop of economic actors turning a blind eye to the impact of their trade.

Pleas of ignorance have tended to characterise the response as to the origin of supplies, as companies have continued to 'hide behind a multitude of other excuses for failing to implement practices which would exclude from their supply chain minerals which are fuelling the armed conflict' (Global Witness, 2009, p.7). As forms of rationale with economic considerations at their base have largely been dominant in analyses, the principal response offered by the international community has been advocacy and what have been termed the application of economic 'sticks and carrots'. These have often taken the form of calls for mineral boycotts, targeted sanctions, or developing assurance systems designed to verify the origin of minerals (Garrett, 2009, p.5).

A report published by the United Nations in 2001 documents a list of responsible middle men companies acting as brokers among the supply chain of coltan. Importantly, despite the bloodiest conflict witnessed on a global scale having been taking place in DRC from

1996 onwards, it was not until February 2000 that the UN deployed peacekeepers to the region. As the single biggest entity which acts as a representative of the international community, the role of the UN in Congo warrants particular scrutiny dating back to 1950s onwards.

A publication by Global Witness in 2009 entitled 'Faced with a gun, what can you do? War and the militarization of mining in Eastern Congo' contains detailed listings of the companies responsible for the import of coltan and cassiterite. In a section about the responsibility of electronics manufacturers, the report documents how companies such as 'HP', 'Nokia', 'Dell', 'Motorola' and 'Nokia' referred researchers from Global Witness to a report by the Global e-Sustainability Initiative entitled 'Social and Environmental Responsibility in Metals Supply to the Electronic Industry' (2008). The Global Witness publication is critical of the report and claims all that really came from it were three weak recommendations in relation to social and environmental responsibility and the supply chain, such 'that electronics companies further characterise special metal content and use in electronic products which would support the tracking of metals used in electronics and help trace sources of materials' (Global Witness, 2009, p.67). However by and large, by the time the aforementioned minerals reach their ultimate destinations – the international markets in Europe, Asia, North America and elsewhere – their origin, and the suffering caused by this trade, has largely been long forgotten and obscured.

A further notable idea among organisations seeking to bring about greater fairness and a move away from the monopolisation of only a handful of companies in the market has been attempted via multi-stakeholder processes. Groups of local stakeholders made up of civil society, journalists, and in some cases including state agents, the mining police and mineral traders have established themselves in key mining areas to monitor mines and mineral trading routes and raise the alarm when they detect military or armed group involvement (Global Witness, 2013, p.4). In conjunction and to summarise, the recommendations of reports aimed at tackling injustice around the sourcing of digital minerals from Eastern DRC have focused on;

- Recognition and prioritisation of the principal impediments to trade reform, placing them at the centre of reform initiatives
- Recommending the convention of independently facilitated forums and dialogues
- Improvement around structures of governance
- The building of a functional DRC army
- Reduction of military beneficiation
- The framing of reforms in the context of regional development
- Encouragement of formalisation through transparency in tax and customs declarations by addressing operational difficulties of export regimes.

The concept of due diligence, stemming from an earlier meeting of the UN and African Regional Forum has also risen to prominence in the analyses of organisations aiming to tackle injustices among these industries. A report published by the Organisation for

Economic Cooperation and Development (OECD) in 2012 emphasised the importance of the implementation of a 'a voluntary programme in which an independent third party assesses smelters to determine whether they can demonstrate that all the materials they process are from conflict-free sources, based on a business process review and a material analysis review' (Taka, 2014, p.9). It has been noted that challenges have been encountered given the difficulties in tracing materials through a supply chain which 'may span thousands of miles across the globe, involve numerous suppliers, retailers, and consumers, and be underpinned by multinational transportation and telecommunication networks' (Taka, 2014). Furthermore, questions around the implementation of due diligence initiatives have been highlighted when considering that it 'can't be the best for the people of the industry for the trade to cease as they would lose their livelihoods' (Nagurney, 2006, p.15).

CHAPTER 5: CASE STUDY 1 – COLTAN

INTRODUCTION

A material which has become synonymous within the global trade in conflict minerals is coltan, otherwise known as columbite-tantalite. As part of the assemblage of components which comprise modern technological devices, coltan is a ubiquitous ingredient as it is primarily used to make transistor capacitors which are present in nearly all mobile electronic devices in the modern day. Sourced as raw material from the eastern regions of DRC, genocidal campaigns have resulted in forms of terror being inflicted on the local population, abetted by the global market for coltan. For this reason, it has been referred to as the 'blood diamond of the digital age' (Mantz, 2008, p.36). It has been asserted that 'thinking about coltan as a digital mineral is instructive because it allows us, as researchers, to think globally and politically about the Digital Age in a way that most of the literature—which often seems focused on debating the extent to which people have become disembodied or posthuman—does not' (Smith, 2011, p.20).

The physical role of coltan, housed within the medium of digital communications and the strong correlation between its extraction and the proliferation of computerised devices capable of distributing and receiving information can provide an insight into the meaning of the materiality of media today. 'The promise of a digitally interconnected world has thus far been predicated on coltan and other unsung "digital substances" and their particular qualities (e.g. of density and relative accessibility) as well as on the violence, systems of labour, trade conditions, and nationwide political fragmentation that have made these substances available to the world at low cost' (Smith, 2011, p.18). Coltan's ubiquity as physically housed among wireless communications is hard to fathom and it is also difficult to overstate the violence, displacement, and dispossession associated with its use in the manufacturing of media. In recent history, more people have died in the ongoing war in the Eastern Congo than in any single conflict since World War II (over five million), and the struggle over resources crucial for high-tech connectivity and everything that it enables and represents has been a major factor in that continuing conflict (Clark 2002; International Peace Information Service [IPIS] 2002; Jackson 2002; Mantz 2008; Moyroud and Katunga 2002; Smith and Mantz 2006; United Nations Security Council 2002).

Coltan as ore and tantalum as a refined mineral are used across a variety of manufacturing processes. That said, around two-thirds of all coltan is used in capacitors, a component of electronic devices (Global Witness, 2010, p.2) whose role is to 'regulate the flow of electricity from the source of power (such as a battery) to the working parts of the device' (Nest, 2011, p.8). Tantalum capacitors are an omnipresent ingredient in the manufacture of computers, DVD players, video game platforms (Ayres, 2013, p.188) as well as mobile phones and I-pads (Nest, 2011, p.9). The material is also used in the manufacture of other components of mobile phones and laptop computers such as processing chips, surface

acoustic wave filters, global positioning systems and computer hard drives (Sutherland, 2011, p.6).

Evidence also suggests that coltan is used in the manufacture of batteries in South Korean products as well as in the manufacture of machinery in Mexico and by the US defence agency in manufacture of aircraft (Moran et al., 2015, p.7). Other uses of coltan and tantalum include in the manufacture of airbags for cars, jet engines and the production of turbines, space vehicles, nuclear reactors, power plants, carbides such as drill bits, coatings for optical devices such as camera lenses, military ammunition, x-ray film, jet printers and hip replacements (Nest, 2011, p.9). Tantalum's density and nuclear stability make it a valuable material for containers of radioactive elements and it is also used for radiation shielding (Pole Institute, 2002, p.5). Given all these technological uses, demand for coltan is unlikely to decrease.

Tantalum is partly responsible for the miniaturisation of modern technological devices as opposed to the utilisation of other materials with similar properties as part of the manufacturing process such as ceramics or aluminium (Nest, 2011, p.8). In comparison to alternative materials, coltan is also said to be favourable due its strength, high density, and chemical properties (Lalji, 2007). It has also been noted that tantalum typically comprises just 0.02% of the mass of a personal computer (Sutherland, 2011, p.8) and that the average mobile phone contains less than 20 milligrams of this material (Nest, 2011, p.8); (Sutherland, 2011, p.8). The journey of a piece of material sourced from under the ground in Congo on its way to being held in the hands of the consumer in the form of a smartphone for example involves a complex web of processes involving companies across many countries.

The international trade in coltan raises questions concerning responsibility, legitimacy, and sovereignty (Montague, 2002, p.107) and it has been identified that 'understanding the trade in coltan requires a combination of geology, mining, chemistry, electronics, economics, law and sociology' (Sutherland, 2011, p.23). The history of mining in general in DRC is also an important aspect. In the early days of the rule of President Mobutu and indeed of the nation's independence, much of the existing infrastructure around these industries had become nationalised. However, by the mid-1990s much of this structure which had historically been centred around the sourcing of copper in Katanga province during the colonial era had fallen into a state of disrepair due to a range of factors. 'With the beginning of the First Congo war in 1996 industrial mining of tantalum ceased completely' (Usanov et al., 2013, p.45), thus the boom in the mining of coltan in the late 1990s was of an artisanal nature and often undertaken by children. At mining sites and areas taken over directly by the Rwandan military for example, civilians were forced into unpaid labour, and paid miners had to sell to army commanders at vastly preferential rates. Accounts have been documented of Rwandan forces instructing people to carry foodstuffs to the camp where prisoners from Rwandan prisons lived. Large numbers of such detainees, many of whom were Hutu prisoners accused of participation in the 1994

genocide, worked in the coltan mines in Eastern DRC to earn their freedom or a reduction in sentence, although their number reportedly declined after 2001 (Amnesty, 2003, p.38).

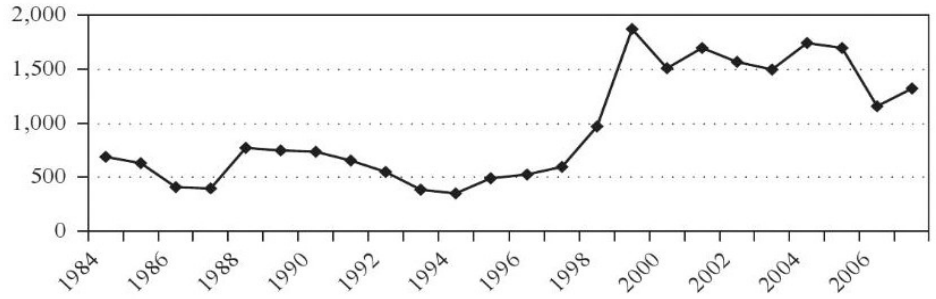
Consequences of the boom in coltan mining which took place during the late 1990s were manifold. Among the most significant aspects was the issue of food security with numbers of workers participating in agricultural practices being depleted as a result of the boom. Other aspects include physical security with regard to unsafe mining conditions, socio-cultural consequences, environmental damage and land conflicts. Innumerate political consequences were also experienced as a result of the coltan boom with the proliferation of weapons also an important aspect of this.

Organisations such as 'Make IT Fair', 'The Enough Project', 'The Pole Institute' and 'Global Witness' have been working to try and address an ongoing humanitarian crisis around coltan. Although a lot of work has been done in raising awareness of circumstances around the mining of coltan from DRC through the publications of academics or NGOs, many of these contributions have failed to represent the uses of niobium and tantalum. In a general sense it has been noted that 'as world demand for mobile phones and Sony PlayStations exploded in the late 1990s and early 2000s, so too did digital industries come to rely increasingly on coltan from the Congo' (Mantz, 2008, p.36).

War in this region resulted in 81% of the population having to flee their homes, more than half experiencing the violent death of family members or friends, more than half have been abducted for at least a week, and 16% having been subjected to sexual violence, usually repeatedly (Smith, 2011, p.18). Although the effects of this industry have been most acutely experienced by the population in the provinces of North and South Kivu specifically during the period between 1996-2005 approximately, armed groups are still operating in the region. The significance of the artisanal nature of the initial extraction of coltan and, perhaps most worrying, the vital importance of the income from coltan mining to communities otherwise reliant on subsistence agriculture has also not been fully acknowledged (Sutherland, 2011, p.23). Despite encapsulating a breadth of subjects when it comes to closer examination of the circumstances around coltan, the material's inextricable link to digital devices provides strong rationale for framing such scrutiny within the study of media. Effects felt within eastern provinces of DRC can be understood in these terms.

The graph below depicts an upsurge in primary production of coltan, particularly between the years 1997-2000. Economics around the material have been subject to greater complexities due to governments of monetarily richer and influential nations practicing stockpiling as well as other forms of market manipulation, circumstances which will be examined more closely later in this chapter. In simple terms this graphic indicates the clear correlation between coltan production and a boom in wireless communications.

Graph showing estimated global tantalite primary production from 1984-2008 in metric tonnes:



(Source: Nest, 2011, p.23)

MINERAL

The term 'coltan' is the adjunction of the two terms columbite and tantalite which had previously been thought to be two different materials at earlier stages. English chemist Charles Hatchett is credited with the discovery of columbite in the area of the northern USA now known as Connecticut in 1801. Hatchett is said to have named the material as such in honour of Christopher Columbus in respect of his supposed "discovery of America". Documentation suggests that tantalite was discovered in Sweden one year later in 1802 by chemist Anders Gustaf Ekenberg at which time it was thought to be an allotrope of the element niobium (Both, 2016, p.8). It is believed that tantalum derived its name from the Greek mythological figure Tantalus (Smith, 2011, p.18) who is said to have been punished by Zeus to forever go thirsty and hungry in Hades despite being stood in a pool of water and almost within reach of a fruit tree having attempted to feed his own son at a feast with the gods.

There are also some additional etymological complexities encapsulated in the term 'coltan'. For example, the material 'columbite' is also known by the names 'niobite', 'niobitetantalite' and 'columbate'. 'Coltan' refers to the ore from which the elements niobium and tantalum are extracted, whereas 'tantalum' is a recognised metallic chemical element. Tantalum has the symbol Ta in the periodic table, its atomic number is 73 and its melting point is 3,017 °C. Its properties include anti-corrosive characteristics which make it less likely to rust or be affected by acidic environments. (Nest, 2011, p.8). Tantalite is believed to have been first discovered in Congo in 1910 (Usanov et al., 2013, p.43).

Mined as ore from muddy deposits, coltan is said to be an 'unseemly substance that resembles black gravel and is heavy as lead' (Van Reybrouck, 2014, p.293). Within the context of the global industry around tantalum as well as specifically within DRC and the geography associated, it has been noted that analysis largely funded by the German government has established that the composition of the ores is quite complex (Sutherland,

2011, p.23). Each deposit of Tantalum was found to be unique, with distinction possible between locations even in districts and provinces where the ores were apparently similar. Thus, it has been asserted that it would be possible to create geo-chemical fingerprints for individual deposits in order to trace the source of any unrefined ores on the market. However, once the ores are refined it is very difficult to identify the source, except by authenticated documents (Sutherland, 2011, p.23).

In the early 2000s coltan originating from North and South Kivu provinces in DRC was 'believed to be of high quality and easily accessible, while not requiring specialised instruments for its extraction' (Moyroud and Katunga, 2002, p.176). Rock from Kivu is also said to be much softer than that of other provinces within DRC such as Katanga (Usanov et al., 2013, p.43). During this period, observations indicate it was not unusual for Rwandan military officers to be seen accompanied by English-speaking 'white people' with sophisticated instruments of measurement (Moyroud and Katunga, 2002, p.176).

As such the coltan industry in Eastern DRC can be mapped on a timeline of material and economic exploitation of mined materials associated to technological developments which traces back to a time when land around the Congo river was claimed as a personal possession of King Leopold of Belgium. Indeed 'during the last century and a half, whenever acute demand has arisen on the international market for a given raw material—ivory in the Victorian era; rubber after the invention of the inflatable tire; copper during full-out industrial and military expansion; uranium during the Cold War; alternative electrical energy during the oil crisis of the 1970s; coltan in the age of portable telephonics—Congo has turned out to contain huge supplies of the coveted commodity' (Van Reybrouck, 2014, p.82).

The coltan mining industry in Eastern DRC experienced a significant boom in the year 2000. Many workers began to orientate themselves around the mining of this material, causing what has been described as an 'exodus' and a 'fever' which 'had striking resemblances to various gold rushes of the 19th century and had a significant impact on the functioning of society' (Usanov et al., 2013, p.46). Between 1999-2001, exports of coltan became a mainstay of the economy of Eastern DRC. As world demand for tantalum used for capacitors in mobile phones and computers reached its peak in 2000, prices rose rapidly and exports of tantalite from artisanal mines, slags and cassiterite deposits in e Congo became an attractive business proposition. During this period existing industrial mining concessions were turned over to informal or artisanal mining, mainly of coltan. As a result, agricultural and pastoral activities were being abandoned in favour of mining (Johnson, 2005, p.15). An unparalleled loss of life in global terms was experienced by local populations during this period, partially as a result of the exploitation of coltan having intensified older conflicts between different communities living in North and South Kivu (Moyroud and Katunga, 2002, p.179). It has also been said that mine workers in Kivu saw coltan as a safer and more reliable material to mine than other materials and that this artisanal mining has been 'a mechanism through which some Eastern Congolese hope to transform their situation, and even the entire Eastern DRC, in a positive way, by using it to

build sustainable social relationships' and epistemological transparency (Smith, 2011, p.18).

MINING HISTORIES

Structural characteristics of the coltan trade in North Kivu province cannot be understood without a knowledge of the peculiar history of mining in the area, a history which is dominated by the story of the Belgian-Zaïrian firm Sominki (Société Minière du Kivu). Formed in 1976 as the result of a merger between several Belgian mining firms whose origins go back to a major concession granted to the Belgian Baron Empain by the Belgian King Leopold II in 1902, Sominiki traditionally owned most of the extensive mining concessions in Eastern Congo, with gold mining constituting four fifths of its activities, the remaining fifth comprised of cassiterite (an ore from which tin is extracted) and coltan (which is often found in cassiterite deposits), industries which experienced steady growth in this region between 1976-1990 (Pole Institute, 2002, p.5). Before the 1990s, tantalum was mainly extracted as a by-product of tin mining (Usanov et al., 2013, p.44).

Numerous manoeuvrings related to the coltan industry have been documented around the time that Laurent Kabila came to power in 1997. Various business entities had formed links with groups on the ground in Kivu including a deal signed in April 1997 between American Mineral Fields and the Alliance of Democratic Forces for the Liberation of Congo (AFDL), said to have been worth $1 Billion. In a similar vein, American engineering firm 'Bechtel Corporation "commissioned and paid for NASA satellite studies on Congo as well as for infra-red maps of its mineral potential," free of charge to the de facto AFDL government, as the basis for a seven-year economic strategy. This survey gave the Kabila administration access to "some of the most complete mineralogical and geographical data of the former Zaïre ever assembled"' (Montague, 2002, p.110).

As has been documented, a boom in the mining of coltan during the year 2000 caused mass migration in Kivu provinces and the depletion of agricultural and pastoral activities, resulting in 'a real danger of food insecurity in North Kivu if the agricultural populations continue to leave their fields in order to mine coltan or turn their fields into mines' (Pole, 2002, p.4). Additionally, abundant ecological repercussions have been observed as a result of coltan mining in provinces in the east of DRC (Moyroud and Katunga, 2002, p.173). Activities relating to the mining of coltan such as forest clearance have resulted in the pollution and diversion of streams, at times leading to landslides as well as severely reduced populations of certain wildlife species and wider ecological and environmental changes (Nest, 2016).

Another organisation whose operations were focused on the sourcing of tantalite in the eastern regions of then Zaïre and which bared comparison with the aforementioned 'Sominiki' was called 'Somikivu'. The company was established in 1981 with 20% of its

shares owned by the Zaïrian government and 74% by the German company GfE Metalle und Materialien GmbH. The firm's principal activity was the mining of pyrochlore, a form of niobium oxide with radioactive content used in the hardening of steel found in the Luheshe mine in North Kivu. When mining in Luheshe stopped in 1993 following the outbreak of conflict between ethnic militias in the region, GfE ceded its share to its local German director Karl-Heinz Albers. Within the first few months of the newly formed government of DRC in 1997, Laurent Kabila's administration promised Somikivu's concessions to the Austrian firm Edith Krall Investments, whose local representative at the time was Austria's honorary consul in Uganda. 'The actualisation of this deal was prevented by the outbreak of the second Congolese rebellion in August 1998, when Kabila lost control of Eastern DRC' (Pole Institute, 2002, p.7). Factors which appear to have contributed to the outbreak of war in Kivu in 1998 include the dis-assemblement of Sominiki whose roots went many years back and had links with Belgium as well as the death of Mwami Luhwindja, a traditional ruler who fought the Rally for Congolese Democracy (RCD) and received armed support from the government side. He was killed in a mysterious car crash in France in 2000 (Pole Institute, 2002, p.6).

A further influential organisation in the attempted monopolisation of the trade in coltan during this period was known as Somigl (Société Minière des Grands Lacs). General secretary Azarias Ruberwa of the Rally for Congolese Democracy (RCD) announced on November 25th 2000 that the group held 75 % of Somigl, the other parties being Africom (part of the US military), Rwandan corporation Promeco and Cogecom of South Africa. Somigl's coltan exports, given as 112.49 tons in December 2000, is then said to have fallen in each subsequent month, to 97.6 tons in January according to RCD, to 27 tons in February and 19 tons in March according to the specialised journal "Africa Mining Intelligence" (Pole Institute, 2002, p.8). On April 5th 2001 while Congolese President Joseph Kabila was visiting Germany, the main purchaser of Congolese coltan, the RCD revoked Somigl's monopoly and dissolved the company, liberalising coltan trading again. 'The decree fixed the annual licence fee for commercialisation and export of coltan at 40,000 dollars. The export tax was fixed at six dollars per kilo of coltan, dropping to four dollars for export quantities exceeding 15 tons' (Pole Institute, 2002, p.9).
Although use of the income generated by coltan exploitation is dictated by the goals and strategies of the various actors involved in the cycle, it has also been noted that the impact of revenues is nonetheless limited in the countries involved, except among a small number of prominent individuals in the army and business community, who are connected one way or another to the international trade (Moyroud and Katunga, 2002, p.177).

INVENTION

Documentation suggests that the first tantalum electrolytic capacitors with wound tantalum foils and non-solid electrolyte were developed in 1930 by Tansitor Electronic Inc.

(US) and were used for military purposes (Tailor, 1969). The first application of metallic tantalum was for incandescent light bulb filaments with around 11 million bulbs manufactured before tungsten wire replaced tantalum filaments in 1909 (Both, 2016, p.8). With the rapid development of broadcasting technology from the mid-1920s, tantalum electrolytic capacitors developed in parallel with aluminium electrolytic capacitors. Solid electrolyte tantalum capacitors, at this time made of ceramics are said to have been invented by Bell Laboratories in the early 1950s as a miniaturized and more reliable low-voltage support capacitor to complement their newly invented transistor. Following this and marking the point at which commercially viable tantalum electrolytic capacitors began to be manufactured, Preston Robinson a researcher from the Sprague Electric Company in Massachusetts is credited with the invention of the first tantalum capacitor in 1954.

Due to having better conductivity than all other types of non-solid electrolyte capacitors, tantalum capacitors soon found wide use in radio and new television devices. In 1965, a theory entitled 'Moore's Law' hypothesised that the practical number of transistors on an integrated circuit would double every two years, 'which has been a very good approximation from the 1971, 4,004 microprocessor with 2,300 transistors, to the 2011 quad core processors with 10^9 transistors' (Both, 2016, p.13). In 1971, Intel launched its first microcomputer and in 1972 Hewlett Packard launched one of the first pocket calculators utilising solid tantalum capacitors.

Transistor capacitors have been described as functioning 'in the same way as a dam stores water from a river and regulates its flow to crops for agriculture' in that they are able to 'store and regulate the flow of electricity from batteries, or other power source, to parts of the electronic device that perform functions, such as the display windows of mobile phones or storage areas for digital information' (Nest, 2011, p.8). Capacitors have a crucial role in ensuring there is no power surge or fluctuations to the device that could disable or break it. As technologies have changed and updated, quantities of tantalum required in manufacturing processes of components found within consumer electronic devices have decreased.

Although there are a wide range of uses of these components, following the initial application of the tantalum capacitor in the manufacture of media forms at earlier points during the 20th century, their proliferation has subsequently been highly correlative with that of screen-based and digital media devices. In many ways the fact that DRC had not yet gained independence from Belgium when tantalum capacitors were first being used in the manufacture of television sets highlights the scope of the coltan mining industry and the long-term economic suppression as a result of influences outside of the region. As audiences have continued to experience developments in the capabilities of media products, the abundance of minerals found to be present in DRC continued to be earmarked by governments internationally and multi-national companies. As has been pointed out new media exist at the bleeding edge of obsolescence and indeed 'new, media, as forms of accelerated capitalism, seek to undermine the habits they must establish in order to succeed in order to succeed' (Chun, 2016, p.2).

The staggered and incremental release of products on the part of manufacturers has been part of a wider strategy to ensure that the ticket was still in hand where their profits were concerned. Furthermore, with the abilities of such products having succeeded in superseding that of their predecessors, courses of conditioning among audiences also come to light, ultimately with the aim of maximising profits through the sale of the maximum number of units. Products seen as pioneering in their day now fade into obsolescence. Located among a timeline of fear-based media messaging, the phenomenon of the millennium bug stands as an enigmatic symbol of such processes. Predictions of widespread systematic failures caused the US government to spend in excess of a billion dollars in its attempt to safeguard information technology infrastructures (Chandrasekaran, 1999). More widely the actions of numerous US government administrations in sustaining president Mobutu's grip on power in DRC between the 1960s and 1990s for example, as well as in the practice of stockpiling materials such as coltan in anticipation of a boom in manufacturing are indicative of the ways in which foresight has enabled manipulation with catastrophic consequences.

SUPPLY CHAINS

Estimates vary substantially as to the proportions of total global tantalum supplies locatable in DRC. According to a report published by Global Witness in 2004 it was thought that 80% of the world's tantalum reserves could be found within DRC (Taka, 2011, p.29). Conversely, a paper published by the Hague Centre for Strategic Studies in 2013 concluded that just 8% of world tantalum supplies were locatable within the country, a figure revised from 20% in 2010. The same paper highlights that a combined total of 60% of global supplies would be source-able from Australia and Brazil combined (Usanov et al., 2013, p.44). One reason for the above disparity is said to be because reserves of tantalum in DRC are 'poorly quantified' (Nest, 2011, p.29) and that the 'truth is that good data on tantalite reserves in the DRC is not available because good geological exploration work has not been done for at least two decades' (Nest, 2011, p.17). In terms of the proportions of global tantalum already in circulation 'it is estimated that about half of the tantalum used to manufacture electronics has been sourced from conflict areas' (Taka, 2014, p.12). 'In 2019, 40% of the world's coltan was produced in the Democratic Republic of Congo, according to official data' (Economist, 2021).

In a holistic sense, author Michael Nest identifies coltan as having come from three sources: as a by-product of tin slag (20% of supply) – 'slag' is the waste material that sits in dumps around historic tin mines; recycling (30% of supply); and mines (50% of supply). Coltan is circulated through elaborate international channels, a journey which typically begins in eastern border cities like Goma and Bukavu before it is bought by high level middlemen frequently operating in collusion with local militias, who in turn typically sell to Belgian, South African, Rwandan, and other foreign business partners (Mantz, 2008, p.42).

It has been proposed that the supply chain of coltan can be broken up into five stages; exploration – detection – extraction – transportation – treatment (Moyroud and Katunga, 2002, p.174). Another model states that this process can be more aptly divided into seven stages; extraction of tantalite ore - trade and export of ore to processing firms - smelting and refining to create tantalum powder - manufacturing of tantalum capacitors - manufacturing of circuit boards - manufacturing of the mobile phone - retail sale to consumers (Nest, 2011, p.32).

When it comes to the transportation of coltan and the trade and export of ore to processing firms, documentation suggests that large quantities of the material would typically be moved by air (typically a Russian made Antonovs), with each aircraft able to carry 20 tons in one journey. An air company known as TAC (Transit Air Cargo) is said to have been purposely created in order to facilitate the fast and efficient transport of coltan and other resources to the capitals of neighbouring nations as well as elsewhere (Moyroud and Katunga, 2002, p.176). The following companies have been identified as being mainly responsible for the exportation of coltan during the boom in demand experienced in the late 1990s: BanroResources Corporation, Geologistics Hannover, Rwasibo-Butera, Eagleswings, Veen, Soger, Afrimex, Cogecom, Ventro Star, Raremet, Finiming Ltd., Union Transport, Specialty Metal, and Finconcorde (Montague, 2002, p.106).

The problem of inaccurate declaration of exports is a perennial one in establishing facts about supply chains and the coltan trade in Eastern DRC in general. For example, 'UN investigations estimated in April 2001 that Rwanda's army may have earned $250m over 18 months from the resale of coltan bought in the DRC' (Johnson, 2005, p.20). The tendency for coltan to be smuggled from DRC to Rwanda before being officially declared as an export there has been described as 'deeply troubling' (Sutherland, 2011, p.24) especially in the context of Rwanda 'trying to establish itself up as an ICT hub for Africa, bringing at least a small part of the metals back to the Great Lakes region. It points to the severe problems of governance, democracy, corruption and morality' (Sutherland, 2011, p.24). Sabena Cargo have been named as one of the main organisations responsible for the transportation of coltan between Rwanda and Europe (Montague, 2002, p.111). Companies responsible for the refinement of coltan in Europe and elsewhere such as H.C. Starck, Cogecom and Sogem are also said to have historic links with the Rwandan army (Fyffe, 2001). Barrick Gold Corporation, Russell Resources, Krall, and Banro American Resources have also been accused of 'funding military operations in exchange for lucrative contacts in the east of the DRC' (Montague, 2002, p.106).

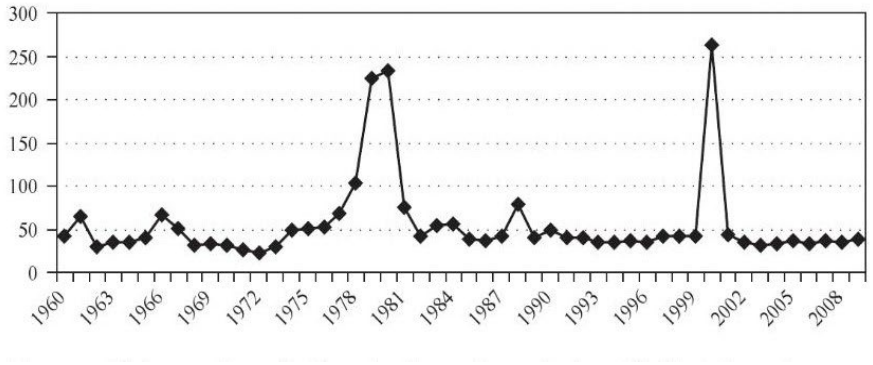
At the treatment stage of the supply chain which includes processes such as the smelting and refining of coltan to create tantalum powder, transforming raw material into that which is commercially viable, three firms were said to be responsible for purchasing 80% of the ore - Cabot Corporation (USA), H C Starck (Germany), Ningxia Corporation (China). Bayer, the German chemicals giant which owns H.C. Starck, reported in April 2005 that 'the market for HC Starck's tantalum powders used in products for the electronic component and device industries was especially buoyant in the first half of 2004, driven by demand for

digital appliances, notebook PCs and mobile phones' (Johnson, 2005, p.24). Estimates suggest that in the year 2000 when armed conflict in Eastern DRC was at its height in terms of loss of life, 70% of DRC-sourced coltan was consumed by 8 countries: Germany (18%), USA (14%), China (14%), UK (7%), Japan (6%), France (4%), Italy (4%), and Canada (3%). Multinational companies involved in illicit access to DRC resources provide instruments at stage 1 - exploration, stage 2 - detection and stage 5 - treatment of the exploitation cycle according to author Celine Moyroud's coltan supply chain model. For instance, such companies have provided devices to detect the availability and test the quality of coltan (Moyroud and Katunga, 2002, p.174). Additionally, when one considers what the means are for armed conflict to take place, the supply of weapons and ammunition to parties involved comes into focus. Armed conflict is not the sole reason for the scale of loss of life in DRC associated to the coltan trade, however this aspect been highlighted as 'if the worry is that revenues from the trade in coltan fuels conflict because they are spent on weapons, then the availability of weaponry becomes the logical focal point' (Ayres, 2013, p.184).

MARKETS

It has been noted that the first increase in demand for tantalum arrived between 1950-53 for use militarily in the Korean war, causing the US government to stockpile it in large quantities, resulting in prices doubling until 1958 at which point global prices halved (Nest, 2011, p.10). Coltan production is said to have dropped massively between 1990-1995 as a result of the US Defence Logistic Agency's (DLA) policy of stockpiling and perception around the need for this resource changed. In 1993 the US government started to target getting rid of these stocks of tantalum. On the 5th December 2000, Alan Greenspan, director of the US Federal Reserve gave a widely noted speech on the risk of world recession. Three days later, on the 8th of December the DLA released a large portion of the US government's strategic stock of columbite-tantalite onto the market, a portion whose value was quoted on the London Metal Exchange at 91.3 million dollars (Pole Institute, 2002, p.8). It has been noted that the DLA released 242 tons of tantalum in 2000 and 216 tons in 2003, both of which had the effect of lowering prices. In 2004, the release was even bigger: 351 tons, much more than the planned 274 tons (Johnson, 2005, p.23) before the remainder of supplies were eventually sold off in December 2007. Notably, global coltan production had dropped but then underwent a resurgence between 2007-2010. In December 2008 the Wodinga tantalum mine in Australia closed, at the time this mine is said to have supplied 30% of global production (Nest 2011, p.17). In 2009 there were 23 coltan mining sites in Eastern DRC: 14 in North Kivu province and 9 in South Kivu.

Graph indicating price fluctuation of tantalum from 1960-2010:



(Source: Nest 2011, p.11)

A shortage of tantalum ore occurred in 1999 to 2000, which resulted in a large increase in the price of tantalum powder and the resulting capacitors. The question was whether this shortage and price increase was “real” or “manufactured” (Both, 2016, p.20)**.** An international coltan price spike in 2000 is said to have been attributable to the ‘demand for laptops, speculation and hoarding, a new generation of battery-intensive mobile phones, and the popularity of the Sony PlayStation 2’ (Moran et al., 2015, p.2). The price of coltan on the ground in Kivu then dropped substantially from $100 per kilogram in 2000, to $10 per kilogram in 2002 (Moyroud and Katunga, 2002). Moreover, there existed no single or standardised price per weight of coltan due to a range of factors such as various quantities of tantalite being extractable from the coltan ore as well as the smuggling of large quantities of the material out of DRC as part of a supply chain which may have led to it being declared an official export of another nation such as Rwanda for example (Johnson, 2005, p.30).

Despite the huge drop in price experienced locally between 2000 and 2002, documentation indicates that production of coltan in Kivu increased during this period with prices only beginning to rise again in 2005. In a global context it has been noted that ‘the world market price for tantalum slumped from $220 per pound in 2000 to $37 in 2001, reaching a low of $22 in 2003 before recovering slightly since’ (Johnson, 2005, p.19).

Research suggests that the activities of miners and chiefs of miners only accounts for 27% of coltan’s export value in Eastern DRC, with the annual income of artisanal coltan and cassiterite miners in North and South Kivu provinces estimated at $800 (Usanov et al., 2013, p.52). Additionally, ‘activities in traditional markets have received little attention when it comes to the stream of commerce vital to the demand for coltan’ (Ayres, 2013, p.185). Metals such as tantalum ‘are usually traded via direct, long-term contracts between buyers and sellers, and the line of sight between the seller and buyer is lost due to contract confidentiality and the mixing of metals from different sources in the supply chain’ (Taka, 2014, p.12). For example, K-salt tantalum ore has been identified as being chemically refined to make a compound called potassium tantalum fluoride, with some

mining and electronics industry representatives stating that they suspect K-salt production may be being used to hide or obscure the origins of tantalum coming from Congo (Global Witness, 2010, p.15).

U.S. Imports of Tantalum Ores and Concentrates by Country								
Country	1997		1998		1999		2000	
	Value - $US (Thousands)	Gross Weight (Metric Tons)	Value	Gross Weight	Value	Gross Weight	Value	Gross Weight
Congo (Kinshasa)	600	51	3,380	186	2,000	81	4,720	167
Rwanda	984	58	1,610	71	1,270	59	2,180	68
Uganda	—	—	429	18	645	24	140	5

(Sources: U.S. Census Bureau and U.S Geological Survey)

Coltan smuggling is also said to have flourished because of variations between prices set in mining areas and those found in the black markets of northern Katanga and South Kivu. In February 2014, one kilogram of coltan cost US$37.50 in Bukavu in South Kivu, US$44 in Uvira in South Kivu and US$34 in Kalemie in Katanga province. Each of these prices exceeded that set in the mines, which ranged from US$28.80 to US$40 depending on the geographic location (Wakenge, Dennis, and Vlassenroot, 2018, p.515). Crucially, the fact that coltan has to be processed elsewhere means that there is a ceiling to what profit can be made on the ground in DRC (Smith, 2011, p.31).

As official figures around exports of coltan from DRC have been subject to moving goalposts in the form of changing economic and political circumstances, verifiable data and transparency around supply chains has been hard to achieve. Indicative of this, in the lead up to implementation of the Dodd-Frank act in United States in 2010 also known as the 'conflict free coltan law', official data also showed that companies in China bought all but 7 of the 106 tonnes of coltan exported from the Kivus from January to June 2010 (Global Witness, 2010, p.15). As what stood at the time as a prediction and perhaps ultimately an indicator of the way the market may have evolved between 2005-2010, 'Reed Business Information in September 2005 estimated that "the tantalum capacitor market will post slow, but steady growth over the next several years because of healthy demand from cell-phone, computer and networking equipment manufacturers. The global tantalum capacitor market will rise from about $1.78bn in 2004 to $1.85-$2.08bn in 2009" (Johnson, 2005, p.25).

CONFLICT

A number of analysts have argued that international demand for coltan has become one of the driving forces behind the war in DRC and the presence of rival militias (Moyroud and Katunga, 2002, p.159). This demand on the part of western companies has seen 'five million people perish and many others suffer hundreds of thousands of rapes and other atrocities' (Ayres, 2013, p.179). Without this demand it is argued the conflict could not persist and there can be no doubt that the industry involved in the manufacture of electronic capacitors used in cell phones has helped rebels to fund conflicts that have had many devastating consequences for DRC's people, animals, and environment (Campbell, MacKinnon and Stevens, 2011). International competition for scarce resources in general, and for coltan in particular, has been a key factor in the lack of state stability and the continuation of war in DRC (Montague, 2002, p.104).

In 2002 it was estimated that 73,000 people per month were losing their lives in Eastern DRC, the majority of these deaths due to starvation and disease (Montague, 2002, p.103). To further put this into some perspective it has been noted that at the time of the September 11th attacks in North America in 2001 'that an equivalent number of deaths, roughly 3,000, occurred every week in the Kivus, week in and week out, month after month, from year to year' (Ayres, 2013, p.181).

In attempting to understand the origins of territorial conflicts in Eastern DRC and the role of coltan in perpetuating such circumstances, one can trace back to the brutal violence inflicted earlier during the colonial era. The series of events during the period when Congo, Rwanda and Burundi all claimed independence around 1960 is also an important aspect. In more recent history the outbreak of a genocidal war in Rwanda in 1994, subsequently causing mass migration across the border into then Zaïre was also a key event in determining the path of history. During what are referred to by historians as the first and second Congo wars between 1996-1997 and 1998-2003 respectively one can also view the lack of intervention on the part of international agencies such as the United Nations with some scepticism. Today, DRC has one of the highest rates of internal displacement in the world with an estimated 1 million people displaced due to forced migration in the first half of 2020 alone. Armed groups are still fighting in Kivu province and at the time of writing the United Nations High Commissioner for Refugees (UNHCR) had received just 21% of the budget required for its operations in Congo (Reuters, 2020).

It has been noted that 'unplanned coltan mining and export in a context of State collapse and prolonged crisis has been a source of wealth for a handful of businessmen working with old and new mineral trading networks in Eastern Congo' (Pole Institute, 2002, p.4). In terms of looking towards any potential solutions to what has been an ongoing crisis, in particular from the 1990s onwards it has been suggested that rather than coltan be thought of as the root cause of clashes between armed groups in DRC, rather 'it has been a conflict-sustaining or aggravating factor that has contributed to conflict within the larger conflict system operating within the DRC' (Moyroud and Katunga, 2002, p.159).

POLICY / CAMPAIGNS / LAWS

Given the scale of consequences felt on the ground in the eastern regions of DRC and in North and South Kivu in particular as a result of the coltan trade, it could be said to be difficult to know where to start in potentially addressing some of the inherent injustices which have become characteristic of this industry. Several million Congolese lives were lost in what has become known as the first and second Congo wars with the plight of materials such as coltan undoubtedly a contributing factor in the conflict. In simple terms, blame for these circumstances can be attributed to an inherently unequal economic system with its roots in colonial practices, practices which were particularly brutal in the case of Congo. In reference to the abundant natural resources found in DRC, this country should logically be one of the strongest in the world economically. However, as part of what has been described as a 'resource-curse', the culture of exploitation which began in colonial times continues to thrive. It has been noted in the case of DRC that monetary 'investment, far from encouraging strong state structures, has helped to create weak states based upon kleptocracy and corruption' (Montague, 2002, p.104).

Following periods of regional violence within DRC during the 1990s, in the summer of 1999 an agreement was signed in Lusaka, Zambia between the Congolese government, rebel groups and representatives of neighbouring nations such as Angola, Zimbabwe, Rwanda and Uganda who had been providing support to the various sides of the conflict. The agreement was focused on the establishment of a ceasefire and resulted in the deployment of UN peacekeepers to the region, a move which could have taken place sooner given the scale of the violence in Eastern in DRC in the late 1990s. 'The signature of the Lusaka agreement was followed by some 18 months of deadlocks and continued armed engagements between its signatories, all of which came to a sudden end with the assassination of President Laurent Kabila on January 16, 2001' (Moyroud and Katunga, 2002, p.166). Highlighting some of the complexities around these circumstances, on the same day Laurent Kabila was assassinated in 2001, a lawsuit was filed in Washington against the DRC government relating to a Canadian company named Banro, an organisation who had owned a stake in Sominiki dating back to 1995. A deal signed between the Zaïre government and Banro in February 1997 during the last days of President Mobutu's rule had been annulled by Kabila in July 1998. Banro had previously set up Congolese subsidiary Sakima (Société Aurifère de Kivu et Maniema) whose assets were seized by the newly formed DRC government and replaced with Somico (Société Minière du Congo) lead by Philemon Luhwindja, the traditional ruler of Luhwindja territory in South Kivu (Pole Institute, 2002, p.6).

Talks initiated by South African President Thabo Mbeki resulted in a subsequent agreement between the Rwandan and DRC governments in July 2002 which appeared to reinvigorate the Lusaka Accords and pave the way for an inclusive settlement. In December 2002, a further agreement made in South Africa between Rwanda and DRC asked for the withdrawal of Rwandan troops from DRC in exchange for an international commitment towards the disarmament of the Interahamwe Hutus. Less than a month later, the

Ugandan government's presence in the Congo came to end with the signing of the Gbadolite Agreement which brought about a ceasefire between three rebel groups backed by the Ugandan government (Lalji, 2007).

On the international stage and with reference to role of the United Nations it has been noted that the war on terrorism launched by the US and its coalition partners as a result of the September 11 attacks on New York and Washington produced a major policy attention and priority shift with a potentially counterproductive impact in maintaining momentum towards a wider ceasefire via the continuation of the implementation of the Lusaka agreement (Moyroud and Katunga, 2002, p.167). In early April 2001, the United Nations released a report implicating some companies 'in a conspiracy of exploitation that stretched from the battlefields of the war-torn Congo to the electronics industry's supply chain' (Fyffe, 2001).

As recognition for the situation vis a vis coltan sourced from DRC has grown in recent years, some initiatives on the part of both governmental and non-governmental organisations have been put into place with some notable outcomes. The determination of advocacy groups such as The Enough Project and Global Witness whose campaigns on the issue of conflict minerals in DRC began in the late 1990s and early 2000s have helped shed some light, 'linking western consumer products to extreme human rights abuses, including sexual violence in Eastern DRC' (Diemel, 2018, p.456). In addition, a 2001 UN report (International Crisis Group) described DRC as the 'world's worst humanitarian crisis' (Taka, 2011, p.32). This report was significant in 'highlighting the role played by private companies in sustaining this vicious cycle of conflict by cooperating to export these resources' (Taka, 2011, p.32).

Having examined some of the core issues around this, research conducted by the Netherlands based Pole Institute in 2002 resulted in the publication of some necessary steps to improve the situation surrounding coltan mining in Eastern DRC (Pole Institute, 2002, p.21). This study found that in the context of Eastern DRC 'no demobilisation, disarmament and reintegration programme can succeed without taking economic security into account' (Pole Institute, 2002, p.4), drawing attention to some of the complexities involved in working towards possible solutions. This research found that a secession in the trade of coltan would 'result in the concerned firms either continuing their activities, but in an even less transparent way, or simply moving to other locations to continue the coltan trade in the same or a similar way' (Pole Institute, 2002, p.4) with the ultimate result of the people of Kivu not gaining, but losing one of their very few remaining sources of income. Concurrently, it was subsequently noted that if a cease fire could be maintained 'in any durable way for this region of Africa, mining actually represents an opportunity for the building of a sustainable economy and society' (Mantz, 2008, p.43).

In Nairobi in December 2006 a conference was held with representatives of the governments of Angola, Burundi, Central African Republic, DRC, Kenya, Republic of Congo, Rwanda, Sudan, Tanzania, Uganda and Zambia in attendance. The conference was aimed 'at breaking the link between taxes on mineral revenues and financing of rebel groups'

through tracking the supply chain of minerals from mine to point of export (Sutherland, 2011, p.21). The meeting resulted in the signing of a pact which included the 'Protocol Against the Illegal Exploitation of Natural Resources' to be implemented through the 'Regional Initiative against the Illegal Exploitation of Natural Resources (RINR)'. The RINR was aimed at breaking the link between taxes on mineral revenues and financing of rebel groups and comprised tools such as the regional certification for tracking the chain of custody of key minerals, the harmonisation of national legislation, the establishment of a regional database on mineral flows, the formalisation of artisanal mining processes and a whistle-blowing mechanism (Sutherland, 2011, p.21).

As mentioned earlier, significantly in 2010 a piece of legislation was passed by the US government entitled the 'Dodd-Frank Wall Street Reform and Consumer Protection Act'. Section 1502 of this act legislated for a requirement that manufacturers certify that their purchases of potential "conflict minerals" and the metals smelted from them were not to originate from sources involved in funding war crimes and human rights abuses in the DRC (Sutherland, 2011, p.17), affecting approximately 6,000 publicly traded companies in the US (Taka, 2014, p.7). In many ways consistent with this piece of legislation from the US, in February 2011 the European Union made a similar resolution in which it was 'reported that the EU was 100 per cent dependent on non-EU sources for imports of Niobium and Tantalum, with only 11 per cent of Niobium coming from recycled sources and 4 per cent of Tantalum' (Sutherland, 2011, p.20). Margaret Wallstrom, the UN Special Representative on sexual violence and a former member of the European Commission, called on the EU to follow the example of the USA in adopting a law on conflict minerals, stating 'it is now time for Europe's leaders to step up to the plate, as a sign of universal resolve to protect the most vulnerable' (Sutherland, 2011, p.20). This certification scheme implemented by the EU is said to have affected 'more than 400 ore and metal importers in the EU' (Taka, 2014, p.7).

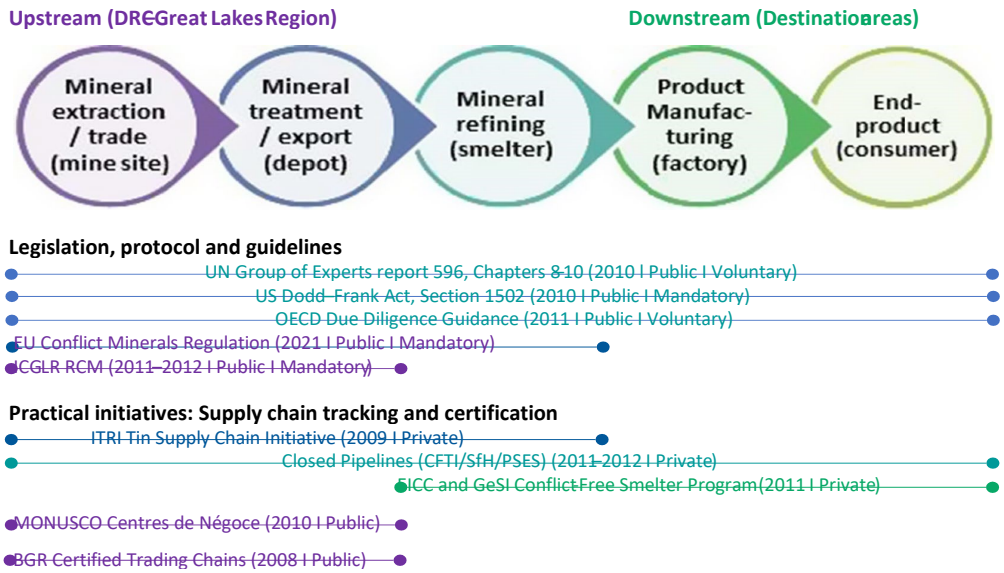
In July 2011, Motorola Solutions Inc and AVX Corporation launched another pilot initiative, the Solution for Hope Project (SfH), to secure conflict-free tantalum from the DRC. By 2014 participants included Foxconn, Hewlett Packard, Intel, Motorola Solutions, Nokia and Research in Motion. Other tantalum supply chain schemes include the G-8 pilot project Certified Trading Chains (CTC) in Mineral Production in Rwanda, the Mineral Certification project in the DRC and the Analytical Fingerprint (AFP) method. There have also been several other initiatives aimed at addressing the issue of conflict minerals, albeit not necessarily concerning circumstances around coltan or tantalum specifically, including the ITRI Tin Supply Chain Initiative (iTSCi), The Chain of Custody in the Diamond and Gold Jewellery Supply Chain, Global Reporting Initiative – Supply Chain Initiative, Extractive Industries Transparency Initiative (EITI) and the Conflict Free Smelter (CFS) program (Sutherland, 2011, p.22).

Since the start of the implementation of the above initiatives in 2010–2011 'there have been fierce debates concerning the success, viability and—especially—the (un)intended

consequences of these initiatives' (Diemel, 2018, p.454). Policy makers and nongovernmental organizations (NGOs) have pointed to the positive effects of such legislation on enhanced transparency and good governance and it is also claimed 'that the initiatives have led to a substantial decrease in militarization, from almost 100% in 2010 to 33% in 2014' (Bafilemba, Mueller and Lezhnev, 2014; Diemel, 2018, p.454). Conversely, it has also been noted that the Dodd-Frank act 'set off a chain of events that has propelled millions of miners and their families deeper into poverty' (Raghavan, 2014). Although motivation behind this law was concerned with bringing about more ethical practice among manufacturers of technology components, as a result of DRC's government shutting down the mining industry for several months by December 2014, only 11 of South Kivu's 900 artisanal mining sites were said to be conflict free with significant repercussions for the local population.

In much of the literature around attempts to source conflict-free minerals responsibly, the term 'due diligence' regularly arises. The human rights due diligence concept is said to be 'at the core of the international movement for corporate accountability and has become the cornerstone of efforts to address conflict minerals in global supply chains' (Taka, 2014, p.7). To get into the detail of what this term might mean in this context, it is notable that considerations around the trade in coltan have in fact set some precedents for the wider issue of conflict minerals. It has been noted that 'making the coltan trade more transparent would 'make an important contribution to the evolution of better governance of the sector'' (Spittaels, 2010, p.62); (Wakenge, Dennis, and Vlassenroot, 2018, p.500). Writing a few years after some of these structures were put into place on the part of both governmental and non-governmental organisations, Jose Diemel proposes a model which stands as on overview of such due diligence processes:

Schematic Overview of the Mineral Supply Chain and Conflict Mineral Interventions. Note: that this overview applies to DRC generally:



(Source: Diemel, 2018, p.457)

It has been identified that in a country where change often seems elusive, the mineral sector has seen a substantial makeover in just a few years as a result of both national and international interventions, including 'changes in the sector's governance and taxation structures, the introduction of co-operatives and the launch of traceability and certification schemes' (Diemel, 2018, p.454). This same study conducted by Jose Diemel of the Erasmus University in Rotterdam found that 'much reform practice is geared towards conflict-free sourcing, and is far less appropriate when it comes to promoting peace' and that 'exercising due diligence has become a goal in itself' (Diemel, 2018, p.453).

More widely, attempts at 'conflict free' initiatives aiming to address the humanitarian crisis have been criticized by observers for being 'top-down, externally driven, insufficiently in tune with one another' and lacking 'an in-depth understanding of local dynamics' (Geenen, 2012, p.21). Issues such as favouritism towards the monopolisation of mineral trading for certain buyers have been highlighted as well as the way these interests have overlapped with that of governing authorities on the ground (Müller-Koné, 2015) (Wakenge, Dennis, and Vlassenroot, 2018, p.500).

MEDIA

Coltan has been described as 'a conductor in a dual sense: of digital capacitors for cell phones or PlayStations, but also of the broader social and political economic processes that underlie the global production of knowledge' (Mantz, 2008, p.34). Conceptually in both a material and symbolic sense this ore is a veritable source of information production in the digital ecumene. 'As such, coltan holds importance for understanding the conflicting and diffuse global role of the digital age, as a source of hope and creativity on the one hand; and as an instrument of terror, regimentation, and routinisation on the other' (Mantz, 2008, p.34). Although DRC is not the only country where coltan is sourced as raw material, it had been identified at the time of writing that **'**manufacturers, by their own admission, have been aware of conditions in the DRC for more than a decade' (Ayres, 2013, p.179).

It has been said that that although most people in the Kivus do not know what coltan and the other "digital minerals" are used for, they do know a great deal about digital capitalism, including its effects of global simultaneity, market volatility, temporal incongruity, future uncertainty and many have experienced these processes in the form of violent displacement and dispossession, at times even as direct enslavement (Smith, 2011, p.18). As an indicator of some of the inherent inequalities which remain housed within the realm of digital information, an account of a conversation with a mine worker in Kivu can be found in James Smith's 2011 publication entitled 'Tantalus in the Digital Age';

> 'When asked what coltan was used for, one man opined that China needed the substance to build its many new roads. Another believed that coltan was used to

> build impregnable houses for the rich. And, closer to the truth, another claimed that, in a very "quiet" factory in Europe, coltan was pressed and turned into magic cards that provide people in Europe and the United States with endless credit so they can live and eat forever without working. All of these imagined uses ultimately concern the development of temporal continuity by building relationships and trust with others across space and time' (Smith, 2011, p.31).

Responding to pressure exerted by rights groups, some mobile phone companies such as Nokia and Vodafone as the end users of tantalum have subsequently published statements on their websites regarding their coltan supply chain management (Taka, 2011, p.35). Mobile phone industry campaigns aimed at greater fairness have also resulted in the establishment of companies such as 'Fairphone'. As mentioned earlier, beginning in Netherlands as a crowdfunded project set up by a few individuals with relevant skills, in 2013 the company became formally recognised having received more substantial funding from donors such as the Dutch royal family.

Notwithstanding, when it comes to other major players in the mobile telecommunications industry including laptops and other computer-based equipment, acknowledgement of any ethical issues regarding the sourcing of materials in the manufacture of products is hard to find. When asked by electronics companies and others about its sourcing practices at an industry meeting in October 2009, a representative from Ningxia, one of the companies involved in the manufacture of tantalum capacitors stated that 'the origin of the tantalum ore the firm uses is nobody else's business' (Global Witness, 2010, p.15).

In highlighting the scope of the set of issues surrounding the trade in coltan originating from DRC, in an interview about the politics of coltan author Michael Nest said that 'the problem is that the focus of activists, and even government initiatives such as the US Dodd-Frank legislation, has often been solely on conflict minerals as a cause of violence rather than a range of factors' (Nest, 2016). Given the ubiquity of coltan among telecommunications mediums 25 years after the outbreak of war in Eastern DRC, it is difficult to gain an independent or objective perspective as this material is now housed within devices, comprising the infrastructure which mediates global economic systems. Additionally, in attempting to address these questions, the sociology of economic life which understands economic action to be embedded in social networks (Granovetter, 1985); (Wakenge, Dennis, and Vlassenroot, 2018, p.500) is also important to consider. If one were able to envisage solutions to what are ultimately ethical problems, the role of coltan itself would be almost impossible to extricate in the process. In reference to the subject of how revenue from coltan should be invested and redistributed, consideration of the overall picture is required regarding other exports such as cobalt, copper, diamonds, gold, manganese, oil, timber, tin, tungsten, uranium and water (Nest, 2011, p.7).

A dichotomy of inherent disproportionality within the practice of mainstream media organisations was viewable in respect of coverage of the Rwandan genocide versus the lack of coverage of the subsequent and related conflict in DRC during the 1990s. This general silence with regard to circumstances in DRC is particularly ironic as materials

originating from the country are integral within the distributors and receivers of today's media landscape. In this light it seems appropriate to return to the concepts of early media theorists such as McLuhan in attempting to rationalise the meaning of a medium, the physicality of which is a message in and of itself. In recent years, the acceptance of terms such as 'post-truth' and 'fake news' have taken their place in the general consciousness and moreover the freedom of expression and so-called democratisation which characterised early developments in the history on the internet is being replaced by a centralisation of power as this medium's sphere of influence becomes increasingly monolithic.

CHAPTER 5: CASE STUDY 2 – COBALT

INTRODUCTION

A material utilised in the construction of lithium-ion batteries, cobalt has in recent years become a particularly desirable commodity in the global market. Due to its uses in the manufacture of mobile technologies, demand for cobalt has been soaring over the last 20 years. At source, this demand is met by workers including children, who work in harsh and dangerous conditions. An estimated 100,000 cobalt miners in DRC use hand tools to dig hundreds of feet underground with little oversight and few safety measures, according to workers, government officials and evidence found by journalists. Deaths and injuries are common and the mining activity exposes local communities to levels of toxic metals that appear to be linked to ailments that include breathing problems and birth deficiencies (Frankel, 2016). Studies have found pregnant women in Kolwezi to have concentrations of heavy metals several times higher than what would be considered normal and there is a strong correlation between birth defects and pollution in the environment as result of the methods used to produce cobalt prior to export (*The Cost of Cobalt,* 2021) (*The Toxic Cost of Going Green*, 2021).

Within the context of DRC, cobalt mining mainly takes place in the southern province of Lualaba, in close proximity to a mineral vein in the region known as the copper belt. Miners typically endeavour to follow seams of cobalt under the ground with very little oxygen available at times. Historically, copper and cobalt deposits have often been located in similar geographic areas and cobalt is generally produced as a by-product of copper and nickel mining. The copper belt occupies a major geological structure called the Lufilian Arc that extends over a distance of more than 500 kilometres from Kolwezi in Lualaba Province to Luanshya in neighbouring Zambia. This arc is host to extensive high-grade copper-cobalt mineralisation in very large stratiform deposits (Lydall and Auchterlonie, 2011, p.25). It is believed that somewhere between 40-70% of world's cobalt supplies can be found in the region.

Cobalt has a significant role as part of a process of commodifying naturally occurring materials which become synthesized and housed within the devices of today's culture industry, rendering uniformity to the landscape around consumerist assemblages. Conceptualised as a mode of coding and decoding, in a geological context substances as formed matters have been described as referring to territorialities and degrees of territorialization and deterritorialization, resulting in an overcoding and the emergence of phenomena such as 'centering, unification, totalization, integration, hierarchization, and finalization' (Deleuze and Guattari, 1987, p.41).

As has been expressed in the context of the 'mediascape', 'deterritorialisation, in general, is one of the central forces of the modern world, since it brings laboring populations into lower class sectors and spaces of relatively wealthy societies, while sometimes creating

exaggerated and intensified senses of criticism or attachment to politics in the home-state' (Appadurai, 1990, p.301). In relation to historical events in a colonial context which have heavily affected the lives of many people in Congo over the course of recent centuries and whereby natural resources have become the plunder of nations and organisations whose interests lie in making profit outside of the region, the industry and economics involved in the supply chains of materials such as cobalt all but continue to ensure that workers remain subject to power dynamics based on inequality. Despite appearing to be immaterial 'within a profit-driven global regime of capitalist production, peer-to-peer in cyberspace does not only have an ecological cost. It also means social hierarchical division across producers' (DeAngelis, 2017, p.73).

Formerly a region within Katanga province, as part of a process of devolution in 2015 the DRC central government 'repartitioned' the six largest provinces to become 21 smaller states of which Lualaba was one. Mining industries within Katanga became a focal point for politicisation at a number of stages throughout the 20th century with much of this activity focused around copper mining, an industry which also became particularly significant during the period when Congo was under colonial rule. A secessionist movement which lead to Katanga declaring independence from Belgium and the central government in Kinshasa in 1960 would eventually lead to a process of nationalisation of the mining industry in the region and the creation of 'Union Minière', subsequently renamed 'Gécamines' during the tenure of President Mobutu. Due to the relative level of peace in Katanga compared to provinces in Eastern Congo, minerals from this area are not internationally recognised as 'conflict minerals' as these mines are not necessarily controlled by armed rebel groups. Nevertheless, the region has been declared unstable, violent, and with little rule of law (Scheele, 2016, p.6).

Minerals are produced in small scale artisanal mines as well as industrial mines operated by mining companies. Many thousands of men, women and children work in atrocious conditions and for little pay in the unregulated artisanal mines. Tunnel collapses are common and the landscape in the provinces of Haut-Katanga and Lualaba around the cities of Lubumbashi and Kolwezi has been re-shaped. The formal mining industry controlled by Congolese state-owned and foreign companies, is associated with labour rights violations, community conflicts and land grabs. In 2020, Tesla signed a deal to mine cobalt in Kolwezi via multinational mining company Glencore who claim to have invested US$8 billion in DRC including a 43-kilometre wall around its mining site. As a result of a deal signed with the DRC government in 2015, Glencore has subsequently been going about the business of evicting artisanal miners (*The Electric Car Revolution: Winners and Losers, 2021*). The company has ultimately taken away jobs from the region rather than creating them. Moreover, every industrial scale cobalt mine in DRC is foreign owned and the extraction of cobalt is not helping local people.

Copper and cobalt mined in DRC are used in a vast number of consumer electronics as well in industrial applications all over the world. In recent years the proliferation of mobile technologies globally has meant that the majority of cobalt sourced as raw material is

ultimately utilised in the manufacture of lithium-ion batteries. The role of lithium-ion batteries has been described as being of a nature whereby 'smartphones would not fit in pockets without them. Laptops would not fit on laps. Electric vehicles would be impractical' (Frankel, 2016).

People around the world increasingly rely on rechargeable batteries to power their mobile phones, tablets, laptop computers and other portable electronic devices. The growing global market for portable electronic devices and rechargeable batteries is driving demand for the extraction of cobalt. Furthermore, the point has been made that 'the current Silicon Valley gold rush — from mobile devices to driverless cars — is built on the power of lithium-ion batteries' (Frankel, 2016). At the time of writing more than half of the world's cobalt was mined in DRC with approximately 85% of DRC's production imported by China for use in manufacturing (Lydall and Auchterlonie, 2011, p.28). While the current global cobalt production rate is the highest on record, it is likely that, in a climate of increasing expectations about the e-mobility revolution, cobalt demand may outrun current supply (Crundwell, 2020, p.20). Concerns of this nature have in recent years caused some mining companies to turn their attention towards the idea of mining for cobalt under the ocean in order to collect billions of nodules from the sea bed as part of what has been termed 'a new kind of gold rush' (Shukman, 2021). Notably, it was only during the early 20th century that cobalt began to be used in various alloys and as a catalyst in the chemical industry, resulting in a rapid increase in production towards the mid-20th century (Crundwell, 2020, p.2). Projections as to the future role of the electric car and other battery powered products has in recent years lead to the belief that the world will need to be harnessing between twice and four times the amount of cobalt by 2050 with some estimates stating 644,000 tonnes per year needing to be produced by that point compared to 2018 production levels of 140,000 tonnes per year (Nathan, 2020).

With between five and ten grams of cobalt in an average mobile phone, twenty-five to thirty in a laptop and between five and ten kilograms in each electric car, the mere ubiquity of cobalt in today's technological landscape is something which is hard to conceive. In an effort to gain some perspective with regard to the role of cobalt among today's media landscape, the work of theorists such as McLuhan whose rationale would reify any one of the technological products which run on lithium batteries as a medium in and of itself comes to the fore. However, as has been expressed in one light 'the synthetic future of soil is enveloped in an environmental context, but it also is related to the fact of soil becoming a tradable entity, entering into circulation of not only the earth but also the monetary reality' (Parikka, 2015, p.110). Elements such as cobalt become isolated, analysed, synthesised, and enter into circulation as deterritorialised bits of information that can be traded in complex, global ways.

MINERAL

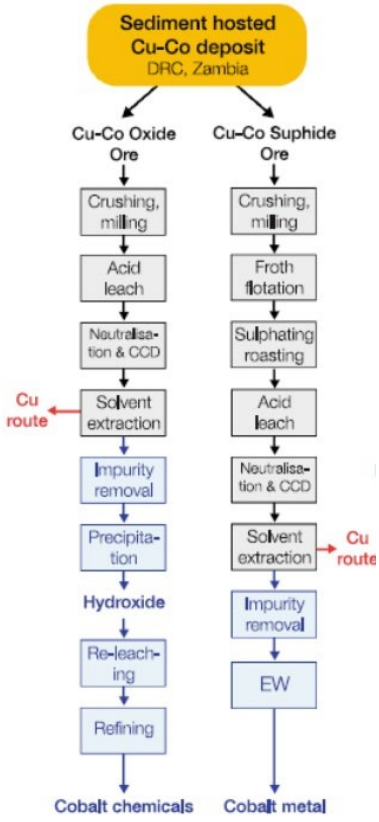
Cobalt is said to have been discovered by Swedish chemist George Brandt in 1735 with its name deriving from the German word 'kobold', meaning goblin or elf. Cobalt is not found as a free element in nature but is found in mineral ores. It has the symbol Co in the periodic table where it is surrounded by iron and nickel which display similarity in physical properties. Cobalt is a lustrous greyish, silver, brittle transition metal with atomic number 27. It is also said to have ferromagnetic properties which allow it to be magnetised. It has a melting point of 1495°C.

In a sense, cobalt is a manually harnessed material in that 'pure cobalt does not exist in nature, but cobalt is present as an essential constituent in about 66 minerals, as recorded in the International Mineralogical Association's (IMA) RRUFF database (Lafuente et al, 2015), and as a minor or trace constituent of several hundred more, particularly those containing nickel, iron and manganese (Crundwell, 2020, p.3). In a conceptual context, cobalt is taken from one medium as it is found under the ground and combined or assembled into another through a series of transformations as part of an articulation between small and large molecules, a segmentarity by successive modifications and polymerization (Deleuze and Guattari, 1987, p.42).

In recent years, an increase in demand has enabled the modernization of manufacturing processes, resulting in the move from direct electrowinning of copper to solvent extraction electrowinning. With this change has come a variety of technical challenges in the recovery of cobalt from these sources. The expansion of markets for cobalt has resulted in a switch in the form of cobalt produced at the mine site, from metal cathode to cobalt hydroxide. The bulk of global cobalt production emanates as a by-product of extraction of commodities such as copper (~55%), nickel (~35%), and arsenic (Azevedo et al, 2018); (Crundwell 2020, p.2).

Because of its by-product status, cobalt beneficiation processes are usually of secondary importance compared to the process required to recover the main commodity (i.e. nickel or copper). As a result, cobalt recovery usually begins after extraction and concentration of the associated primary metal. The three main processes for cobalt extraction are hydrometallurgy, pyrometallurgy and to a lesser extent vapometallurgy. Processes involved and flowsheets employed depend on the ore mineralogy and are usually unique to the ore deposit type and even the ore type (Crundwell, 2020, p.14). An emulsified mixture of palm oil and fuel is used to recover heterogenite present in siliceous ore at the Kolwezi concentrator (DRC), using sodium silicate to depress the quartz (Crundwell, 2020, p.13). The role of palm oil itself as part of a history of exploitation of Congo's natural resources in the 20th century is also of significance here both literally and symbolically.

The table adjacent depicts the process involved in cobalt production with respect to previously defined deposit types found as naturally occurring in DRC as opposed to other locations where it is sourced. The main geo-metallurgical characteristics of cobalt-



(Source: Crundwell, 2020, p.15)

containing mineral deposits of the type found in the Katanga region mean that issues can be encountered such as low recoveries for mixed oxide or sulphide ore, high acid consumption (carbonates, chlorite, talc), high quartz content (high working index) and high manganese content. Processes such sulphidisation, reverse flotation, flocculation and manganese removal by precipitation have been outlined as potential solutions for these inefficiencies (Crundwell, 2020, p.15).

In a context of materiality and the formation of assemblages via a process of 'machinic phylum', attention has been paid to the fact that 'we may speak of aggregates of consistency when instead of a regulated succession of forms-substances we are presented with consolidations of very heterogeneous elements, orders that have been short-circuited' or even ultimately a reverse causality of destratifying transversality, moving through elements, orders, forms and substances, the molar and the molecular, freeing matter and tapping forces (Deleuze and Guattari, 1987, p.336). Although it may still be easier to say what a machinic phylum is not as opposed to what it precisely is, it has been noted that 'this complicated organization is what allows a turbulent flow to maintain its pattern: it takes energy from its surroundings, channelling and dissipating it through this system of nested eddies. But the same processes that allow this form of internal order to emerge as if from nowhere, cause external disorder' (DeLanda, 1991, p.8).

MINING HISTORIES

Where emphasis in DRC's mining sector has shifted in recent years, reflecting demand for materials utilised in the manufacture of various forms of digital technology, much of the industry around cobalt has been operating along lines which were drawn up at earlier points in the country's history. In a general sense, economic independence has been difficult to achieve for nations such as DRC during the post-colonial era and when it comes to resources, forms of colonialism can still be found to be in full flow. One of the main materials to be exploited during the period when this land was claimed by Belgium was copper. The Union Minière du Haut-Katanga (Mining Union of Upper-Katanga), often abbreviated to Union Minière or UMHK, was an Anglo-Belgian mining company which operated in the copper belt region between 1906 and 1966. The company's practices during this period have been described as harshly capitalistic and its operations are said to have greatly contributed to the wealth of Belgium.

In 1967 Union Minière became nationalised and renamed La Générale des Carrières et des Mines, also known as Gécamines. Today the organisation is one of the largest mining companies in Africa and the biggest in DRC as it sits on what is believed to be the world's greatest deposit of cobalt as well as some of the world's largest deposits of copper. Copper mines in which Gécamines has a major interest include, but are not limited to, Kambove, Kipushi, Kamfundwa and Kolwezi. The company has been described as a 'parastatal' entity and the 'cornerstone of the Congolese economy over decades', holding 'around 30,000 square kilometres of mining concessions around Lubumbashi, Likasi and Kolwezi in Katanga containing the highest concentrations of minerals in the world' (Johnson and Tegera, 2005, p.100).

At its peak in the 1970s and 80s, the state mining company Gécamines employed around 34,000 workers, ran farms, hospitals and schools for their benefit, and was the largest contributor to the state treasury. As the regime of President Mobutu Sese Seko collapsed in the early 1990s, so did Gécamines. The company stopped paying salaries, and employees were forced to fend for themselves, looting its assets by dismantling mining apparatus, sending truckloads of spare parts, equipment and ore concentrates to South Africa. During the late 1990s, with little chance of reviving the industrial mining sector while fighting continued, Laurent Kabila encouraged the inhabitants of mining towns to dig for themselves. Thousands of adults and children, using only hand tools, started mining in the Gécamines concessions. In 1999 Kabila established a government agency 'The Service d'Assistance et d'Encadrement du Small Scale Mining' (SAESSCAM) to regulate, and tax, this growing sector and today it remains a key government body charged with overseeing artisanal mining (Amnesty 2016, p.16).

Many large mining deals, especially in the copper and cobalt mining areas of former Katanga province, were signed during the three years of transition (2003-2006) as the DRC headed towards nationwide elections. It has been highlighted that even those contracts which were signed legally during this period were viewed with suspicion by the Congolese population, not only because of the lack of information about the circumstances in which they were signed but because many of them were seen as imbalanced. In particular, some of the big copper mining contracts provided 'disproportionately large shares of the profits to private, multinational companies and a poor deal for the Congolese state' (Global Witness, 2007, p.3).

The development of renewable energy sources, electric vehicles and lithium-ion batteries has increased the demand for cobalt from the African Copperbelt that traverses the Democratic Republic of Congo (DRC) and Zambia**.** In 2015, Gécamines signed a strategic copper and cobalt cooperation accord with Hong-Kong-listed China Non-Ferrous Metal Mining, a deal which was part of an even larger $2 billion accord for five different projects and the details of which are contained in a series of subcontracts and amendments that have been kept secret, despite DRC's legal obligation to publish them under the country's mining laws (Global Witness, 2020). In a more general context today, a paradox can be found inherently situated within the distributors and receivers of information via forms

telecommunications whereby knowledge and information as to the circumstances behind the creation of such devices is largely obscured from the attention of consumers in the blind-spot found internally within products themselves.

INVENTION

Long before being isolated as a proper element by Swedish chemist Georg Brandt in 1735, cobalt metal and cobalt minerals have been used during the Antiquity period as blue pigments (cobalt blue) for jewellery, pottery and paintings, and to impart a distinctive blue tint to glass (Crundwell, 2020, p.1). In the modern day, cobalt is contained in super alloys used in jet engines in the aerospace industry, land-based and marine turbines and various industrial, medical, automotive and defence-related applications (Alves Dias and Blagoeva, 2018, p.13). However, its use in the manufacture of lithium-ion batteries that power most electronic devices today such as laptops and cell phones make it particularly sought after and ubiquitous (Amnesty, 2016, p.18). In an effort to conceptualise the role of energy storage in the modern global economy, it has been identified that at an earlier point around the year 1980 a crisis had emerged where capital's control over work across the planet was coming into question, with energy commodities offering a solution whereby control over the work process could be once again imposed (Caffentzis, 2013, p.1).
As part of a continual updating process among capacities of technological products, it should also be acknowledged that recent research suggests that newer designs of solid-state lithium batteries are moving towards a goal of being cobalt free. Most of today's electric vehicle batteries use nickel-manganese-cobalt cathodes, with 60% nickel and 20% each of cobalt and manganese, however researchers are now working on pushing the proportion of nickel up to 80% and bringing the other metals down to 10% each. Some carmakers want to eliminate cobalt entirely, given its scarcity and ethical considerations around mining the metal in light of circumstances in DRC in particular (Patel, 2020). In 2014, half of the world's cobalt used in the manufacture of batteries was mined in the DRC.

Notwithstanding, demand for cobalt is growing at over 5% per year, and it is expected to continue doing so as the lithium-ion battery market expands with the increasing popularity of technology such as electric vehicles (Amnesty, 2016, p.15). Market projections highlight that 'the expansion of the electric vehicle market globally and in the EU will increase exponentially the demand for cobalt in the next decade' (Alves Dias and Blagoeva, 2018, p.2). That said, estimates suggest that 29% less cobalt will be needed per battery by 2030 (Alves Dias and Blagoeva, 2018, p.4). More widely, it is believed that 'batteries are essential to achieve the EU objective of decarbonisation of the economy and other challenges related to sustainable development' (Mancini et al, 2020, p.7). This drive towards decarbonisation means cobalt's properties are in demand as it is perceived to be essential for clean energy, a quest which comes at a cost to people in the south of DRC.

SUPPLY CHAINS

Reports from non-governmental organisations (NGOs), international organisations and media about the sourcing of cobalt have increased in number since 2016, and the issue is now more visible than in 2007 when the first reports on the sector emerged (Mancini et al 2020). According to the government's own estimates, at the time or writing 20% of the cobalt exported from DRC came from artisanal miners in the southern part of the country where approximately 110,000 to 150,000 miners would work alongside much larger industrial operations (Amnesty, 2016, p.4). In 2021, updated estimates stated the proportion of DRC's cobalt mining undertaken by artisanal means to be somewhere between a quarter and a third of all output (*The Toxic Cost of Going Green,* 2021) (*The Cost of Cobalt,* 2021). These workers, referred to as creuseurs in DRC, mine by hand using the most basic tools to dig out rocks from tunnels deep underground. Artisanal miners include children as young as seven who search for rocks containing cobalt in the discarded by-products of industrial mines, and who wash and sort the ore before it is sold. Cobalt that is dug from the DRC's artisanal mines soon enters a global trading network, largely untraced.

Artisanal miners in DRC work in a range of different ways and locations to mine cobalt. In some places, the miners dig deep underground to access the ore. These miners, who are mainly adult men work underground in tunnels and use chisels, mallets and other hand tools. In other places, miners, including many children, dig for cobalt in the discarded tailings (by-products such as rocks left over from mining and refining processes) of the region's many industrial mines. They collect rocks containing minerals that lie on or near the surface, most often without the companies' permission. The stones they pick are then washed, sifted and sorted in streams and lakes close to the mines. Generally, women and children are involved in washing and sorting the ore (Amnesty, 2016, p.5). As the world's primary cobalt exporter, southern DRC has intense truck traffic. Since the national railway is largely dysfunctional and politicians and businessmen have invested in trucking, all mineral ores, machinery, equipment and chemicals are transported on roads which are few in number and most often unpaved (Scheele, 2016, p.20).

It has been asserted that the path cobalt would tend to take on route from its source under the ground to its use in the manufacture of a mobile phone, laptop or electric car battery could be summarised as a process with five stages. Beginning at the artisanal mine, raw material would then be passed to traders or intermediaries, some of whom may have official licenses, some may not. These intermediaries then broker the process of distribution to organisations responsible for smelting or refining material before this product is then passed to producers of lithium-ion battery components and companies who assemble lithium-ion batteries. It has been identified that major refineries of cobalt are located in China, Finland, Canada, Belgium, Zambia, Japan, Norway, Madagascar, Australia, New Caledonia, Russia, Morocco and South Africa (Alves Dias and Blagoeva, 2018, p.33). Once the batteries themselves have been manufactured, electronics and car companies will then assemble the batteries into the end-product, ready for consumer use. The world's lithium battery mega factories are operated by the following companies: LG

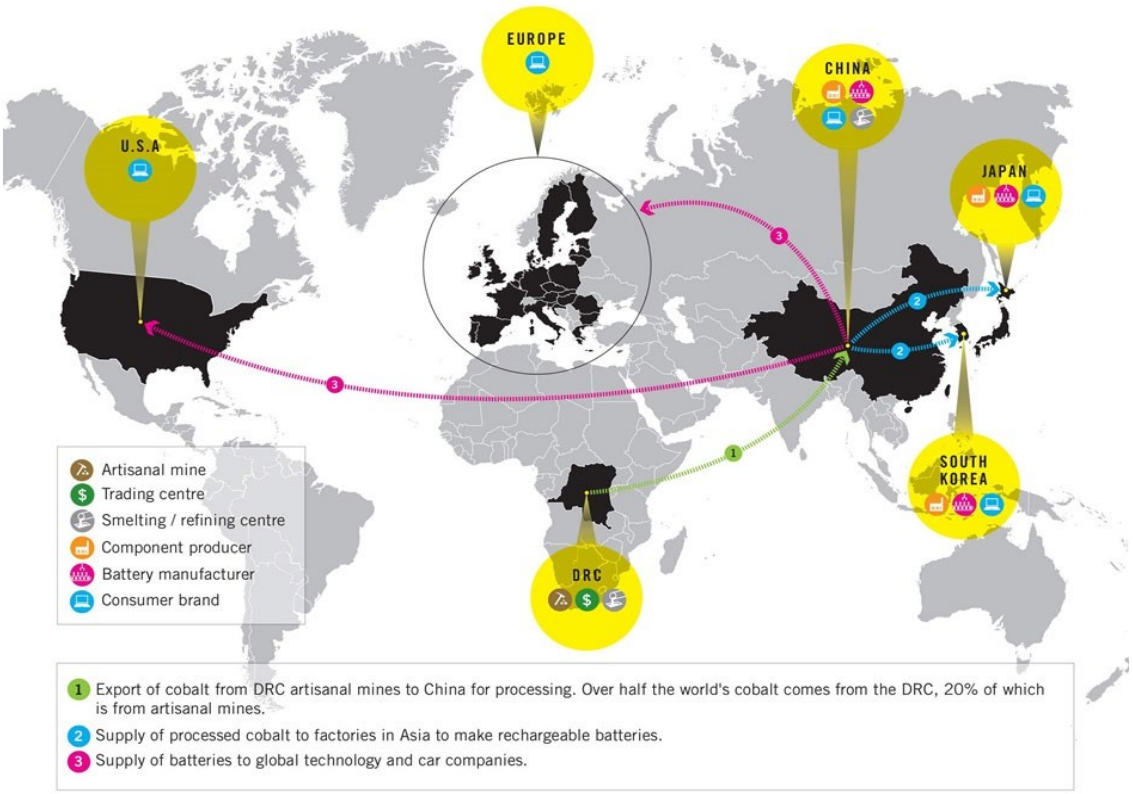
Chem (US, China, Korea, Poland), CALB (China), Panasonic (US), Samsung SDI (China, Korea), Boston Power (China), SK Innovation (Korea), Dynavolt (China), BYD (China), Lishen Battery (China), Northvolt (Sweden), Tesla (US), CATL (China). (Alves Dias and Blagoeva, 2018, p.26).

A key factor which characterises ethical problems associated to the industry around cobalt is highlighted in the pay gap between consumer brand workers in Europe and African mine workers, the ratio of which is said to be in the region of 25 to 1. Accounts of artisanal miners working on the ground indicate that despite huge quantities of production such as half a tonne per worker per day, each worker might be paid around 1,500 Congolese Francs per day (around US$1.50) for working 12 hours in the direct sun with no shade and subject to a rate of 500 Francs ($US 0.50) taxation from the government agency SAESSCAM (Amnesty, 2016, p.27).

Although cobalt is mainly mined in DRC, the country is only responsible for 0.4 % of global refinery production, despite a high level of unutilised capacity. DRC provides the majority of the feed material for China's production of refined cobalt. In 2013 it was announced that DRC intended to ban exports of copper and cobalt concentrates to encourage refining within the country. To date, this has been put on hold and its implementation is not foreseen at any point over the coming years. The importance of raw material exports to national GDP and a lack of electricity for such an energy-intensive sector, are pointed out as the main reasons. Nevertheless, according to the OECD, the DRC central government imposed export taxes of up to 25 % on cobalt ores and concentrates over the period 2010-2014 (Alves Dias and Blagoeva, 2018, p.32).

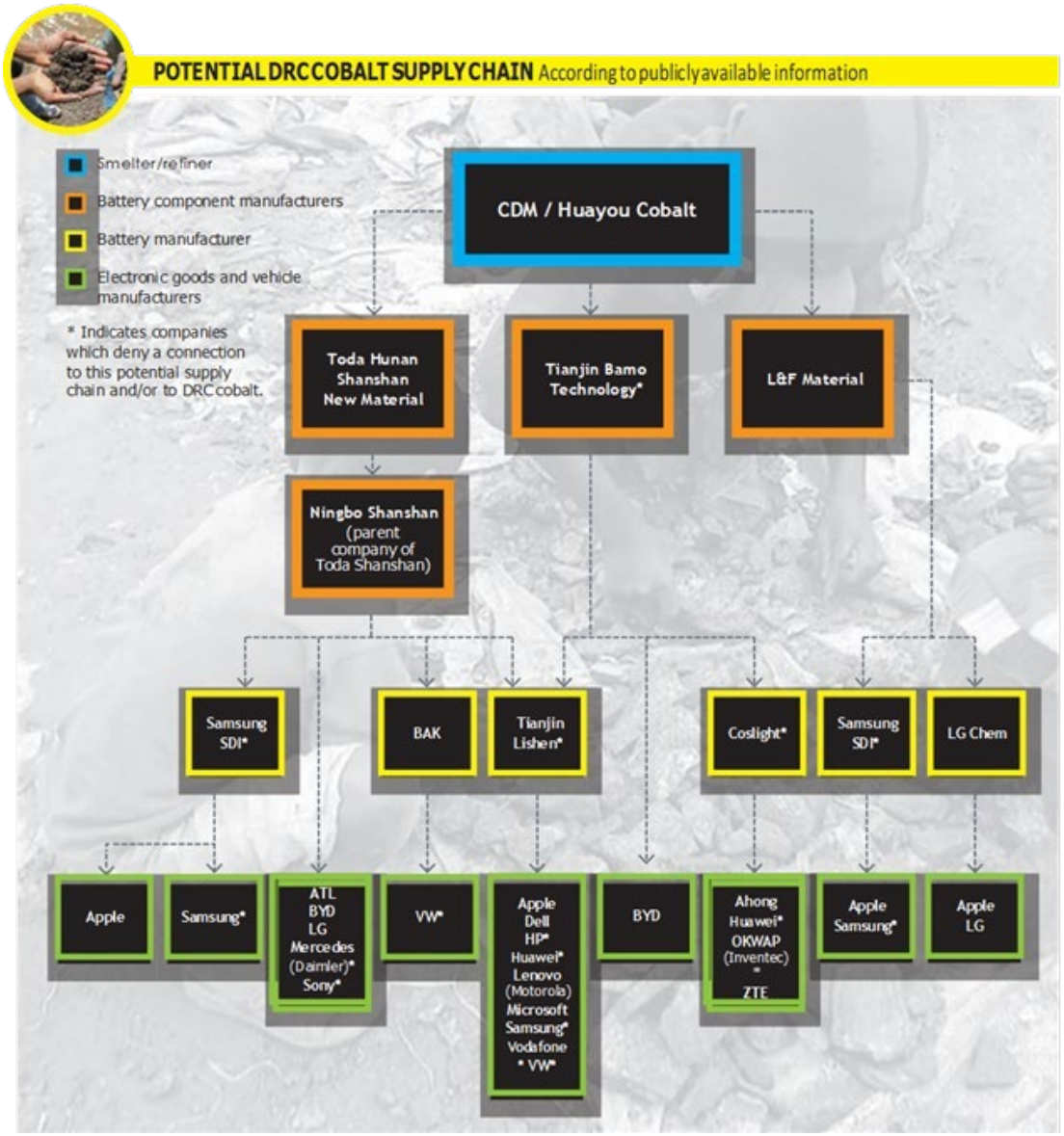
Cobalt supply has issues of concentration and risk of disruption, as it is mainly produced in DRC and China. According to the analysis of experts these risks are likely to persist in the future, increasing in the near term. According to a European Report published in 2018, 'minerals exploration and the recycling of electric vehicle batteries can make for an improvement in the stability of cobalt supply from 2020 onwards, which together with the expected reduction in the use of cobalt, driven by substitution efforts, should help bridge the gap between supply and demand. Despite this, worldwide, demand is already perceived to exceed supply in 2020 and such a loss-making trend is expected to become more consistent from 2025 on' (Alves Dias and Blagoeva, 2018, p.2). Furthermore, although the capacity to meet rising demand is projected to increase through mining and recycling activities, it has also been noted that an increasing gap between endogenous supply and demand would be expected according to projections.

Movement of cobalt from artisinal mines in the DRC to the global market



(Source: Amnesty, 2016, p.46)

In Lubumbashi in the south of Haut-Katanga province, the company Congo Dongfang Mining processes the low-grade cobalt into crude cobalt hydroxide before shipping it, via Durban in South Africa, to Zheijiang province on the eastern seaboard of China, where its parent company Huayou Cobalt is based. Huayou Cobalt is a publicly traded company, listed on the Shanghai Stock Exchange and claims to be China's largest manufacturer of cobalt products, and the third largest in the world. In 2013, it sold cobalt worth almost 1.5 billion yuan (US$235 million), making a profit of almost 200 million yuan (US$32 million). Congo Dongfang is a wholly and directly owned subsidiary of Huayou Cobalt who also operate several industrial mines in DRC. In the three years up to 2014, company documents show that Congo Dongfang provided Huayou Cobalt with more than 40 per cent of the company's total production of cobalt. Once the processed cobalt arrives in China, Huayou Cobalt processes it further, turning it into a range of different chemical products (Amnesty 2016, p.52)



(Source: Amnesty, 2016, p.55)

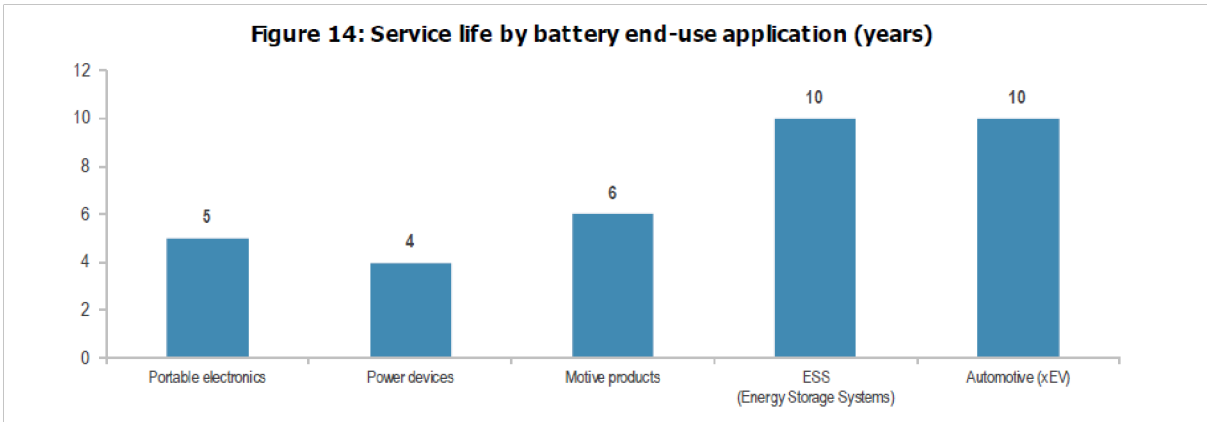
Congo Dongfang Mining International (CDM) is a 100% owned subsidiary of China-based Zhejiang Huayou Cobalt Company Ltd (Huayou Cobalt), one of the world's largest manufacturers of cobalt products. Operating in DRC since 2006, CDM buys cobalt from traders, who buy directly from the miners. CDM then smelts the ore at its plant in the DRC before exporting it to China. There, Huayou Cobalt further smelts and sells the processed cobalt to battery component manufacturers in China and South Korea. In turn, these companies sell to battery manufacturers, who then sell on to well-known consumer brands (Amnesty, 2016, p.8).

Other companies undertaking cobalt mining in DRC include Eurasian Resources Group, Chemaf, Shalina Resources, Katanga Mining ltd, Glencore plc, Jinchuan Group, China Molybdenum Company ltd (Crundwell, 2020, p.5) as well as Gécamines, Minière de Kalumbwe Myunga, Huachin, SEK (Scheele 2016, p.14). A company called Groupement du

Terril de Lubumbashi export huge quantities of copper, cobalt, germanium, zinc and thus may consider itself to be generating economic development to the Katanga region. According to prevailing international standards, companies that use DRC cobalt in their products should be sourcing that mineral responsibly. They should therefore be aware of, and address, the risks associated with its extraction and trading. Many red flags exist in relation to cobalt extraction in DRC. Campaigns and initiatives aimed at addressing ethical problems around the cobalt supply chain will be examined in more detail later in this chapter.

A further question is what happens to cobalt once it has been discarded by the consumer. It has been estimated that about 69% of cobalt used in manufactured products today is sent to landfills (Crundwell, 2020, p.20). About 22% of the discarded cobalt is collected for scrap markets and the remainder is downgraded for other scrap markets (Harper, Kavlak and Graedel, 2012) (Crundwell, 2020, p.2). Below is a graph indicating the life span of different kinds of products which contain cobalt.

Figure 14: Service life by battery end-use application (years)



(Source: Alves Dias and Blagoeva, 2018, p.34)

Across these various technological forms a tendency is observable whereby inventions that appeared suddenly can disappear just as quickly. In a more sceptical light, media are said to be 'special cases within the history of civilization' which 'have contributed their share to the gigantic rubbish heaps that cover the face of our planet or to the mobile junk that zips through outer space' (Zielinski, 2006, p.2). At some point in the future, searches through heaps of refuse may uncover some shining jewels from what has long been discarded or forgotten, reifying the assertion that 'nothing endures in the culture of technology' (Zielinski, 2006, p.2). In the present however we do have the ability to influence how long ideas and concepts retain their radiance and luminescence, if only as consumers.

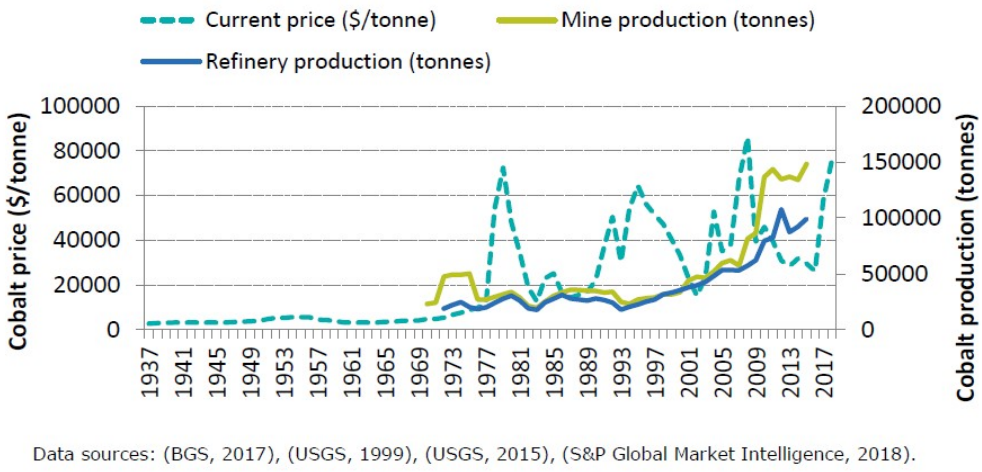
MARKETS

Two-thirds of the world's cobalt was produced in DRC in 2017 (Africa Research Bulletin, 2020), a material crucial for making batteries used in mobile phones and electric vehicles. Congo is the world's largest producer of the rare metal, yet provinces in the south such as Lualaba and Haut-Katanga from where this material is sourced remain impoverished. In the search for any potential solutions to what appears to be a process of perpetual exploitation with regard to the sourcing of cobalt from this region, closer examination of the economics involved would seem to be an appropriate starting point.

One factor which has had the effect of shackling any economic development around this booming industry in DRC is that prices of raw materials per ton or by kilo are not set and may be subject to negotiation at times. As a result, the cobalt market is unstable as demand continues to rise. As mentioned, cobalt extraction is heavily associated to the copper industry in terms of the locations from where both materials are sourced within the country as well as the infrastructure around copper which had itself been booming at earlier points in the 20th century as demand grew. In 2008 approximately 75,000 tonnes of cobalt were being exported from Katanga via Gécamines and as a result of the global financial crisis of 2008, copper prices are said to have dropped by 60%.

Ever since large quantities of cobalt began to be exported and stockpiled by the US during the late 1960s prices have continued to fluctuate. During the early 1980s prices took a sharp downturn before in 1984 the governments of both Zaïre and Zambia announced a fixed producer price. Strikes among workers in Zaïre as well as political unrest in Zambia then led to the Soviet Union exporting to western markets before the dissolution of the Soviet Union in 1991. During the 1990s, the US again became more influential in the cobalt market as it began to export its stockpile. Then since the turn of the 21st century demand has steadily increased resulting in a cobalt deficit around 2008 which later became a surplus with China then taking its turn to export quantities which had been stockpile (Alves Dias and Blagoeva, 2018, p.8).

Figure 2. Historical mine production and prices of cobalt.



Data sources: (BGS, 2017), (USGS, 1999), (USGS, 2015), (S&P Global Market Intelligence, 2018).

(Source: Alves Dias and Blagoeva, 2018, p.7)

In today's circumstance, the global cobalt market is dominated by the rechargeable battery industry which is responsible for 58% of cobalt use (Darton Commodities Ltd., 2020); (Crundwell, 2020, p.2), a figure which has increased from 10% in 1999. This growth in the battery market is due to the emergence of smartphones, tablets and laptops, and the large batteries required for electric vehicles and plug-in hybrid electric vehicles. As a result of the accelerated introduction of electric vehicles, demand for lithium-ion batteries is expected to increase significantly in the future (Alves Dias and Blagoeva, 2018, p.3). As economies increasingly move towards the utilisation of renewable energy sources, a large part of the motivation for this transition is the establishment of stationary energy storage in transitioning to a low carbon economy, as well as profitability among multinational private companies.

Estimates indicate that the degree of trade mispricing in the form of undervalued import from DRC to the European Union between 2000 and 2010 was in the region of €9.95 billion, exceeding the declared total import value of €8.06 billion. Research has shown that almost all of the under-pricing among the EU import from the DRC, 98% of the undervalued amount, is through under-priced non-industrial diamonds imported by Belgium and cobalt ore and mattes imported by Finland (Cathey, Hong and Pak, 2018). In November 2010 'Finland imported 3,164 tons of cobalt mattes and other intermediate products of cobalt metallurgy from the DRC at €3,286 per ton, less than 10% of the median EU-World import price. This represents mispricing of over €80 million (under-pricing) compared, conservatively, to a lower quartile price of €28,657 per ton during the same period' (Cathey, Hong and Pak, 2018, p.2).

Prior to refinement processes, a kilo of raw material containing cobalt ore is purchasable for approximately US$50. Cobalt production in DRC is said to have increased by 470% between the years 2000 and 2015, with supplies originating from the region now said to constitute 60-70% of global stocks. While market prices of cobalt have spiked 300% in the past two years, none of that increase makes its way to workers on the ground. The cobalt reserves at Kasulo for example are estimated to be worth $100bn with prices for the mineral set to rise further at a projected rate of 7%-13% over the following decade (Alves Dias and Blagoeva, 2018, p.2). Between 2017-2019 the price of cobalt was volatile, varying by about 300% due to speculation that global cobalt consumption will triple in the next decade.

Emphasis in moving towards the utilisation of lithium batteries across innumerate sectors of great proportions within the global economy has resulted in geo-political imbalances coming to focus across a number of geographic areas. Along with cobalt, circumstances around the sourcing of material lithium itself which comprises the batteries is also an important aspect. In Bolivia what appears to have been an external state-sponsored regime change has transpired in recent years, resulting in the democratically elected President of the country having to seek asylum in a series of other Latin American states. It has been said that this was the result of the Bolivian government's position with regard to its lithium exports having changed, with one of the two main importers having lost out in a

trade deal. In Afghanistan an ongoing 20-year war waged by a coalition of western nations contributed to results such as the US Geological Service having discovered within the country an estimated 1 trillion dollars of lithium and gold in 2007.

CONFLICT

Notably, cobalt currently does not sit among the official conflict minerals list as defined by US government legislation, a list which includes tantalum, tin, tungsten and gold. According to the criteria around this legislation, much of which was developed during the Obama administration in the lead up to the Dodd–Frank Wall Street Reform and Consumer Protection Act 2010, materials included in the list are described as those from conflict affected and high-risk areas. Although provinces in the south of DRC where cobalt is mined may not have been affected by armed conflict on the same scale as those in the east of the country in recent decades, there are also a number of environmental, social and economic conflicts around this industry.

Widespread environmental contamination caused by the mining of copper and cobalt has led to concerns about the possible association between birth defects and exposure to several toxic metals in the provinces of Haut-Katanga and Lualaba. A study involving research body the Lancet was conducted between 2013 and 2015 with the aim of assessing the possible contribution of parental and antenatal exposure to trace metals to the occurrence of visible birth defects among neonates in what was described as the first investigation of its kind (Van Brusselen, 2020). An increase in the rate of birth defects in this region such as cleft palates and neural tube defects which affect brain development among infants has been attributed to factors such as mothers being exposed to dust and irradiation in the first trimester. Studies have also found the likelihood of such defects to be 3 or 4 times more likely if the father works in a mine (*The Cost of Cobalt,* 2021).

Closer study of the impact of the copper and cobalt industry on children provides strong indicators as to the repercussions of this industry with documented accounts of child labour on an unparalleled scale being of central importance. Accounts of child labour in the cobalt mining industry in DRC have been circulating increasingly in recent years. Amnesty International's 2016 report documents how 'all of the tasks carried out by children in the mines require them to carry heavy sacks of mineral ore, sometimes carrying loads that weigh more than they do' (Amnesty, 2016, p.29). In reference to the International Labour Organization (ILO) Worst Forms of Child Labour Convention, the report states that 'it is widely recognized internationally that the involvement of children in mining constitutes one of the worst forms of child labour, which governments are required to prohibit and eliminate', adding that the work children do in artisanal cobalt mines in DRC is hazardous, and likely to harm children's health and safety (Amnesty, 2016, p.6). Among workers of all ages, unsafe conditions in mines have resulted in miners losing their lives to collapses, fires and flooding (Amnesty, 2016, p.24).

Another aspect of this mining work is the chronic exposure to dust containing cobalt which can result in a potentially fatal lung disease known as 'hard metal lung disease'. Inhalation of cobalt particles can also cause 'respiratory sensitization, asthma, shortness of breath and decreased pulmonary function', and sustained skin contact with cobalt can lead to dermatitis. Researchers found that the vast majority of miners, who spend long hours every day working with cobalt, do not have the most basic of protective equipment such as gloves, work clothes or facemasks (Amnesty, 2016, p.5). Criticism of the DRC government and its apparent failure to regulate or implement adequate safety and labour standards is also a common thread throughout the Amnesty report from 2016.

In DRC the production of copper and cobalt is also inextricably linked to violations of peoples' right to a clean environment. One example of this which has been documented is the discharge of contaminated wastewater into the Dikanga River from the operations of Minière de Kalumbwe Myunga (MKM), which resulted in the water being unfit for human consumption by local communities (Scheele, 2016, p.4). Additionally, those people who live within a few metres of the mines, are also exposed to air and noise pollution, as well as dust containing cobalt compounds. Thousands of trucks travel to and from the mines and related operations all day and through the night, exposing residents in the cities of Lubumbashi and Likasi to heightened air pollution and leaving them rightfully afraid of contracting lung diseases. Chronic exposure to such dust can lead to potentially fatal lung disease as well as other pulmonary problems, including asthma and pneumonia. Previous research has shown that people living close to cobalt mines had 43 times the level of cobalt, five times the level of lead, and four times the level of cadmium and uranium in their urine than is considered normal (Scheele, 2016, p.4). Ironically, cobalt is essential for human health in the form of vitamin B12 which is essential for red blood cells but only in minute doses otherwise it is highly toxic.

Processes associated to cobalt mining have been found to result in local river water becoming toxic, with high levels of uranium making fish radioactive as well as high levels of manganese and zinc resulting in a 10-70 times increased likelihood of deformations of unborn children (*The Cost of Cobalt*, 2021). Studies have found rivers near the city of Kolwezi to be acidic with very little life remaining in them (*The Toxic Cost of Going Green,* 2021) with others finding 60% of the rivers in Haut-Katanga to have been contaminated. This pollution is the result of the way cobalt is extracted via hydrometallurgy using acid which spreads into the environment.

Another important aspect to the cobalt mining industry in the south of DRC relates to land and property rights. It has been asserted that 'analyses of conflict between large-scale mining (LSM) and artisanal and small-scale mining (ASM) in the provinces of Haut-Katanga and Lualaba should take into account the equity and fairness considerations linked to the enforcement of the property rights of corporate and other actors' (Katz-Lavigne, 2020, p.1). Research has also shown how at the sites of mining operations, citizens have had their land and property expropriated by mining companies. 'Some sold their houses, many sold their land, and many more saw their access to land destroyed – this was land that was

not legally theirs but which they used to sustain themselves, such as forests from which wood and essential non-timber forest products are collected' (Scheele, 2016, p.29). Violence has also occurred between police or military and illegal miners perceived to be trespassing on mine sites. As miners flee, police open fire indiscriminately and have reportedly hit innocent civilians. In June 2014, police action to chase away illegal miners in the concession of South Katanga Mining Company (CMSK) led to the deaths of three people. The municipality of Kawama registered four people who were wounded by bullets in May 2014 and at the same site in August 2014, the military shot five diggers (Scheele, 2016, p.36).

The proximity of homes to sites of mining operations is also an aspect of this industry which impacts on lives of residents in these areas. Given that some communities live physically very close to mines, accidental deaths do happen. Communities including those near the Ruashi mine on the outskirts of Lubumbashi, have also faced physical danger when explosions caused by the mine's operations damaged homes and property, for which they received no compensation (Scheele, 2016, p.5). In a similar area at Luiswishi mine in 2009 hundreds of houses were bulldozed unlawfully by police. Reports of illegal miners being shot and killed by the police are frequently published.

The displacement of people is another important consequence of the cobalt mining industry in southern DRC. Local communities are regularly cut off from their farmland and water sources near mines, without having had a say in the matter. There are several examples of forced relocations of entire villages. For example, in Kasai-Oriental province inhabitants of the village Kishiba were forced to move to make way for Frontier, a cobalt and copper mine. It has been documented that their new homes in Kimfumpa lack the most basic of services such as clean water, fertile farmland, schools and health care (Scheele, 2016, p.29). In more recent times, DRC authorities were said to be paying some 10,000 families to move away from a south-eastern town sitting atop billions of dollars worth of cobalt, a provincial governor said on December 17th 2020 (Africa Research Bulletin, 2020). It has also been documented that in less populated areas which are declared as reserves, mining sometimes goes ahead with government permission.

POLICY / CAMPAIGNS / LAWS

Throughout the course of the 20th century, Katangese copper and cobalt have continued to flow freely onto the world market, without buyers, end users or foreign governments posing questions about the conditions under which they were produced. It is upon this backdrop of a lack of accountability that the current boom in cobalt exports from the south of DRC comes into focus. It has been noted that to date 'no international stakeholder has taken any steps to start setting standards for the environmental or human rights performance of the Katangese mines' (Scheele, 2016, p.10) with companies using copper

and cobalt in their products having so far shown little initiative in improving environmental impact and human and labour rights in this part of their supply chain.

Although most companies have adopted ethical codes that entail the whole production chain, including the extraction of minerals, most efforts concentrate on processes in production of electronic components rather than in relation to the sourcing of materials necessary for this. International guidelines that provide the framework for both governments and companies such as the UN guiding principles on business and human rights and the Organisation for Economic Co-operation and Development (OECD) guidelines for multinational enterprises are barely followed. According to a 2011 OECD report, companies were to avoid infringing on human rights and conduct due diligence to identify, prevent, and mitigate any actual and potential adverse impacts they cause, or to which they contribute or are directly linked through a business relationship. This recommendation included adverse impacts that are not caused by the company itself, but by other companies (or even states) to which the company is linked through its operations or products (Scheele, 2016, p.53).

The mining of copper and cobalt, whether for use in consumer electronics or other uses, thus falls under the due diligence of companies further downstream in the supply chain and would clearly demand much further action than is currently being taken to ensure these minerals are sourced responsibly and with respect for human rights. Albeit a statement which is not in reference to circumstances around cobalt specifically, according to an updated OECD report dated 2019, 'the past eight years of implementation of the OECD Minerals Guidance have resulted in increased awareness amongst stakeholders that companies have a responsibility to cut the link between the mineral trade, serious human rights abuses and conflict. However, despite anecdotal reports of various results, there appears to be a continued lack of comprehensive and empirically-based evidence' (OECD, 2019, p.56). Documentation suggests that the guidelines of due diligence as outlined by organisations such as OECD is something which companies such as the Chinese Chamber of Commerce of Metals, Minerals & Chemicals Importers & Exporters are aware of, however the question may ultimately lie more with tech firms and the consumer. Notwithstanding, in the context of DRC there are many challenges involved in attempting to lift the conditions of mine workers as power in the economy of the industry is centralised outside of the country.

Attempts by the state or local authorities in DRC to gain authority over some of the mining practices to improve and or standardise conditions for workers are severely compromised by arrangements made by foreign companies, representatives of whom may be present at sites of mining operations. Profit seeking investors may visit these sites and put money into the industry, investors who are associated to industries which will ultimately profit from other manufacturing processes and the sale of consumer goods and digital media devices.

In 2002, a new mining code law was introduced by the DRC central government, article 21 of which recognised artisanal mining as "any activity by means of which a person of Congolese nationality carries out extraction and concentration of mineral substances using

artisanal tools, methods and processes, within an artisanal exploitation area limited in terms of surface area and depth up to a maximum of thirty metres". Another part of what was proposed in these reforms was that artisanal mining could only take place within authorized Zones d'Exploitation Artisanale (Artisanal Mining Zones or ZEAs) where industrial or semi industrial mining is not viable. However, the government has subsequently been criticised for not creating enough ZEAs resulting in most artisanal miners being pushed to work in unauthorized and unregulated areas, or to illegally trespass on land controlled by industrial mining companies to access cobalt and other minerals (Amnesty, 2016, p.17).

Analysis also suggests that strikes among workers seeking better pay and working conditions may at times only have resulted in greater collaboration between local authorities and representatives of multi nationals despite attempts to stand firm in representation of communities of workers. 2009 film *Katanga Business* documents how a strike among cobalt and copper mine workers results in the arrival of armed police who were willing to shoot those protesting. This film also highlights a deal made at one particular cobalt mining site in Mashamba, Katanga in 2007. This deal was signed by Gécamines representatives with 68% of all profits going to Chinese branches of the company and 32% remaining in DRC. The film also documents how Katanga governor Moïse Katumbi's attempts at diplomacy and negotiation between foreign mining companies and the workers.

Congolese mining legislation requires mining companies to initiate and maintain constructive dialogue with communities affected by their projects, but this is almost never done in practice. Lack of adequate safety and labour standards as well as the failure to protect children from hazardous work to ensure their right to education has led to accusations that the Congolese government is failing to give its citizens sufficient protection against the abusive practices of large companies. It has been noted however that ultimately there is a significant lack of capacity within governmental agencies to monitor and enforce safeguards and improve conditions for artisanal miners (Amnesty, 2016, p.7).

As quantities of cobalt exports from DRC have continued to increase in recent years, car makers and technology companies such as Apple, Microsoft and Tesla have continued to look towards securing future cobalt supply for use in the manufacture of rechargeable batteries. According to a report from media outlet Bloomberg in 2017, falling battery costs will push electric vehicles to price parity after 2025. To this end, companies' strategies have included closing long-term supply deals directly with mining companies or engaging actively in promoting and implementing traceability mechanisms throughout the supply chain (e.g. The Better Cobalt pilot project) (Alves Dias and Blagoeva, 2018, p.6). Other schemes piloted by the European Union such as the Raw Materials Initiative and the Battery Alliance frameworks are also important to mention here.

The Mutoshi Cobalt project, supported by Chemaf and the government of DRC, recently announced plans to monopolize the artisanal mining sector through a newly-formed state

enterprise (Darton Commodities Ltd., 2020). Beyond these initiatives, it has been asserted that international coordination and governance through whole value chain of cobalt will receive more attention (Sun et al., 2019) with improvement in cobalt traceability along all the steps of the supply chain, from mining to down-stream uses potentially becoming a requirement to certify responsible sourcing. A number of projects using digital technologies such as Blockchain or QR codes to control provenance are also being explored (Crundwell, 2020, p.23).

As mentioned earlier in this chapter, significantly the 2010 US Government Dodd-Frank Wall Street Reform Consumer Protection Act, aspects of which were aimed at addressing responsible sourcing of materials, namely those referred to as the '3Ts' – tungsten, tantalite and tin, does not apply to cobalt. However in late 2019, a law suit was filed in the US by 14 families of children killed or injured while mining cobalt in DRC. Companies such as Apple, Dell, Google, Microsoft and Tesla were named as defendants in the case which was filed by human rights firm International Rights Advocates and was the result of field research carried out by anti-slavery economist Siddharth Kara (Kelly, 2019).

As part of its 2016 report entitled 'This Is What We Die For: Human Rights Abuses in the Democratic Republic of the Congo Power the Global Trade in Cobalt', Amnesty International contacted major tech firms, declared as 'companies along the cobalt supply chain failing to conduct adequate human rights due diligence' (Amnesty, 2016, p.9). This document claimed to be 'the first comprehensive account of how cobalt from the DRC's artisanal mines enters the supply chain of multinational companies, including some of the world's wealthiest electronics companies' at the time of writing (Amnesty, 2016, p.4). Contacted as part of this report were: Apple Inc., Dell, HP Inc. (formerly Hewlett-Packard Company), Huawei, Lenovo (Motorola), LG, Microsoft Corporation, Samsung, Sony and Vodafone, as well as vehicle manufacturers like Daimler AG, Volkswagen and Chinese firm BYD. Companies considered as intermediary parts of the supply chain were also contacted. A list of responses was included from each of these firms to questions like 'Does cobalt in the company's products originate in DRC?' and asking for details of the company's human rights and due diligence measures. As part of this research, only Apple and Microsoft said that they had taken any sort of proactive steps to address human rights issues in the artisanal mines in southern DRC (Amnesty, 2016, p.64). The report also included recommendations to the governments of DRC, China and others.

A study published in the International Trade Journal in 2018 focused on the undervaluing of imports from DRC to the EU between 2000-2010. This research ultimately generated numeric data as to the level of economic exploitation, in doing so potentially providing a platform on which reparations or recompense to the people of DRC could happen (Cathey, Hong and Pak, 2018).

MEDIA

In the year 2015, total cobalt consumption is said to have reached 99 kilotons globally with laptop computers being the leading application of the material accounting for 22% of the total, followed by superalloys (15%) and mobile phones (12%) (Sun et al, 2019, p.45). To highlight the trajectory of the lithium battery industry in recent years, derivatives of this product surpassed superalloys in becoming the main application of cobalt in 2006. Prior to this, cobalt used in the manufacture of batteries was primarily used in mobile phones between 1995-2008 at which point this use was surpassed by laptop computers. Marking the next generation of products to use lithium batteries, electric vehicles have been the fastest-growing application of cobalt consumption, with an average annual growth rate of 34% from 2010 to 2015 (Sun et al, 2019, p.45).

The conceptual basis for considering the car as a medium is pertinently outlined in McLuhan's 1964 book *Understanding Media: The Extensions of Man*. Prior to the era of information in the so called 'electric age', communication's history is described as being heavily associated to roads and bridges as indeed these were the routes via which messages would be physically carried, bringing into focus the notion of transportation as communication. In examining the role of the wheel both metaphorically and literally, the author asserts that in today's circumstances 'when the greatest volume of transport consists in the moving of information, the wheel and the road are undergoing recession and obsolescence' (McLuhan, 1964, p.107) and that 'not only clock-time, but the wheel itself, is obsolescent and is retracting into animal form under the impulse of greater and greater speeds' (McLuhan 1964, p.170). Furthermore, in a time when wireless technologies continue to facilitate and mediate communication between people to an increasing degree as part as of what has been described as a process of individualisation, it has been written that the car itself 'has quite refashioned all of the spaces that unite and separate men, and it will continue to do so for a decade or more, by which time the electronic successors to the car will be manifest' (McLuhan, 1964, p.245).

In consideration of what the lithium battery as an object itself symbolises and in particular in relation to an inherent disproportionality of labour from the sourcing of raw material to the hand of the consumer, it has also been noted that 'with automation, for example, the new patterns of human association tend to eliminate jobs' (McLuhan, 1964, p.7). The author goes on to write that this is a negative result but that 'positively, automation creates roles for people, which is to say depth of involvement in their work and human association that our preceding mechanical technology had destroyed' (McLuhan, 1964, p.7). The phenomenon of update culture and the staggered and incremental release of products on to the market as part of the journey towards mechanisation is also relevant here in highlighting the tactics of tech giants and multi nationals which have put into practice in order to retain profitability of products. As has been expressed 'new media, if they are new, are new as in renovated, once again, but on steroids, for they are constantly asking/needing to be refreshed. They are new to the extent that they are updated' (Chun, 2016, p.2).

In consideration of what the cultural significance of any particular item of media technology might be literally or symbolically, the principle of mechanisation has been described as paradoxical as in working towards maximal growth and change, the very possibility of growth or the understanding of change is excluded (McLuhan, 1964, p.12). In terms of the physicality of the relationship between human beings and the forms of digital media which they have created, a distinct lack of movement is observable even if a lot may be happening at any moment economically or mentally in the mind of the participant. At the same time, this embodiment takes form where 'the insides of computers are folded with their outsides in material ways; the abstract topologies of information are entwined with geophysical realities' (Parikka, 2015, p.110).

Processes of conditioning have had their effect in normalising interaction with forms of media and ways of communicating which were not possible only a few years ago in the workplace, the home or in social settings. Housed within the physicality of the lithium battery itself are a number of processes, many of which stem from a history of colonial practices, particularly in relation to the economics involved. In addition to circumstances around the sourcing of cobalt from DRC, a material which boosts energy density and battery life, one may also look at circumstances around the sourcing of the lithium itself and the way this industry has impacted the lives of people in countries such as Bolivia or Afghanistan in recent years.

Much of the motivation among governments of what are sometimes termed 'developed' nations in moving towards the electric vehicle revolution is about meeting targets for carbon emissions. Manufacturer Tesla whose mission statement is 'to accelerate the advent of sustainable transport and electric technology' is playing an increasingly prominent role in the market. Tesla is now a bigger entity than many of its competitors in the automobile industry, who are fighting for influence in the cobalt market. Its boss Elon Musk now said to be the richest man alive (*The Electric Car Revolution: Winners and Losers, 2021*). It is believed that 3-4kgs of cobalt are present within each Tesla vehicle, meaning that this company is putting more cobalt on the road than anyone else.

In the UK, drivers are being encouraged to make the switch through financial incentives such as not having to pay any road tax. In the year 2020 in Norway, sales of electric vehicles surpassed that of other types of vehicle for the first time, marking a significant milestone. Among these developments is the notion that through technological advancement and the mediation of machines, human beings will be able to de-escalate the climate crisis. However, it seems just as important to remember that finite materials are used throughout the manufacturing processes of technological items whose capabilities are said to surpass that of their predecessors. The measure of sustainability has been expressed as 'not merely the carbon footprint but the material footprint: the aggregate quantity of biomass, metal ores, construction minerals and fossil fuels used during production and consumption of a product' (Dhara, 2021). A global spike in the demand for EVs would drive an increased demand for rare earth metals, plastics, glass and rubber.

As has been expressed over a longer period of history ‘as rocks of the Miocene or Eocene in places bear the imprint of monstrous creatures from those ages, so today arcades dot the metropolitan landscape like caves containing the fossil remains of a vanished monster: the consumer of the pre-imperial era of capitalism, the last dinosaur of Europe’ (Parikka, 2015, p.109). A lack of media coverage of issues around the supply chain involved in lithium batteries continues to be observable and with almost no acknowledgement among the companies responsible for carrying the media’s message in today’s landscape, this may come as little surprise. Facts such as child labour in DRC or state sponsored regime change in Bolivia are inconvenient for governments and companies who continue to emphasize a shift towards renewable energy sources and so-called green technologies.

CHAPTER 7: CASE STUDY 3 – CASSITERITE

INTRODUCTION

Cassiterite (otherwise known as tin) has multiple uses but in the context of the manufacture of mobile devices it's primary use is in the construction of circuit boards. Cassiterite is tin oxide with the chemical formula Sn[6]O2 and thus industrial processes are required to create tin from its ore, cassiterite. The word cassiterite comes from the Greek word kassiteros meaning 'tin' which was derived from the Phoenician word Cassiterid, referring to the islands of Ireland and Britain which were the ancient sources of tin. Another origin of the term is said to refer to the region of Kassites which today comprises parts of South-Eastern Iraq and South-Western Iran. The element tin is believed to be named after the Etruscan god of the thunderbolt, sky, and storm called 'Tinia' and the chemical symbol Sn derives from the Latin word 'stannum' (Sun, 2013, p. 6).

Although cassiterite can be sourced in many parts of the world including Cornwall, Malaysia, Thailand, Indonesia, Somalia and Russia, it is thought that up to one third of global supplies of the material are located within Democratic Republic of Congo. In DRC, cassiterite mining is conducted mostly by artisanal methods across provinces in the east of the country such as North Kivu, South Kivu, Tshopo, Maniema, Tanganyika and Haut-Lomami, with the largest reserves believed to be found in the Kivu region which experienced a significant boom in production in 2003 and 2004 (Johnson, 2005, p.49). Partly through recognition among the international community of the circumstance at Bisie mine near the town of Walikale in North Kivu, cassiterite has now become defined as a 'conflict mineral'. Known broadly as the 3Ts or 3TGs (tin, tantalum, tungsten and/or gold), the reference to conflict minerals originates in large part from the US Government's 'Dodd-Frank Wall Street Reform and Consumer Protection Act 1502' which was published in 2010. A reduction in imports of tantalum and tin in 2010–2011 coincided with the publication of the conflict mineral section of the Dodd-Frank act, a temporary ban of artisanal and small-scale mining in the DRC and a de facto embargo established by a number of international mineral buyers (Schütte, 2019, p.674). Prior to this point, it was estimated that more than half of the cassiterite and coltan production and more than 90 per cent of gold production in Eastern DRC was considered 'informal' (Geenen, 2012, p.12).

A more recent definition by the EU declares conflict minerals to be a source of finance to armed groups which can result in forced labour and human rights abuses as well as supporting corruption and money laundering. The same report states that this group of materials are often used in everyday products such as mobile phones and jewellery and that 'it is difficult for consumers to know if a product they have bought is funding violence, human rights abuses or other crimes overseas' (European Union, 2020).

The world's most active producers of tin in a worldwide context are countries such as Malaysia and Indonesia and according to the US Geological Survey 'although the estimated deposits in the DRC are substantial, the mining capabilities are not developed enough to

have a notable effect on world tin production' (USGS, 2015). Notwithstanding, a 2009 study by Global Witness which aimed to track the exploitation of natural resources, ranked the tonnes of tin ore exported from Eastern Congo in 2007 and 2008 as fourth worldwide, after China, Indonesia, and Peru. During the period 2010-2012, quantities from the Bisie mine alone located in Walikale, North Kivu were said to account for 4% of global stock (International Peace Information Service, 2016, p.17). In another light, DRC and Rwanda combined accounted for around 75 % of tin sourced in Africa in 2013 (Sun, 2013, p.25). 50%-80% of all exports of cassiterite from North Kivu are said to originate from the Bisie mine, where between 15,000 – 25,000 workers toil daily to earn a comparative pittance, many of whom are children. In DRC, cassiterite deposits are often found together in the same or similar locations as that of coltan (Johnson, 2005, p.49).

The metal is used in a range of products, with about 40% of the world's tin used to produce solder for electronic circuit boards (Global Witness, 2010, p.7). Tin metal is found in everyday life in the manufacture of electronic devices, such as mobile phones and video games consoles. Materially, it is a fusible alloy used to connect two pieces of metal with a melting temperature below that of either piece. Soft solder with melting points lower than 450 °C is used as mechanical and electrical connection in switching networks for electronic devices (Sun, 2013, p.23). In electrical applications, it is conductive, allowing a charge to flow across the connection. A new application for tin is in lithium-ion batteries, which are used in mobile phones, laptops, and electric cars (Sun, 2013, p.33). Along the supply chain, tin ore finds its way to smelters in Asia, Europe, and the United States where it is then processed to become solder, tin plating, and an alloy for components in electronic devices.

When asked in June 2010 if minerals to make the iPhone 4 came from Eastern Congo, Steve Jobs said, "We require all of our suppliers to certify in writing that they use conflict free materials. But honestly there is no way for them to be sure. Until someone invents a way to chemically trace minerals from the source mine, it's a very difficult problem" (Schrank, 2010). As part of an in-depth study of the circumstances at Bisie, the makers of 2010 documentary *Blood in the Mobile* took questions about the sourcing of materials used in manufacturing to Helsinki, Finland and the headquarters of Nokia, a company which 100 years previously was a rubber boot factory who sourced its rubber from King Leopold's slave colony. Nokia became one of the biggest corporations on the planet, producing 1 in every 3 mobile phones worldwide in 2010.

International imports of tantalum and tin ore concentrates from the Great Lakes region show correlated trends for both commodities comprising a pre-regulatory period from 2006 to 2009, a transitional period of initial due diligence implementation from 2010 to 2012 partly as a consequence of the Dodd-Frank act, and an on-going period of streamlined due diligence implementation starting in 2013. The recent stability in global tin demand came to an end in 2019, with world consumption said to have fallen for the first time since 2015, possibly as a result of stockpiling and / or supply chains being disrupted. Demand is expected to remain subdued in the short term, driven by falling output of consumer electronics amid a contracting global economy as result of the COVID-19

coronavirus pandemic. However, the long-term outlook 'remains bright for global tin demand, driven by new applications such as 5G network rollout, smart home devices and advances in lithium-ion (Li-ion) batteries' (Roskill, 2020). Year on year between 2019 and 2020, consumption of refined tin in consumer electronics suffered its first decrease in five years (approximately 5%), driven by falling output of conventional mobile phones, smartphones, and desktop computers.

Materially, the role of cassiterite as housed among the circuitry of today's digital media devices is one of connection, facilitating the flow of electricity across components. In relation to the movement of energy on circuit boards, the concept of Deleuze and Guattari's rhizome returns to focus, fostering 'connections between fields, the removal of blockages on bodies without organs, the maximum opening of bodies without organs onto a plane of consistency' (Deleuze and Guattari, 1987, p.12). In the context of media archaeology, the assertion has been made that 'perhaps one should start investigating what is the bind, the glue, in terms of objects of analysis, instead of the intellectual lineages that connect the two fields that increasingly share a fascination with the contemporary' (Parikka, 2015, p.9). The author describes how studying this contemporary archaeologically enables one to address 'the constitution of modernity through its garbage and modes of production, and, especially, consumption, as well as by the spatial determinations of cultural practices and material culture, and, at times, also technology' (Parikka, 2015, p.8).

Once assembled as a component among the circuit boards of normative forms of digital media manufactured on mass, cassiterite's role as a material connector of components becomes understandable in the context of media archaeology and ultimately as 'the proper domain' of the archaeologist, operating 'within systems of observation and measurement that produce agential cuts that world the world' (Parikka, 2015, p.1). Notwithstanding, 'archaeology appears to have made little impact on attempts to understand media's circulations through, and enactment of the world' (Parikka, 2015, p.3). In another light, for the abundance of information available at one's fingertips when engaged with forms of digital media today via a combination of the material and the ethereal, sources of knowledge remain potentially subjective and at times a search for truth can ultimately be fruitless. As with the previous two case study chapters in this volume, closer examination of circumstances around cassiterite supply chains and the economics involved reify a continuality stemming from a colonial past whereby any potential mechanisms to tackle inherent injustices have tended to fall on deaf ears. In this sense, cassiterite's role in connecting components among today's digital media can provide a conceptual springboard whereby the meaning of the materiality of devices can be understood.

MINERAL

Tin is a metal often found in nature in its oxidized form, as the mineral cassiterite (SnO_2). Cassiterite has been the primary source of tin throughout history and it remains the primary source today. At source, deposits of cassiterite are usually locatable near the surface or coming through the soil. The regions known as the Mesoproterozoic Kibara belt (KIB) which stretches from the central DRC province of Maniema to the southern state of Lualaba as well as the Karagwe-Ankole Belt (KAB), which includes Kivu province as well as Rwanda and Burundi, are characterized by 'the presence of numerous rare metal mineralized Sn-(Nb-Ta) pegmatites and Sn-W mineralised quartz veins that are related to a S-type granite generation formed at 986 ± 10 Ma, of which cassiterite is one' (Dewaele, Goethals and Thys 2015, p.66). Generally, in the mines of the region, cassiterite, coltan and ferro-oxides coexist in the same mineral and are separated manually, using pans and sifting. Pure cassiterite is said to have a melting point of about 1625 °C (Sun, 2013, p.11). Post refinement, important properties of tin metal are its low hardness of 1.5 on the Mohs scale (VHN10 = 7 to 9 kg/mm2 on Vickers scale), low melting point at 231.93 °C and a contrasting high boiling point at 2602 °C (Sun, 2013, p.8).

As an end-product tin is a malleable, silvery white metal with a bluish tint. However as raw material, the colour of cassiterite varies from colourless, yellowish and reddish brown to brownish black with a yellow to mostly colourless streak. It can also appear as light grey in colour, dark grey, light brown, beige, rose-beige and with varying degrees of metallic luster. With the exception of the occasional presence of a certain mineral or a special colour for a certain cassiterite, no systematic variation can be observed between concentrates from differing locations. Often, the mineral and colour variation in one concentrate can be as large as for concentrates found from other locations (Dewaele, Goethals and Thys 2015, p.66). The colour from cassiterite crystals can vary from transparent and colourless to black and non-transparent. The variation in colour within a single grain can be as varied as the colour variation between grains for an entire concentrate (Dewaele, Goethals and Thys, 2015, p.66). On the Binakwa-Obae trade route in North Kivu, alluvial cassiterite deposits are black (they are known locally as "ma-noirée") whereas on the Bisie trade route in the same area, deposits are red (and known locally as "ma-rougée") (Cuvelier, 2010, p.27).

In a geological context it has been identified that 'physical particles and chemical substances cross thresholds of deterritorialization on their own stratum and between strata; these thresholds correspond to more or less stable intermediate states, to more or less transitory valences and existences, to engagements with this or that other body, to densities of proximity, to more or less localizable connections' (Deleuze and Guattari, 1987, p.53). As part of a framework which understands the overall transformational process cassiterite undergoes from raw material to component as housed within circuitry of media devices and thus from one form of assemblage to another, it has also been asserted that 'substances, being formed matters, relate to territorialities and movements of deterritorialization and reterritorialization on the epistrata' (Deleuze and Guattari, 1987,

p.53). As an articulation of what the meaning of the process of sourcing a mineral such as cassiterite on its way to the consumer ultimately could be, it is proposed that 'assemblages may constitute every constellation of singularities and traits deducted from the flow—selected, organized, stratified—in such a way as to converge (consistency) artificially and naturally; an assemblage, in this sense, is a veritable invention' (Deleuze and Guattari, 1987, p.406).

MINING HISTORIES

Tin extraction is said to date back as far as 3000 BC and thus has a long and illustrious history in manufacturing processes and in the development of forms of technology. Tin is one of the oldest known metals and was used in ancient times as a Cu-Sn alloy, also known as bronze, the oldest finds of which date back to approximately 3500 BC and were discovered in Turkey, Mesopotamia and Egypt (Sun, 2013, p.5). Tin mining is believed to have begun about 2500 BC in the Erzgebirge area, spread out to Brittany in France, South-West England and the Iberian peninsula around 2000 BC. The Greeks imported tin from the 'Casseterides' (Tin Islands) which are possibly referred to as the British Isles. In the 17th century metallic tin was used in plates, cups and dining utensils, but generally unalloyed tin is too soft for such applications and thus its most common application at this time was in the coating of plate steel to prevent corrosion (Sun, 2013, p.6)

In more general terms in relation to the mining of materials, practices known as artisanal mining have a long history in the DRC, dating back to colonial times. Informalisation of the economy has been one of the factors which has contributed to state authority being undermined, perpetuating situations in which the people of the Congo have not been able to determine their own destiny (Nzongola-Ntalaja, 2002, p.5). Cassiterite and coltan were discovered in the Kivu region in 1910, after which the tin sector soon fell entirely into the hands of private Belgian companies. By the first half of the 1940s, production of cassiterite amounted to more than 10,000 tonnes per year and employed more than 73,000 people. Following a decade of rising production figures, companies began to invest in industrial exploitation in the late 1940s and early 1950s, enabling a further rise in production in the 1950s and 1960s (IPIS, 2012, p.8). During these years, the major use of tin was as tinplate for food and beverage cans, but it became less important over the years and now less than 20% of tin production is used for tinplate (Sun, 2013, p.23).

Cassiterite production in the country then known as Zaïre is then said to have fallen from 4638.1 tons in 1976 to 352.8 tonnes in 1997 (IPIS, 2012, p.9). Following the fall of President Mobutu and the inauguration of Laurent Kabila in 1997, between 2000 and 3000 tons of cassiterite were removed from the region between November 1998 and April 1999 (IPIS, 2012, p.10). Cassiterite was discovered in Bisie, North Kivu several years previously but until around 2003, it did not attract much attention as the price of tin was low. Mining in Bisie only took off in a significant way in 2004, when the price of tin rose (Global Witness,

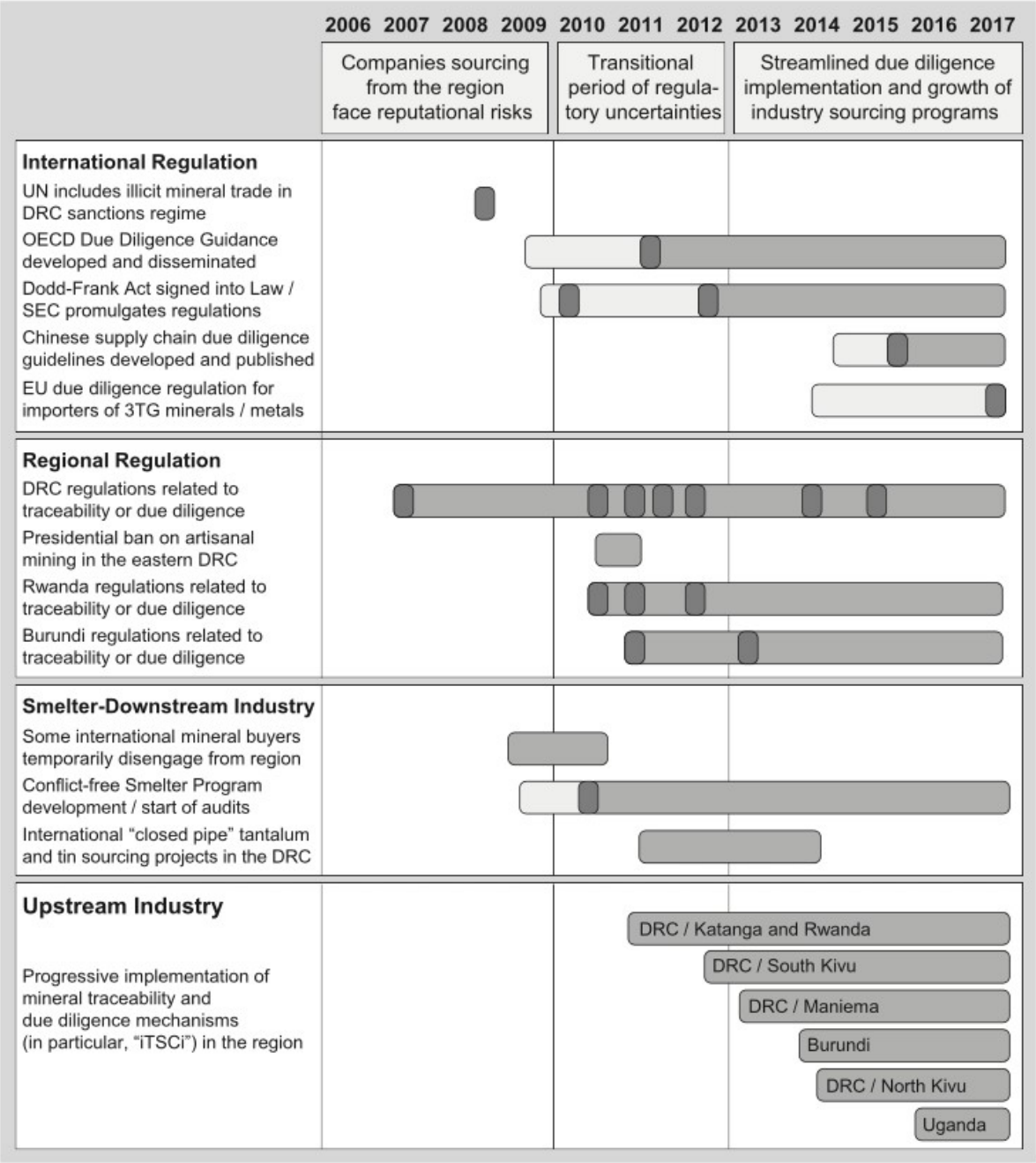
2009, p.27) with official exports from Goma said to have quintupled from 939t in 2003 to 4672t in 2004 (Johnson, 2005, p.50).

During this period in the early 2000s, the United Nations Commodity Trade Statistics Database did not include data on cassiterite exports from DRC (Pöyhönen and Simola, 2007, p.21). Mining practices were often carried out in violation of the sovereignty of DRC, the national legislation and sometimes international law, and led to illicit activities. Key individual actors including top army commanders and businessmen on the one hand, and government structures on the other, have been the engines of this systematic and systemic exploitation (Pöyhönen and Simola, 2007, p.24). Following the end of president Mobutu's tenure, ownership of the country's most valuable mineral assets was transferred to joint ventures controlled by private companies owned by a network of elite individuals. In 2007 it was estimated that $46 million dollars were received from exports of cassiterite for an amount valued at $115 million (Garrett, 2007, p.20).

Bisie's mineral wealth was said to have been discovered by local people around the start of the 21st century. At this time the area was contested between Congolese armed forces and local and foreign armed groups, with Rassemblement Congolais pour la Démocratie-Goma, a rebellion supported by Rwanda, controlling the cassiterite trading route from Bisie to Goma. However, in 2006 the 85th Forces Armées de la République Démocratique du Congo (FARDC) Brigade commanded by Colonel Samy Matumo took over Bisie. This brigade was largely composed of former Mai-Mai fighters and Colonel Samy is said to have soon used the mines for his own profit, imposing his power through illegal taxes. Numerous human rights violations occurred including arbitrary arrests, child labour and forced labour. In 2009, the area came under the control of Congrès National pour la Défense du Peuple (CNDP) rebels, thus moving towards integration to the national army of DRC (IPIS, 2016, p.21). As the largest and most productive cassiterite mine in the area, Bisie has attracted thousands of civilian miners and other men, women and children in search of work with some describing it as a big village. Local sources estimated that in mid-2008, between 10,000 and 15,000 people worked in and around Bisie, some as miners, others as transporters, and some trading in other goods in or around the mine (Global Witness, 2009, p.28).

With the arrival of a few thousand miners, cassiterite production at the Bisie mines had peaked by 2009/2010 to an estimated 7,000 tonnes a year. At that time, Bisie's production reportedly accounted for most of Congo's declared cassiterite exports (IPIS, 2016, p.13). Despite the export ban resultant from the introduction of new legislation internationally promoting due diligence with regard to the industries around conflict minerals, a 2011 IPIS study showed through satellite images that the actual mining area in Bisie expanded between September 2010 and March 2011 (IPIS, 2012, p.23). Starting in 2012, mineral imports from the region show a systematic recovery trend and in 2014, mineral imports are believed to have reached levels comparable to or exceeding the 2007–2009 period (Schütte, 2019, p.680).

The table adjacent stands as an overview of due diligence-related regulations, industry program implementation and associated mineral sourcing developments in the Great Lakes region during the period from 2006 to 2017. ITSCI refers to the ITRI Tin Supply Chain Initiative, an industry upstream sourcing scheme. In 2017, the Conflict-free Smelter Program changed its name to Responsible Minerals Assurance Process. Time periods were compiled based on web information published by the respective regulatory or international organizations and industry initiatives. The grey bars indicate implementation or applicability periods, while the light grey bars indicate consultation and development phases.



(Source: Schütte, 2019, p.677)

In the context of materials sourced from conflict-affected and high-risk areas, study of international mineral trade patterns may provide an insight with regards to possible market reactions as well as fulfilling a complementary function of national-level analyses of policy and regulatory effects in DRC. Since 2010, the due diligence concept has increasingly been established as an industry standard in supply chains of conflict minerals such as tantalum and tin. Regulations in several mineral producer and consumer countries now require mandatory due diligence implementation, particularly along upstream supply chains from mine to smelter.

It has been repeatedly asserted that the extraordinary natural wealth of DRC has never been used for the benefit of the Congolese people and furthermore what could have been the foundation of welfare and development has so far been little more than a curse on the country (Pöyhönen and Simola, 2007, p.23). This mineral wealth has benefitted local traders and numerous military factions but has left the local population living in danger and poverty, not to mention the fiscal losses to central government (Pöyhönen and Simola, 2007, p.33). The relationship between people and resources and an underlying culture which can result in further exclusion and marginalisation, particularly on a backdrop of economically exploitative terms and territorialities imposed upon populations during the colonial era can be found to have been expressed; 'I want to demonstrate the deep historical link between movement that overturns the constants of sovereignty on consequence of the problem of choices of government; the movement that brings about the emergence of population as a datum, a field of intervention… the process that isolates the economy as a specific sector of reality; and political economy as the science and the technique of intervention of the government in that reality' (Foucault, 2000, p.219)

INVENTION

In 2009, a research project sponsored by the Belgian government began to study mineral deposits in Central Africa. Based on a model from what is described as 'a politically-driven project on the establishment of a mineralogical and geochemical fingerprint' for coltan, the project was assisted by the Royal Museum for Central Africa and aimed to apply the same to cassiterite. Techniques involved in this geological survey included 'X-ray fluorescence spectroscopy, electron microprobe analysis, laser ablation inductively coupled mass spectrometry, fully automated electron microscopy or mineral liberation analysis and thermal ionisation mass spectrometry' (Dewaele, Goethals and Thys, 2015, p.69). In addition to cassiterite, this research also included data about a number of other materials including quartz, Fe-oxide or hydroxide, muscovite, columbite –tantalite, feldspar mineral, sulphides, wolframites and tourmaline as well as information about the geographic locations where each of these materials could be found.

When it comes to the processes involved in the extraction of cassiterite from the earth, it is usually mined by the dredging of alluvial deposits, taking place when the ore is broken up

by either high-pressure water, an excavator or by hard-rock mining methods, usually from underground mines. The ore is then concentrated usually at the mining site through a combination of flotation, gravity, and magnetic processes to produce a cassiterite concentrate containing 70 –77% tin (USGS, 2015). Tin concentrate is then smelted by heating it in the presence of carbon to 1,200 –1,300 degrees centigrade, reducing the cassiterite to tin metal and releasing carbon dioxide. Following the smelting process to produce tin metal, the remaining impurities are removed through a refining process which usually takes place at the same facility as the smelting. Refining involves heating impure tin to temperatures just above melting point, allowing impurities to drop out as solids and the pure liquid tin to be skimmed off. While the provinces of North and South Kivu currently do not host any hydrometallurgical tantalum processors relating to the industry around coltan, there are several historical tin smelting facilities that could theoretically convert tin ore concentrates to tin metal for subsequent export. While repeated attempts have been made to reactivate some of the smelting facilities, these efforts did not result in any tin smelter in the region entering commercial production in the 2006–2017 period (Schütte, 2019, p.678).

A parallel can be drawn between the process of cassiterite from DRC being profited from several times over by individuals and organisations based outside of the region and the economic role of digital media devices which are ultimately manufactured from these materials. Not a new phenomenon in either case, this coexistence is characterised by the extortion of wealth and a disproportionate division of labour which takes place via forms of economic triangulation and processes of disenfranchisement and deterritorialization. Philosophically, attention has been paid in identifying that culturally among a medium ‘there are only multiplicities of multiplicities forming a single assemblage, operating in the same assemblage: packs in masses and masses in packs’ with the question being posed ‘how could lines of deterritorialization be assignable outside of circuits of territoriality?’ (Deleuze and Guattari, 1987, p.34).

SUPPLY CHAINS

Following the implementation of due diligence schemes as a result of the Dodd–Frank Wall Street Reform and Consumer Protection Act in 2010 such as the International Tin Supply Chain Initiative (ITSCI) in 2011, it has been asserted that tin supply chains tend to reflect an oligopsonistic market that does not change systematically through time (Schütte, 2019, p.674). In the context of DRC, the movement of cassiterite from the site at which it is mined to the point of export has been aptly described as a ‘value chain’ rather than a supply chain.

On the Binakwa-Obae-Mubi trade route, historically a highly volatile region which produces most of North Kivu’s cassiterite on its way to South Kivu and further afield, taxes would be paid to a number of different entities, representing approximately 11% of the

value of the quantity of cassiterite (Cuvelier, 2010, p.29). Tax costs here include payments to civil aviation, general tax office, Entités Administratives Décentralisées, Service d'Assistance et d'Encadrement du Small-Scale Mining, Agence Nationale de Renseignements, police, authorisation to transfer minerals, mining administration, visa for Mubalaka barrier and more. Among this value chain a tendency was identified whereby economic actors would profit more from this trade than civil servants who in turn profit more than the producers (local chiefs and diggers) (Cuvelier, 2010, p.30).

A snapshot of how the monetary value of a quantity of cassiterite would increase on its geographic route in late 2009 and early 2010:

Month	Cassiterite in kg	Binakwa $5/kg	Obae $5.50/kg	Mubi $6.80/kg	Goma $10/kg
November 2009	6000 kg	$30 000	$33 000	$40 800	$60 000
December 2009	6500 kg	$32 500	$35 750	$44 200	$65 000
January 2010	6000 kg	$30 000	$33 000	$40 800	$60 000
February 2010	5800 kg	$29 000	$31 900	$39 400	$58 000
March 2010	5800 kg	$29 000	$31 900	$39 400	$58 000
April 2010	7600 kg	$38 000	$41 800	$51 680	$76 000
May 2010	6000 kg	$30 000	$33 000	$40 800	$60 000
June 2010	7000 kg	$35 000	$38 500	$47 600	$70 000
Total	50700 kg	$253 500	$278850	$344 680	$507 000

(Source: Cuvelier, 2010, p.28)

In line with national legislation at this time, minerals could only be transported by individuals with a miners' or a traders' card. In North Kivu, the petits négoçiants who would buy cassiterite at the mining sites and sell to négoçiants in larger villages would often be as informal as the miners, as they too lacked the required trading license. Regulation tends to be avoided, potentially resulting in further exploitation of the miners as the price paid may not correspond to the real value of their minerals (Garrett, 2007, p.18). As far as working conditions are concerned, the lack of roads would mean that minerals would be transported from sites by porters carrying 50-kg bags for many kilometres. Although this work is physically exhausting and unhealthy, it is one of the few lucrative jobs available for young men in the region (Cuvelier, 2010, p.27).

At the time of writing, Bisie mine in Walikale supplied around 70% of North Kivu's tin ore exports (Bavier, 2009). The only way of getting to Walikale from the regional capital of Goma is by cargo plane that goes to Kilambo where it lands on a stretch of asphalt road. These planes transport food and other necessities to Walikale territory and cassiterite back to Goma. It was documented that on a normal day, six planes, transporting two tons of around 50% tin-content grade cassiterite each, would fly four rotations (Garrett, 2007, p.24). At this time around 2009 there were said to be three Chinese buying offices (TTT Mining, Huaying and Donson International), a South African buying office (MPC), a Russian buying office (Panafrican Business Group), and an Indian one (Afromet) (Cuvelier, 2010, p.30).

The next 18 km to the trading centre of Ndjingala would be undertaken by road, however from Ndjingala to Bisie there are no suitable dirt tracks and the 27 km through the forest has to be done by foot (Zingg 2011, p.2). Mining at Bisie started in 2003 and is completely artisanal. Alluvial and open pit mining practices are conducted on the surface and hard rock mining is done underground in tunnels which vary between 100 and 600 meters in length. Collapses in the tunnels would not be uncommon, other safety hazards include mudslides and naturally occurring carbon dioxide underground (Zingg 2011, p.2). Miners work in extremely harsh conditions without training, equipment or protection. Fatal accidents and serious injuries would occur regularly and although the provincial representation of the Ministry of Mines have only been able to record a small fraction of the number of accidents, the vast majority have gone unreported (Global Witness, 2009, p.24).

During the period prior to the implementation of due diligence schemes resultant from the US government's Dodd-Frank legislation, it was presumed that about half of cassiterite production was leaving Eastern DRC informally. The Pole Institute estimated in 2007 that less than 30% of cassiterite exports were registered in the official statistics (IPIS, 2012, p.15). Research found that in factoring cassiterite arriving in Goma from other parts of Eastern DRC, it was prudent to add another 30% on top of a quantity arriving from Walikale. Official comptoirs would process the cassiterite up to an export grade of 65% tin content with an estimated 30% of its weight lost in the process. The difference between officially recorded exports and net tonnage of export grade cassiterite was found to be 43%, suggesting a world market value of export grade cassiterite going through Goma of US$115.3 million at this time (Garrett, 2007, p.24). It has subsequently been asserted that the case of cassiterite illustrates the tax burden on mineral exports in that 'while cassiterite exports represented no more than one-third of the total value of North Kivu's exports in 2006, they contributed over two-thirds of total customs revenue from exports' (IPIS 2012, p.15).

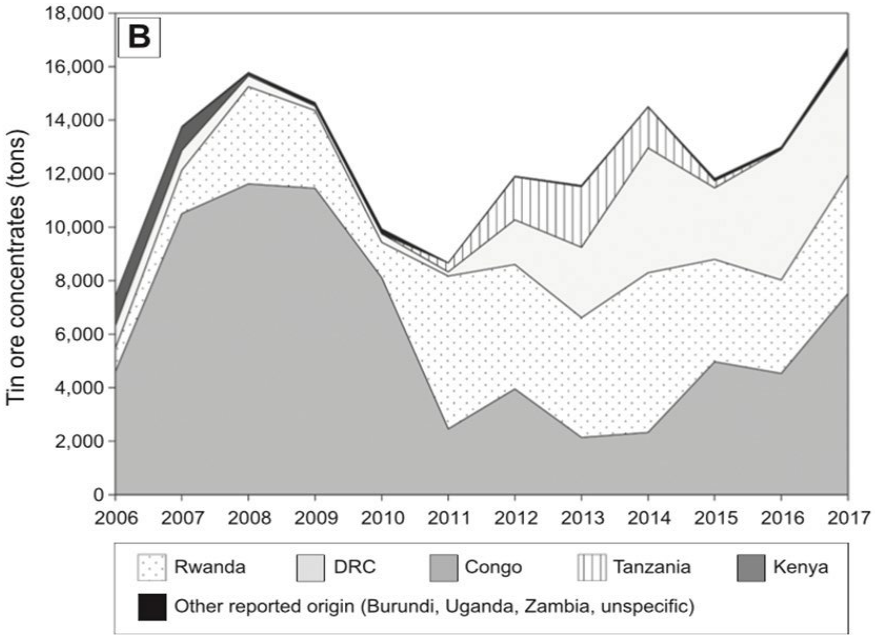
In 2009, it was believed that 48% of cassiterite exported from North Kivu made its way to Belgium, the main companies responsible for this being Trademet, Traxys, SDE, STI and Specialty Metals (Global Witness, 2009, p.59). A report published by a panel of UN experts in 2008 declared that Traxys had purchased 1,631 tonnes of the tin ore cassiterite and 226

tonnes of coltan in 2007 from four Congolese companies which would systematically buy from FDLR (Democratic Forces for the Liberation of Rwanda) controlled mines, the use of both minerals being in the manufacture electronics devices, such as mobile phones and video games consoles. At this time it was also believed that more than 70% of production from North and South Kivu was going through Thai company Thaisarco, who in 2009 suspended its purchases of tin ore from Congo, complaining that bad publicity was undermining industry efforts to combat illicit trading in the mineral (Bavier, 2009). During this period in which the industry around cassiterite was experiencing an increase in demand, the largest refiner and therefore number one destination for exports of tin from DRC on a national scale was Malaysia (Global Witness, 2010, p.2).

Before the implementation of the tin traceability scheme and the export ban of the so called '3Ts' from DRC around the time of the US government's Dodd-Frank legislation, the cassiterite supply chain within the region was described as typically beginning with diggers, before moving to traders, then carriers, on to the house of the purchaser's property and finally to the comptoirs (counters). This pattern is said to have then changed, partially as a result of a process of formalisation which has meant that miners are now organised into co-operatives, a move which would speak to the approach being taken by the DRC central Government in its attempt to improve control of artisanal miners and their production (Byemba, 2020, p.423). Thus, it has been identified that the typical supply chain of cassiterite from North Kivu now contains less points with miners passing the goods to traders, who in turn organise stocks to be transported by identified carriers before it is finally passed to the comptoirs (Byemba, 2020, p.424).

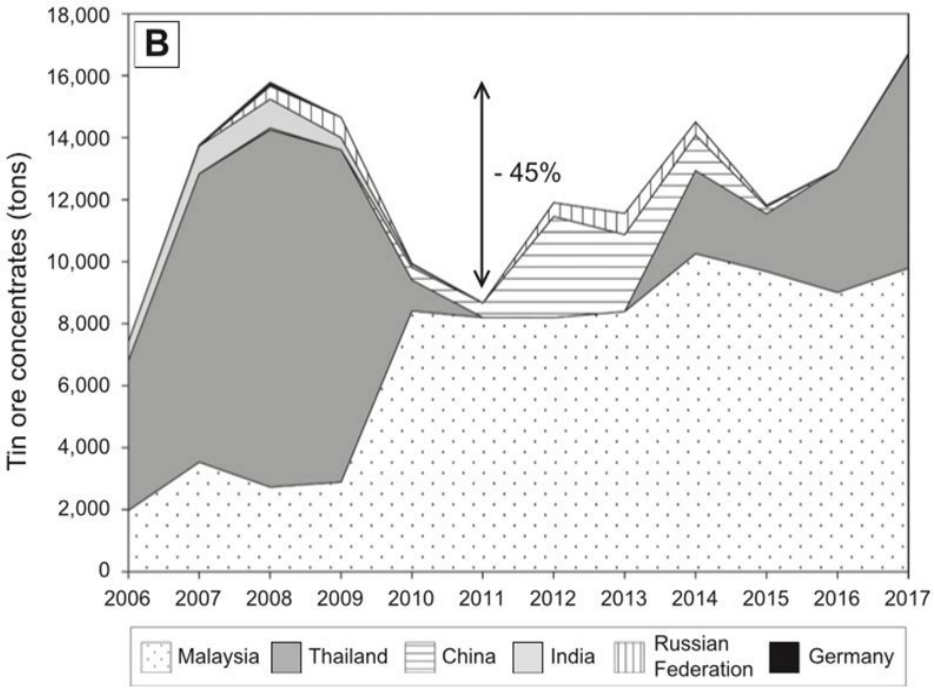
Historically, much of Eastern Congo's mineral output has passed through Rwanda and although the Rwandan government's data has shown most of its cassiterite exports to be of Rwandan origin, the proportion of the ore coming from Congo has been significantly higher than those numbers would indicate (Global Witness, 2010, p.12). According to several comptoirs in Kivu, DRC around 5–20% of a local miner's selling price would be subject to tax-like levies. These fees are part of the explanation why despite the implementation of due diligence schemes and the increased awareness around conflict minerals at some non-validated sites, the local 3T (tin, tungsten, tantalum) prices are higher than at iTSCi (International Tin Supply Chain Initiative) sites thus encouraging smuggling, including to neighbouring Rwanda where iTSCi levies are lower (Vogel, Musamba and Radley, 2018, p.76). Traceability was also one the key factors which has led to the implementation of more rigorous due diligence processes on the ores entering the country in an attempt to stop the supply chain in conflict minerals. Between 2011-2013 the leading global importers of tin ores and concentrates from DRC were China (53%), Malaysia (39%), and Rwanda (7%) (USGS, 2015).

Import tonnages of ore concentrates from the Great Lakes region by identified origin as reported by international smelter countries between 2006-2017:



(Source: Schütte, 2019, p.683)

Import tonnages of tin ore concentrates from the Great Lakes region as reported by international smelter countries between 2006-2017. Arrows indicate the relative reduction of reported imports in 2011 compared to pre-Dodd Frank act peak imports:



(Source: Schütte, 2019, p.681)

The way in which raw material is profited from at each stage of the value chain around cassiterite originating from DRC can be an allegory for the role of tin within digital media devices which are ultimately manufactured from this material. A closer look at this commodity chain reveals every step, even transportation as an arena of cultural production (Tsing, 2005, p.51). Commodities which emerge having been manufactured as if untouched by the inherent friction of global capitalism then provide the infrastructure for economic interaction and monetary systems to operate via the medium of telephony. A rhizomatic structure of capitalist relations produces new forms of poverty, albeit that such causality may be invisible in liberal accounts that advocate the expansion of "the market" as the route to increased productivity and wealth (Li, 2014, p.7). Moreover, this friction is characterised by an ensemble of relations of private and unequal ownership of means of production, a group of nonowners subject to forms of deterritorialization who are compelled to sell their labour, and the use of capital to generate profit under competitive conditions. After all, the emergence of capitalist relations governed by competition is not an inevitable progression, however it is ironic that an ideology which stresses freedom is concerned with material relations that restrict it, a progression which is not inevitable.

MARKETS

In 2007 and 2008, DRC accounted for around 4-5% of the global production of tin ore (Global Witness, 2009, p.20) with quantities from Bisie mine in North Kivu alone accounting for 4% of global stock between 2010-2012 (IPIS, 2016, p.17). In another context, DRC and Rwanda combined accounted for around 75 % of tin sourced in Africa in 2013 (Sun, 2013, p.25). Since the early nineties China and Indonesia followed by Peru are the world's leading tin producers. Following the turn of the century, China and Indonesia played the dominating role on the tin market with both together accounting for about 65 to 70% of global tin concentrate production (Sun, 2013, p.24).

At the site of cassiterite mining operations in North Kivu for example, each digger would provide his own equipment such as a spade, a crowbar, plastic bowls or half cans and the proposed owner would rent out access to the mine in return for a share of the production. This share would generally vary between 10% and 20%, depending on the tax collected by customary chiefs from the renter of the land (Cuvelier, 2010, p.26). Most diggers would work informally due to not being in possession of an artisanal miner's card. The card is issued by the Mines Division and is expensive varying between US$30-$40 in price depending on the location and on the services issuing it (Cuvelier, 2010, p.26). It was noted that 'artisanal miners do not perceive any incentive to purchase the card, deeming it too expensive, as in practice they get nothing in return for card ownership, such as technical support or better infrastructure (IPIS, 2012, p.12). However following implementation of some of due diligence initiatives as a result of the Dodd-Frank act, research by the International Peace Information Service did find that a social security service had been

included in a risk management plan for miners at a site in Katanga, working as part of a co-operative for the large mining company Chemaf (IPIS, 2012, p.41).

That said, in general very little rights would exist for mine workers in this setting and working conditions are far from satisfactory. Mine pits are usually circular in shape with diggers tending to dig vertically, sometimes reaching a depth of 30-50 metres. Bags or buckets would be used to evacuate waste material and minerals by tying them to a rope connected to a horizontally placed beam at the entrance of the pit. Since most of the pits are very deep, artisanal mining is extremely dangerous. Diggers would run the risk of the sudden collapse of their pit or running out of oxygen at any moment (Cuvelier, 2010, p.59).

There is said to have been no cash payment between site owner and miner and no cash economy at the mining location. Cassiterite would replace cash and serve as a reference for price fixing. Everything would be measured in cassiterite units of measurement, including game sold by hunters and goods sold by ambulant vendors, including manioc flour, palm oil and fish. Ambulant vendors would sell on credit to villagers and come back on a fixed date to fetch the cassiterite. It has been documented that in Binakwa school fees and health care were also paid for in minerals (Cuvelier, 2010, p.26). Another constraining factor economically was the interference of the military who reportedly would take a cut of 8 to 15 kg per mining pit without having to pay certain taxes. The military would therefore be able to sell minerals at a lower price than others, a competitive advantage which accounts for the persistence of a military commercial chain (Cuvelier, 2010, p.27). During a period in which demand for cassiterite on the world market grew substantially, the economy around it was characterised by over 30% of the total export value being added at the mine whilst at the same time, the majority of miners, for example in North Kivu were persisting on US$1-5 per day with production costs for the mining site owners very low at no more than US$1 per miner per day, covering some food expenses only (Garrett, 2007, p.20). Until 2007 much of the cassiterite exported from DRC was in unprocessed form, with no value being added within the country (Garrett, 2007, p.22).

Most of the comptoirs who are responsible for quantifying exports of cassiterite in trade hubs like the city of Goma have acquired concessions and have done so with foreign financial backing, predominantly from Europe, Canada, China, South Africa and Rwanda (Garrett, 2007, p.25). In June 2009, Mining Mineral Resources (MMR) became the first comptoir to open in Luena in the province of Haut-Katanga in the geological region of the Kibara belt. The Lubumbashi-based mineral buyer is part of the large Indian business conglomerate Vinmart, which is active throughout DRC and other parts of Africa (IPIS, 2012; Priester, 2012). MMR also has close relationships with the Malaysia Smelting Corporation (MSC), historically the largest purchaser of tin ore in Africa's Great Lakes region. MSC is the sole buyer of MMR's tin ore (Diemel, 2018, p.60). From 2011 to 2013, MMR became Katanga's top producer of cassiterite, on average accounting for 82% of the province's cassiterite (Diemel, 2018, p.60). Although appearing to contribute the fairer trade in cassiterite, MMR also increasingly had a monopoly. In spring 2010 a process of contestation resulted in Gecamines (La Générale des Carrières et des Mines) industrial

guards seizing large cassiterite loads from individual negociants with several negociants also finding themselves arrested by the Police des Mines on charges of mineral theft from MMR concessions. Ensuing court cases resulted in some negociants losing their trading licences (the carte negociant), and others were forced to sell their mineral loads back to MMR, allegedly for no more than 25% of the market value (Diemel, 2018, p.60).

In North Kivu's Karagwe-Ankole belt believed to be rich in cassiterite, research conducted by a panel of UN experts in 2007 found that a quantity of tin with 65% purity worth US$88.7 Million was exported from Goma in the previous year with just $800,000 staying in the local economy around Walikale (Garrett, 2007, p.24). Internationally some of the main companies responsible for the import of these goods were the world's fifth-largest tin-producing company Thailand Smelting and Refining Corporation (Thaisarco) owned by the large British metals company Amalgamated Metal Corporation Group (AMC), UK-registered company Afrimex and the Rwanda-based subsidiary of South-African owned Kivu Resources – the Metals Processing Association. These were followed by the Malaysian Smelting Corporation Berhad (the world's fourth-largest tin-producing company) as well as companies based in China such as African Ventures Ltd, India - Met Trade India Ltd, Russia - Eurosib Logistics JSC, Canada - BEB Investment Inc and others (Global Witness, 2009, p.59).

In July 2012, cooperatives, economic stakeholders of the mining sector, North Kivu Civil Society and the local communities of Walikale signed an Acte d'Engagement pour le Développement. Article 2 stated that stakeholders of the artisanal mining sector (cooperatives, traders, porters and comptoirs) had to pay US$180 per tonne of cassiterite produced in Walikale territory, $130 of which would go to the territory and $50 to the province of North Kivu. To manage these funds transparently, the National Minister of Mines proposed to implement a Comité Local de Développement (CLD) and a Comité Provincial de Développement (IPIS, 2016, p.33).

The price of cassiterite internationally has been subject to considerable fluctuation in recent times. Following a series of events within DRC such as the assassination of Laurent Kabila after a period of 4 years as President, in 2001 in the wake of the coltan boom 'businessmen from all over the place came to Goma to sign contracts with the Rally for Congolese Democracy' (RCD) (Johnson, 2005, p.62). The RCD had at this time gained control of many of the areas of Eastern DRC that would be mined as a result of Kabila having annulled. A deal was made with Canadian firm Banro, creating a Congolese state company called Somico (Société Minière du Congo) in the process. In 2004, tin prices on the world market rose by 74%, faster than those of any other industrial raw material, a phenomenon believed to be driven by China's economic growth. Between the beginning of 2002 and the beginning of 2004, 'the tin price on the London Metal Exchange had already risen from US$3500 to $9000 per ton, reaching a high of $9500 in June 2004 and falling again later' (Johnson, 2005, p.49). At this time, miners in North Kivu were massively abandoning coltan in favour of cassiterite and sales of the raw mineral would now outstrip the costs of industrial extraction, even deposits buried in DRC. In 2004 on both the London Metal Exchange and the Kuala Lumpur Tin Market prices shot up for cassiterite with both

institutions publishing the tin price in ingots with a minimum purity of 99.85% (Sun, 2013, p.30).

The tin price continuously increased from about $6000 per ton in November 2005, reaching a climax of up to $25500 per ton in May 2008 (Sun, 2013, p.30). This was said to have been the highest tin price ever and resulted from low stocks and supply concerns caused by deficits. This was strengthened by the growing demand for solders in electronics without any adequate substitute. At the end of 2008, the global economic and financial crisis also influenced the electronics industry and affected the price of tin price which dropped to approximately $11000 per ton (Sun, 2013, p.30). International prices for tin ore concentrate then increased significantly from 2009 to 2011 at a rate of two-fold (Schütte, 2019, p.680), rising to an all-time high of $33600 per ton in April 2011 (Sun 2013, p.31). The high price for tin metal at this time is said to have been driven by significant supply deficits and the use of lead-free solders in electronics.

Implementation of the International Tin Supply Chain Initiative (iTSCi) between 2009-2011, which ostensibly aimed to bring greater fairness to the industry around materials such as cassiterite, then began to take its effect on the market. Economic structures put in place around this time have subsequently been criticized for being of a 'concomitant monopsony' (Vogel, Musamba and Radley, 2018, p.78). While in most cases one big international smelting company buys iTSCi-tagged cassiterite from DRC, the local part of the supply chain has been similarly articulated since only iTSCi-registered comptoirs are able to buy. This leads to situations where there is a single buyer at the local level with a combination of global price drops, monopolised supply chains, iTSCi levies, and local tensions leading to insecurity and affecting the socio-economic environment.

It has been stated that much of 2019 was marred by an oversupply of refined tin, which led to several of the major tin producers, including PT Timah and China's Yunnan Tin, announcing output cuts (Roskill, 2015). Global tin demand had been set to recover by 2021, buoyed by several new applications that are set to grow rapidly over the outlook period. The foresight for tin estimates that demand is going to increase at a rate of 0.62 in 2006 to 0.77 in 2030 (Sun, 2013, p.33). Increasing demand is coupled with the increasing demand for solder and transparent electrodes in electronic devices (Sun, 2013, p.33).

CONFLICT

Since King Leopold of Belgium's time, the scandal of the people of Congo never having benefitted from the country's enormous wealth in natural resources has been perpetual. In more recent years and particularly during the two civil wars (1996-2003), what has been termed the 'resource curse' has 'almost automatically become associated with the country's natural resource sector' (Garrett, 2007, p.32). During this period of armed conflict, foreign armies and private actors operated exploitative systems of natural

resource exploitation and trafficking in DRC, often with the help of the private sector as has been documented by numerous academic studies, the reports of the UN Panel of Experts and NGOs.

Walikale territory in North Kivu was the centre of the cassiterite boom in 2003-04 which in some ways took the place of the coltan boom of 2000-01. At the height of the boom, war broke out around the control of cassiterite trading. This was not only a resource war; it was linked to the aftermath of the Nkunda rebellion in Bukavu in June 2004 and tensions around Kanyabayonga in North Kivu in December 2004 (Johnson, 2005, p.56). At this time, it was said that this region of DRC had been a war zone continuously for longer than any other part of the country. The first "ethnic" conflicts in North Kivu between Banyarwanda and Bahunde in 1993 began in this area.

Walikale town itself has been cut off by road from the rest of the country since 1996 with what remains of it having been turned into an improvised airstrip through which precious minerals leave the area and arms and soldiers come in (Johnson, 2005, p.57). Mining sites in this part of North Kivu have been isolated forest enclaves with their own governance systems and economies based on barter. The difficult access means that public services are almost non-existent, except in the repressive forms of police and military (Cuvelier, 2010, p.26). The geographical isolation creates a powerful socioeconomic constraint and mining in this forest is a violent business which benefits both local and international actors (Cuvelier, 2010, p.31).

Since the first "Kassem report" in 2001 by the UN Panel of Experts on the Illegal Exploitation of Natural Resources and Other Forms of Wealth in the DRC, many international observers have settled under the theory that the DRC's neighbours have been stealing the country's resources. However, this over-simplified theory neglects the pivotal role of western and eastern companies and their complicity in the process (Garrett, 2007, p.21). Moreover, western governments have not done enough to ensure their multinational companies conduct proper due diligence prior to purchasing and/or brokering these minerals. The miners themselves are in most cases victims of exploitative practices, which often take on the form of outright theft of their production, bonded labour or illegal taxes. Mine workers are 'often locked into dependency, indebted to local strongmen or their financiers higher up the trading chain' (Garrett, 2007, p.20). The feedback from most actors suggests that up to 70% of value added in the mine accrues to "big men" in military, business and politics (Garrett, 2007, p.20).

Global Witness undertook research on the cassiterite trade in Eastern DRC in 2005, three years later the organisation declared that notwithstanding turbulent political developments in the region, the practices of the warring parties and the individuals with whom they trade had remained constant (Global Witness, 2009, p.15). The organisation documented the involvement of the Congolese state in the form of the Armed Forces of the Democratic Republic of the Congo (FARDC) at Bisie mine in Walikale (Global Witness, 2009, p.35-39). In 2007 and the first part of 2008, researchers found the FARDC based at

Bisie were collecting at least $120,000 a month by taking a commission of $0.15 on every kilogramme of cassiterite (Global Witness, 2009, p.6). The same report also found that an estimated 60% of cassiterite production in Walikale was produced, directly or indirectly, by the Democratic Forces for the Liberation of Rwanda (FDLR) (Global Witness, 2009, p.42). Further enquiries found that military units and officials were getting between $14-29 million a year from the Bisie mine in early 2010. Those profiting from the mine included former rebels who used to belong to the National Congress for the Defence of the People (CNDP) (Global Witness, 2010, p.2).

The objective of the Congolese government's military campaigns in 2009 has been described as 'to push back the armed groups - and notably the FDLR - from mining sites in the hope of weakening them both financially and militarily' (Cuvelier, 2010, p.27). Armed group interference at Bisie is said to have subsided from early 2012, with no more reports of undisciplined FARDC involvement in human rights abuses such as arbitrary arrest and torture, or predatory behaviour such as forced labour (IPIS, 2016, p.28). Having been acquired by Alphamin Resources Corporation/Alphamin Bisie mining (ABM), when representatives of Mining and Processing Congo PLC (MPC) returned to Bisie in March 2013, they found the security situation was impacted by two factors, firstly as a result of ethnic conflicts between the Nyanga of NDC-Sheka and the Nkumu of Mai-Mai Simba and secondly by the hostility of artisanal miners to MPC's return. ABM complained that diggers regularly sabotaged their equipment and mining co-operatives explained their hostility as they feared the return of MPC/ABM would result in their evacuation from the site (IPIS, 2016, p.30).

Another example of conflict around the cassiterite trade was recorded on July 16th 2014 when Sheka rebels launched an attack against MPC/ABM's camp. Rebels reportedly ransacked the camp, looted the pharmacy and stole food in an attack which lasted about 30 minutes, during which one FARDC lieutenant was killed and several others were injured, others managed to flee and hide in the bush. According to ABM staff who witnessed the attack, artisanal miners from Manoire quickly arrived to loot the place, destroying machines and material and burning the camp. Looters allegedly also destroyed samples from potential sites for relocated artisanal miners. ABM estimated the loss at $13 million (IPIS, 2016, p.31). SAESSCAM (the Service for Assistance and Organisation of Artisanal and Small-Scale Mining) is believed to have played a decisive role in resolving these disputes by granting or blocking access to the mineral trade. Notably, interfering in such situations goes significantly beyond SAESSCAM's mandate, taking over tasks of the Mining Registry which is legally responsible for safeguarding property rights (Diemel, 2018, p.64).

In another part of the country in Haut-Lomami state, contestation over access to the mineral trade in Bukama is said to have reached its peak in 2013 at Kyenze, Bukama's main cassiterite mine site which accounted for almost 50% of this area's mineral production (Diemel, 2018, p.63). A dispute arose when the newly arrived comptoirs from companies such as Chemaf started sourcing from Kyenze, where Mining Mineral Resources (MMR) claimed to have exclusive purchasing power based on their lease contract with Gécamines.

Over the course of a year, several comptoirs are reported to have sent representatives to source minerals from Kyenze with the situation remaining tense and disputed, with various parties accusing each other of mineral theft and the illegal blockage of access.

Recent studies have found that to some extent, 'attempts to regulate the cassiterite industry and establish more responsible supply chains has resulted in a process of territorialisation' (Diemel, 2018, p.56). Initial observations regarding the effectiveness and impact of the mining ban which took place in 2011 on production and on the security situation in Walikale were said to be such that production volume decreased considerably and the military increased their control of mineral exploitation and trade, with continued severe consequences for human rights (Zingg, 2011, p.14).

Returning to consider the role of cassiterite as a material component among assemblages which comprise the physical infrastructure of the digitalised media landscape being one of connection, one may ask the question to what extent underlying conflicts and territorial disputes have become manifested in devices themselves. In a theoretical context, the term 'connection' is said to 'indicate the way in which decoded and deterritorialized flows boost one another, accelerate their shared escape, and augment or stoke their quanta' (Deleuze and Guattari, 1987, p.220). As the transmission of information continues seamlessly and unhindered, 'delaminated from any specific material substrate' circulating, dematerializing and rematerializing unchanged (Brown, 2010, p.55), the medium becomes 'a kind of immaterial fluid that circulates effortlessly around the globe while sill retaining the solidity of a reified concept' (Hayles, 1999, p.246). The immaterial aesthetic associated with a single device, just one component among a near infinite number which constitutes the infrastructure of global communications is something which exists irrespectively of the ethics behind its construction. Proportionality is not always an attribute which can be assigned to the output of media organisations unwittingly or otherwise, particularly when representation is geared towards a specific agenda or audience. However, in this instance in relation to the sourcing of cassiterite from DRC as well as other materials, the term 'whitewashing' springs to mind, the inherent irony being that this or any message would not be transmitted without the materiality of the medium.

POLICY / CAMPAIGNS / LAWS

In tracking the chronology of initiatives which have aimed to address inadequacies and injustices around the tin supply chain and cassiterite originating from DRC, a pattern is observable whereby corporate claims of ethical and responsible mining have been inserted into a shifting landscape of regulation (Vogel, Musamba and Radley, 2018, p.74). From the implementation of mining code laws in the country in 2002 and 2018 to the implications of the Dodd-Frank act in the US in 2010 or the International Tin Supply Chain Initiative (ITSCI), ever since a surge in demand for the material in the first years of the 21st century

attributable to a boom in consumer electronics, regulators have been attempting to grapple with the issue of fairness around this industry.

The Dodd-Frank act which was announced in July 2010 also contributed to a mining ban which was issued by the national government in Kinshasa in September 2010, a move which somewhat changed the complexion of the cassiterite industry. However, documentation of a letter written by Malaysia Smelting Corporation (MSC), the biggest importer of Congolese cassiterite at the time in 2009 stated; 'we consider total disengagement not to be an ethical option as this would deprive those dependent on artisanal cassiterite production of their only livelihood" with Thai importer Thaisarco making a similar argument, claiming that "most parties and commentators appear to be in agreement that the continued trade in minerals from DRC is fundamental to the well-being of the artisanal mining communities" (Global Witness, 2009, p.64). The mining ban was lifted by the DRC government on 10 March 2011.

Following the initial establishment of the Extractive Industries Transparency Initiative (EITI) in 2003, it was identified that foreign companies would tend to disincentivize national operators to support reform in Artisanal and Small-Scale Mining (ASM) by continuing to buy minerals without conducting proper due diligence (Garrett, 2007, p.26). In general, the concept of due diligence among the trade in conflict minerals has become a key aspect in organisations' attempts to address failures around ethical sourcing and as part of this process, international mineral trade data has become more consistent with the ongoing implementation of due diligence (Schütte, 2019, p.674).

At an earlier point, some of the main challenges identified in the implementation of EITI in the Great Lakes region including North Kivu and South Kivu provinces were said to be around the lack of democratic or co-operative bodies among the ASM sector with whom to liaise. An air of suspicion of such organisations among workers was also reported. Others issues included the lack of cohesion between elements such as the Central Bank, the Ministry of Finance, the Ministry of Mines, the Ministry of Planning, and provincial level institutions as well as the potential for 'spoilers' from 'modern, traditional and customary spheres' (Garrett, 2007, p.38) to derail any such transparency initiatives and the dangers of misinformation which could have adverse effects. Primarily, it was identified that western and eastern governments had not been doing enough to ensure their companies were conducting proper due diligence prior to engaging in business transactions in DRC, creating a direct disincentive for sector reform on the ground (Garrett, 2007, p.39).

In what was Katanga and now Haut-Lomami state in the south of DRC, a process of drawing boundaries around mineral deposits, classifying them, placing spatial markers were all said to be part of MMR's claims to access from 2009 to 2013. In the town of Bukama, the local SAESSCAM branch played an important role in deciding who could accumulate wealth from the mine sites, simultaneously establishing a space where the organisation claimed to hold authority over organising access (Sikor and Lund, 2009) (Diemel, 2018, p.64).

The role of organisations associated to the United Nations has also been an important aspect to the implementation of due diligence schemes. In 2008 for example, the Security Council extended arms sanctions to cover illicit trading in minerals from Congo, prompting Thaisarco and others to come up with a certification scheme aimed at ensuring the sector does not fuel conflict (Bavier, 2009). More recently in November 2014 at the 8th meeting of the OECDICGLR-UN Group of Experts Forum on Responsible Minerals Sourcing in Kinshasa, the Organisation for Economic Co-operation and Development (OECD) organised a side event to facilitate discussion between different stakeholders on the issue of mineral stocks. This process involved labelling the minerals with unique tags to inform potential buyers about the associated risks, as well as the clear identification of stakeholders in the process to ensure compliance with tax requirements. Participants highlighted the need 'to ensure that these minerals be exported using a traditional certificate of origin issued by the Congolese authorities rather than an International Conference on the Great Lakes Region (ICGLR) certificate, for which these minerals could not qualify' (IPIS, 2016, p.5)

Another significant organisation in this area is the International Tin Research Institute (ITRI), a tin industry association based in the UK which has since 2008 been developing a chain of custody and due diligence, namely the ITRI Tin Supply Chain Initiative (ITSCI) (Taka, 2014, p.9). MSC is a leading member of ITRI and was one of the initiators of the organisation's traceability and due diligence system (Diemel, 2018, p.60). Driven by the international tin industry, ITSCI associates key end-user industries such as RIM/Blackberry, Boeing, Qualcomm and Motorola with full members such as local trading houses / comptoirs and smelters / refiners such as MSC. Alongside corporate members, ITSCI's board also includes NGOs such as Global Witness (Vogel, Musamba and Radley, 2018, p.1112). Some of the main criteria of eligibility for the scheme are whether a concession is covered by a legal title, whether armed groups are present, if child labour persists, and if there are pregnant women working at the mine site.

In attempting to implement the ITSCI in its early days, MMR and the Katanga government set up a custody tracing scheme. In Eastern DRC this traceability scheme linked to ores began with ITSCI and a formalization system which first launched in 2010 at the Kalimbi mine site in South Kivu for the 3Ts (tungsten, tin, tantalum). The ITSCI scheme has since been implemented at numerous mine sites in Eastern DRC, but not across the entire country. In South Kivu for instance, research suggests that only 17.5% of mine sites are certified under this traceability system (Byemba, 2020, p.423).

As part of what has been described as a process of deterritorialisation, the mining of materials such as tin in Eastern DRC has been referred to as 'the gradual articulation of externally legitimised extraction' (Vogel, Musamba and Radley, 2018, p.1107). Regulatory initiatives which recognise industrial practices as being either legal or illegal have tended to reify patterns of inclusion and exclusion. Furthermore, 'in good neoliberal fashion, the attempt to seal off this perceived terra nullius of global resource extraction from its alternatives over the latter part of the 2000s has gone hand in hand with an attempt to remodel state infrastructure at the service of economic markets' (Vogel, Musamba and

Radley, 2018, p.1107). A focus on liminality brings to light an association between the work of the law with violent capitalist extraction (Pereira, 2015, p.10). Ultimately, autonomous economies are not fixed in space but rather the result of a process, the outcome of a violent struggle over what are the accepted terms of regulating access and rights to wealth (Abraham and Van Schendel, 2005; Mitchell, 2002; Roitman, 2004).

Once the ITSCI validation has been approved by ministerial decree, ITSCI and its implementing partners Pact, a US NGO, and SAESSCAM can start "bagging-and-tagging" minerals from identified areas, a process which was halted in April 2012 due to heavy clashes (Taka, 2014, p.13). 'The b/ordering between "conflict" and "conflict-free" areas is thereby strengthened by an enclosure of the formerly unregulated, supposedly militarised, areas' (Vogel, Musamba and Radley, 2018, p.1112). While subject to economic reasoning, in so much as that only larger sites have been included so far, 'the validation process dis/articulates mining areas through a flat two-dimensional mapping of mining sites as being either "occupied" or "unoccupied" by armed actors' (Vogel, Musamba and Radley, 2018, p.1112). It has been said that structurally, this process both perpetuates and reifies DRC's ASM sector as an 'imagined "uncivilised" area that needs to be captured by a legitimising trade regime, in this case, a closed supply chain' (Vogel, Musamba and Radley, 2018, p.1112). In progressing a frontier logic, ITSCI has also been criticised for having incorporated lucrative mines backed by the national ratification of foreign laws and guidelines influenced by powerful corporate members.

The ITSCI system presents an externally induced, yet integral, part of a larger push towards ASM formalisation and the progressing enclosure of thus far decentralised local production networks that used to be organised in more fluid ways (Vogel and Raeymaekers, 2016; Mueller-Koné, 2015; Iguma, 2014). Although ITSCI can be credited for rolling out a complex system in a challenging environment, statistics paint a mediocre picture with only around 50 out of 900 sites in South Kivu alone reported to be connected to legal markets four years after the scheme's inception (Vogel, Musamba and Radley, 2018, p.1112). Documentation also suggests that the regional ramp-up period of the ITSCI industry sourcing program from 2011 to 2015 was characterized by local economic disequilibria that caused price differentials for artisanal miners selling their production at either covered or noncovered mine sites.

Despite having ostensibly admirable intentions in terms of the motivation behind it, the Dodd Frank Wall Street Reform and Consumer Protection Act has resulted in a range of consequences, not all of which have been desirable. One such effect which has been highlighted is that the economics around this are said to have triggered stagnation and the decrease of local prices (Vogel, Musamba and Radley, 2018, p.73). Conversely there is also a case to say figures are more accurate as a result of this legislation (Schütte, 2019, p.684).

There is also evidence to say that regulation around Dodd-Frank such as ITSCI and those implemented by MONUSCO and SAESSCAM resulted in quantities of cassiterite being stockpiled as part of what could be referred to as a bottleneck in the supply chain. Factors

such as this are said to have caused ‘around 1000 tonnes being ‘evacuated’ from the area in late 2015’ (IPIS, 2016, p.15).

A further aspect associated to the formalisation of cassiterite mining in recent years has been the establishment of workers co-operatives. Observations suggest that one issue to have arisen from such initiatives has been regarding organisations being granted mandatory state powers which has interfered with the freedom of association among parties involved. ‘Several elites have already used their connections at the provincial level and in the country capital of Kinshasa to establish mining co-operatives, without actually being present on the ground’ (Byemba, 2020). Also, by proscribing formal regulation as a prerequisite for ‘peace’ a virtual embargo is reified, the result of which has been described as exacerbating the monopolisation of extraction and exchange by a few foreign-linked military–commercial networks (Vogel, Musamba and Radley, 2018, p.1107).

As mentioned earlier, another issue around this industry has been the tendency for materials to be smuggled out of the country and declared an export of another nation such as Rwanda for example. As part of a process of establishing Certified Trading Chains (CTC) in both DRC and Rwanda, light has been shed on the supply chain relations between downstream buyers and upstream producing companies. One of the ideas behind this was said to be that ‘instead of boycotting commodities originating from conflict-affected or high-risk areas, downstream companies use their leverage to trigger positive changes upwards in the chain’ (IPIS, 2012, p.22). In January 2015, a new tin smelter in Rwanda started a 10-day pilot program operated by Phoenix Metals Ltd with a reported capacity of 2,200 metric tons per year of tin (USGS, 2015).

As part of a report published in 2017, the Responsible Minerals Initiative based in the US highlighted several schemes aimed at responsible tin sourcing. These included initiatives such as documentation of the identification of key health and safety risks associated to the industry, business plans which included steps to ensure sustainable land reclamation and a responsible tin production guide.

MEDIA

The market in what are referred to as the 3Ts (tungsten, tin, tantalum) in the Kivus has been described as a ‘global resource frontier’ (Vogel, Musamba and Radley, 2018, p.1106). The predominant use of each of these materials over the course of the last 20 years or so has been in the manufacturing process of products which house and distribute information, comprising the media landscape of today. Within this context, tin is the primary component of solder, a fusible metal alloy used to connect two pieces of metal with a melting temperature below that of either piece. In electrical applications, it is conductive, allowing an electrical charge to flow across the connection. Tin also is a metal which is found in everyday life.

In addition to its use as solder in circuit boards, another application of tin in the manufacture of today's media devices is as transparent and electrically conducting indium-tin-oxide. Molten tin is used in the production of so called 'float glass', said to be 2% of the world's tin consumption. The industrially applicable process to create this material was invented by Sir Alastair Pilkington whereby molten glass floats on liquid tin and a very plane surface is formed. Tin is suitable for this process because of its high density, low melting point and its surface tension (Sun, 2013, p.24). Used as an electrically conductive coating on flat glass for screens and displays and touchscreen technology, it is believed this material will have increasing significance on future demand for tin and indium, a finite resource which is usually sourced as raw material in Siberia.

The use of tin in lithium-ion battery anodes is a sector that has shown some of the highest growth over the last decade, accounting for 0.4% of refined tin consumption in 2011 and growing to 3% in 2019. This trend is set to continue over the outlook period, with the degree of vehicle electrification expected to increase substantially over the coming decade. Advances in Lithium-ion battery materials indicate tin and tin compound materials offer increased stability in such batteries, which could become a major driver for increased use of tin in the sector. The rollout of 5G networks is set to boost the telecommunications and other electronics sectors more widely. Smartphones and conventional mobile phones account for nearly half of all consumer electronics and with demand for conventional mobile phones rapidly falling, a boost to smartphone demand will be key to increased refined tin use in consumer electronics (Roskill, 2015).

As part of a more topological view, global power assemblages can be viewed as facilitating a more sophisticated vision of the ways in which capital and labour flow through the interconnected prism of mineral extraction and exchange networks than some anti-capitalist critics tend to assume. In the frontier constellation of Eastern DRC's mineral extraction and trade, capital does not jump from one place to another nor is labour necessarily fixed in a particular location. The two intersect in a multidimensional space that is actively modelled by protagonists who act as brokers of economic wealth. From the diggers to the mining cooperatives as well as local, national and foreign actors such as corporations, governments and NGOs, numerous middlemen not only co-determine the terms of transnational trade but also play an active role in negotiating the implementation of local development schemes (Vogel, Musamba and Radley, 2018, p.1107).

In summary, although depicting artisanal miners and civilians in today's resource wars as clueless victims captured between global consumerism and local militia may serve campaign purposes quite well, this view gravely glosses over the intricate networks of exploitation, debt, contested land and access rights that accompany violent accumulation networks in the aftermath of war (Vogel, Musamba and Radley, 2018, p.1105). Rather than a clear-cut standoff between capitalist and non-capitalist modes, frontiers have been described as a twilight zone in which the reorganisation and accumulation of wealth results in integration and encapsulation, violently moulding into submission the actors that are navigating this unstable terrain (Sikor and Lund, 2009).

What could be referred to as so-called irregular or informal forms of wealth creation as in the context of Eastern DRC have been identified as not being situated outside capitalism, rather in 'liminal' zones in the margins of expanding markets (Vogel, Musamba and Radley, 2018, p.1106). The world's marginal zones of production have been conceptualised as 'decompression chambers' that equilibrate the constitutive tensions that underlie the very existence of capitalist markets, in the most violent of ways (Mezzadra and Neilson 2013, p.149). Calculative techniques of marking, bordering, and categorising mobile networks as essentially separate, and separable governable units have worked to proscribe specific activities within fixed spatial boundaries (Vogel, Musamba and Radley, 2018, p.1106). Variations in these relationships are not determined by armed conflict exclusively, as diggers, intermediary traders and local authorities try to navigate continuously shifting landscapes of debt, opportunity and insecurity (Geenen 2011; Smith 2011; Vigh 2009).

CHAPTER 8: CONCLUSION

OVERVIEW

Within the context of media materiality, this thesis has attempted to assess the extent to which a boom in the manufacture of modern technological devices has been implicated in territorial conflicts within Democratic Republic of Congo. Building from a prism which encompasses the work of authors such as Marshall McLuhan, Gilles Deleuze, Manuel DeLanda and Jussi Parikka, this work has aimed to consolidate some of the key concepts in areas such media geology, media archaeology as well as the theory of assemblages, all of which have provided the rational basis in order to focus on the physicality of modern telecommunications devices. Somewhat paradoxically, the utilisation of a methodology based from literary sources, many of which have been accessed digitally, as well as the ubiquitous role of the computer as a workstation and communicator throughout this project are both factors which whilst researching particular aspects of the physicality of media forms I have tried to remain aware of throughout.

The timeline of this PhD project has been heavily affected by the coronavirus pandemic, a period which has resulted in a greater reliance on telecommunications globally. This has also been a period in which a resurgent Black Lives Matter movement has resulted in a ground-shift and a culture of change whereby acknowledgement of racial injustice has become more prevalent. In a wider sense, strides towards equality for all no matter what ethnicity continue to take place. After all it was only one hundred years ago that several European countries were territorialising much of African continent in what became known as 'the scramble for Africa'. In general terms, a culture of dispossession and exploitation which has developed across this historical period and been facilitated by forms of capitalist enterprise has been expressed as the contact point of geographical proximity with the earth, constructed specifically as a node of extraction of properties and personhood (Yusoff, 2018, p.11).

In looking more closely at the work of key theorists, this project has gone as far as possible to consolidate and develop a rationale which is applicable within the context of the assemblage of wireless telecommunications devices such as the mobile phone, the laptop or the electric car. A strand in media theory which in many ways began with the perspective outlined in Marshall McLuhan's *Understanding Media: The Extensions of Man* (1964) and the maxim 'the medium is the message', this thesis has traced a lineage of discourse which has evolved over the course of the past 50 years or so. Key concepts which have become integral to the notion of media materiality such the apposition between territorialisation-deterritorialisation or coding-overcoding as introduced in Deleuze and Guattari's *A Thousand Plateaus: Capitalism and Schizophrenia* (1987) have provided the foundation, enabling a constellation of elements to be viewed as constituent parts.

As such, the application of assemblage theory has been an integral part of the methodology of this project. These perspectives have enabled a bridging point between materiality in a very literal sense along with cognitive and philosophical forms. Ultimately, each stage

involved in the manufacture of telecommunications devices can be aptly viewed as an assemblage whether it be in the case of geological artefacts which are then mined as raw materials, the assembly of components on a circuit board or processes associated with the consumption of technological products. In simple terms, assemblage theory can be a lens which enables any given whole to be understood as the sum of its constituent parts across a variety of scales. This approach has also been complimentary to an inherent interdisciplinarity within this work, encompassing subjects such as human geography, culture studies, decolonial studies, economics, ethics as well as supply chain management and more. Overarchingly, the emergent properties resultant from the manufacture of telecommunications devices have been articulated as 'a mythology of disassociation in the formation of matter independent of its languages of description and the historical constitution of its social relations' (Yusoff, 2018, p.14).

Sociologically, much has been made of the manifold implications associated with the increasing ubiquity of wireless telecommunications as we move into the 21st century, processes which have been subject to a variety of trajectories and geo-political factors. In the context of DRC, attention has been paid where 'cell phones and communications technology are also used to create disconnection, and to keep people separated' (Smith, 2011). In the eastern provinces of North and South Kivu, it has been noted that the generals of armed militia groups have sometimes prohibited their subordinates from possessing cell phones so that they alone can communicate with comptoirs and that military units have expropriated the cell phones of miners who are producing the material needed for the cell phones they themselves would use, paradoxically. Prevailingly it has been identified that 'if a network property fails to coincide with formal authority, the result may be conflict and stalemate in the mobilisation of resources' (DeLanda, 2006, p.42).

As mentioned, the terms 'media geology', 'media archaeology' and 'media ecology' have been explored in detail in the previous chapters of this text. In each case, situated among the study of processes involved in the manufacture of technological devices there can be found to be two strands of comprehension, both the literal and the conceptual. A conjunction of the two, one notion of blackness has been contextualised in a geological context as 'diasporic subjects that are summoned' as 'the ghosts of geology's epistemic and material modes of categorization and dispossession, which sit beside the earth's own coiled velocities, its meteoric elegance' (Yusoff, 2018, p.11). In a more literal sense, the study of geology is believed to be 'the science about the ground beneath our feet, its history and constitution, the systematic study of the various levers, layers, strata, and interconnections that define the earth' (Parikka, 2015, p.4). Notwithstanding, a further articulation of the relationship between geology and colonial injustice has been expressed in the sense that 'geology is a mode of accumulation, on one hand, and of dispossession, on the other, depending on which side of the geologic colour line you end up on' (Yusoff, 2018, p.15). In a critical light, geology has been highlighted as operating on normative presuppositions as a way of extending settler colonialism through the nomenclature of materiality and the praxis of extractions (Yusoff, 2018 p.110).

In looking at the history of DRC it is also important to bear in mind that 'western understandings of the Congo, even in the twenty-first century, rely heavily upon earlier

representations generated by Westerners', leading to 'an interesting paradox: while Westerners are generally uninformed about Congolese history and politics, they feel they know it well because of the powerful images of it encountered everyday' (Dunn, 2003, p.18). Consideration is also warranted with respect to the role of language and linguistics as avenues of expression which may or may not offer a level aptitude which is not affected by forms of cultural bias. As has been identified in the context of the theory of assemblages, linguistics 'should never be considered any more than component parts entering into relations of exteriority with other component parts' (DeLanda, 2006, p.45). Despite languages such as English and French having strong associations with cultures of globalisation, the potential for populations to become unified through these modes of communication is offset against histories which are often unspoken and associated with colonialism.

One important question in addressing economic inequalities related to the trade in minerals and rare earth metals is the relevance and governmental power of the nation state of DRC, particularly given that these materials are largely mined on the other side of the country from Kinshasa where the central government is based. This is after all an enormous country whose landmass is the second biggest in Africa. During a speech made on June 8th 2022 in Kinshasa by Belgian King Phillipe upon his first visit to DRC since ascending the throne, he stated 'the Belgian presence in Congo before 1960 has left a heritage that has defined today's borders of the country and the preservation of the territorial integrity of Congo is a major pre-occupation that we share'. Even today, analysis on the part of non-governmental organisations which places emphasis on the notion of DRC as a singularised sovereign state has the potential to overlook the question of how relevant or useful this may be. To be critical, after all 'nation-states are configurations of origins as exclusionary power structures which have legitimacy based solely on conquest and acquisition' (Yusoff, 2018, p72), an assertion which is particularly resonant in the context of DRC.

As has been explored in earlier chapters, such limitations of perspective in relation to the role of the nation state as an entity can be attributed to the influence of genealogy as explored in the writing of Michel Foucault for example. As a development of the genealogy concept, what has been termed 'necropolitics' (Mbembe, 2003) defined as 'new and unique forms of social existence in which vast populations are subjected to living conditions that confer upon them the status of the living dead' (Mbembe, 2019) is also relevant here. After all, conflicts in DRC and particularly in the east of the country over the last 25 years are widely believed to be the mostly deadly in recent world history with several million lives lost, a scale which is difficult to comprehend. To further contextualise the 'war machine' concept outlined in *A Thousand Plateaus: Capitalism and Schizophrenia* (1987), it has been asserted that 'war machines (in this case militias or rebel movements) rapidly become highly organized mechanisms of predation, taxing the territories and the population they occupy and drawing on a range of transnational networks and diasporas that provide both material and financial support' (Mbembe, 2019, p.34). Furthermore, 'the extraction and looting of natural resources by war machines goes hand in hand with brutal attempts to immobilize and spatially fix whole categories of people or, paradoxically, to unleash them, to force them to scatter over broad areas no longer contained by the boundaries of a territorial

state' (Mbembe, 2019, p.34). Indeed, it is estimated that between 2008-2021, a total of 16.7 million people have been internally displaced within DRC (Internal Displacement Monitoring Centre, 2022), one of the key drivers of this migration being global demand for natural resources in affected areas.

Although materials from DRC are utilised across a variety of manufacturing processes, the wireless telecommunications industry bears a particular responsibility, commercial practices designed to maximise profitability are identifiably integral in perpetuating forms of injustice. The staggered and incremental release of products as well as perpetual and pre-ordained obsolescence have been identified as some of the key strategies, amounting to what has become known as 'update culture' (Chun, 2016). As has been explored in this text, the notion of 'deep-time' as expressed in the work of theorists such as Siegfried Zielinski becomes pertinent in considering the cycle of matter which comprises the physical infrastructure of today's media landscape. As an extension and contextualisation of this, attention has also been paid in highlighting that 'deep-time and near-time geologic questions are entangled with hard political questions about decolonizing and the possibility of futures' (Yusoff, 2018, p.107).

THE MATERIAL ASSEMBLAGE IN MEDIA

The theory of assemblages, said to have been initially proposed by Deleuze (DeLanda, 2006, p.3), highlights that entities across a variety of scales ranging from atoms and molecules to biological organisms, species and ecosystems can be usefully treated as assemblages and therefore as entities that are products of historical processes. In this context it has been asserted that the causal understanding of relations between material resources and the adequacy of a particular technology, relative to the properties of raw materials are able to serve as inputs (DeLanda, 2006, p.81). In observing a timeline among media developments over the course of recent decades as novel and perceivably ground-breaking technological products are periodically introduced to the consumer, obsolescence becomes an observable part of the process. In consideration of each stage across this evolution, the application of assemblage theory as a theory of immanence presents the ability for any emergent properties such as the proliferation of rhizomatic networks of wireless communication to be identified. Notwithstanding, as manoeuvrings in the telecommunications sector move to focus on the advent of 5G technologies and electric vehicles for example, the physical manifestation of each of these products can also aptly be understood as assemblages in that they are entirely comprised of what were once raw materials. Properties emergent from the assemblage of telecommunications devices have been expressed in the sense that 'the mine and the afterlives of its geomorphic acts constitute the materiality of the Anthropocene' (Yusoff, 2018, p.17).

As explored in chapter 3 of this text, assemblage theory retains its relevance across several strands of cognition in attempting to answer the question of the extent to which the manufacture of technological devices has been implicated in territorial conflicts in DRC,

including geology, economy, sociology and politics. In another light however, despite highlighting the modular adaptability of this particular philosophical approach whose remit is potentially quasi-universal, the role of considerations such as ethics and justice remains less apparent. To consider the physical composition of an I-phone for example may shed light on the components from which it is comprised, however in a context whereby motivations around profitability tend to characterise many aspects around the proliferation and engagement with such technologies, ethical considerations may be required in attempting to move forwards tackling inherent injustices, subjective as this pursuit may be.

Moreover, from the accumulation of materials which form media's physical infrastructure, conceptualised at each stage throughout technology's life cycle as a 'constellation of singularities' (Deleuze and Guattari, 1987) emerges a pattern of wastefulness and a finite life span. One may blame capitalist culture or the racist backdrop upon which colonial history was built for this phenomenon. In one light, blackness has been expressed 'as a historically constituted and intentionally enacted deformation in the formation of subjectivity, a deformation that presses an inhuman categorization and the inhuman earth into intimacy' (Yusoff, 2018, p.11). Furthermore, 'thinking blackness in terms of the relations of materiality, of coal black, black gold, black metal, and how these are configured in discourses of geology and its lexicons of matter uncovers the transactions between geology and inhumanism as a mode of both production (or extraction) and subjection (or a violent mode of geologic life)' (Yusoff, 2018 p.19).

As much as wireless telecommunications play an increasingly integral role among the global financial system as we progress further into the 21st century, it becomes hard to separate the physicality of this infrastructure from what are vastly inequitable economic circumstances. The aesthetics of devices in many ways prove to be at odds with their ethics. A disproportionate global division of labour (Lazzarato, 1996) has become housed within screen-based media whilst a wider disenfranchisement of workforces has taken place. Relating to the context of communications devices culturally, it has been expressed that 'the main territorialising process providing the assemblage with a stable identity is habitual repetition' (DeLanda, 2006, p.50). Today there is little doubt that private companies play a key role in facilitating communication and that 'all user industries bear some responsibility, albeit distant, for the situation' regarding mining industries in DRC (Hayes and Burge, 2003, p.51).

As expressed in chapter 1 of this text, materials originating from Congo Free State / Belgian Congo / Zaïre / DRC have played an integral role in the manufacture of innumerate forms of technology throughout the 20th and 21st centuries. In attempting to trace the origins of a culture of exploitation which has developed among global industries, in a more general sense colonial occupation itself has been expressed as 'a matter of seizing, delimiting, and asserting control over a physical geographical area—of writing on the ground a new set of social and spatial relations' (Mbembe, 2019, p.25). In a modern context when examining circumstances around the supply chains of what have been termed 'digital minerals' (Mantz, 2008) from the process of extraction through to the consumer, the question has been posed; 'how does the maintenance of structures of materiality (or geologic codes) facilitate

and perpetuate antiblackness and its forms of subjugation, as well as ongoing settler colonialism?' (Yusoff, 2018, p.19).

Each of the three materials featured in the case studies of this thesis respectively have their own set of circumstances and have been subject to different economic emphases during different chronological periods. Nevertheless in geographical terms, coltan and cassiterite can be said to pertain to a greater similarity as these materials have predominantly been mined in the same areas in the east of DRC in the provinces of North Kivu, South Kivu and Maniema, whereas cobalt mining mainly takes place in the southern provinces of Lualaba and Haut-Katanga.

Despite not being featured as a case study within this research, tungsten (wolframite) is also mined in a similar region to that of coltan and cassiterite and has a prominent role in the manufacture of telecommunications as it acts as a heat sink in providing the mass for mobile phone vibration. Despite wolfram mining having been found to take place at numerous sites in South Kivu, a 2013 report commissioned by Global Witness found there to be no official exports of the material over the course of the previous 3 years since 2010 despite provincial mining authority reports having highlighted the location of the mines. An eyewitness account from Luntukulu mine near the town of Walungu estimated that just under 0.5 tonnes of wolfram was being produced each month from that site alone, for example. These discrepancies indicate a high likelihood of large-scale smuggling (Global Witness, 2013, p.7), a practice which has also been commonly taking place in the supply chains of coltan and cassiterite.

Michael Nest, an author who has also written extensively about the plight of coltan and the role of the industry around it in proliferating armed conflict particularly during the early 2000s, has argued that the broader historical context behind DRCs armed conflicts need to be more widely acknowledged in academic discourse. In further contextualising the implications of DRC's armed conflicts since 1997 and in developing a greater understanding around these circumstances, Nest denotes that rather than economic factors being central in determining the course of events, rather it has been a complex tapestry of security concerns, 'ethnic-based harassment and killings, grievances related to access to land, citizenship rights' (Nest, Grignon and Kisangani, 2007, p.31) and various other socio-political incentives. In the later stages of this volume, Emizet Kisangani argues that in search of a solution to the armed conflicts as experienced in the province of North Kivu for example, the economic legacies of these conflicts need to be acknowledged. The author identifies that 'an interruption to subsistence farming, confused property rights, and the emergence of new patterns of economic ownership' (Nest, Grignon and Kisangani 2007, p.100) are all consequences of the territorial conflicts associated with the mining of raw materials used in the global telecommunications industry. These passages of the text are important in that they highlight the impact of the destruction of subsistence farming on the lives of a vast number of Congolese people as well as the impact that Congolese conflicts have wrought in the lives of so many African women and the horrendous effect this has had on their respective communities.

At the beginning of this historical period, coltan was a particularly desired commodity among manufacturers of transistor capacitors, a desire which led many in the provinces of North and South Kivu to abandon agricultural practices in order to take up the mining of this material almost overnight. It was expressed at earlier points that 'all tantalum-using industries should recognize that there is undoubtedly a direct relationship between the illegal exploitation of coltan and the conflict in the DRC' (Hayes and Burge, 2003, p.51). In 2007 it was estimated that approximately 12.5 million Congolese citizens were dependent on 'artisanal and small-scale mining' (Garrett, 2007), 300,000 of whom were engaged primarily in sourcing coltan with further estimates indicating that 3 million people were dependent on the mining of coltan specifically (Nest, 2011, p.32).

In more recent years and as part of a drive towards decarbonisation, demand for cobalt has become insatiable on the part of manufacturers of lithium-ion batteries, demand which is leading to innumerate ecological consequences in the regions of Haut-Katanga and Lualaba in the south of DRC. Child labour is also prevalent among this industry with UNICEF having estimated that around 40,000 children are at work in the mines of southern DRC alone (Amnesty, 2016). In relation to the cobalt industry, the notion that mining is contributing economic development in the region has tended to underwrite the motivations of those seeking potential solutions to what is an unfolding crisis in terms of the impact upon people and the environment. This is particularly ironic as the construction of batteries made from cobalt is being widely portrayed as one of the potential solutions in the global battle against climate change. In this context, human rights have for too long faced a trade off with environmental impact. In respect of considerations relating to sustainability, attention has been paid where 'imperialism and ongoing (settler) colonialisms have been ending worlds for as long as they have been in existence' (Yusoff, 2018, p.12).

REPARATIONS

To return to the start of this text and as my work as researcher of this subject began in December 2018, Dr Denis Mukwege was jointly awarded the Nobel Peace Prize for his work in Eastern DRC. Born in 1955 in Bukavu, South Kivu, during Denis Mukwege's lifetime his country has seen a lot of change politically, however due to factors such as the global economic system having been built on exploitation there has been little chance for inequalities to be addressed. A gynaecologist and obstetrician, Mr Mukwege was receiving recognition for his efforts to end the use of sexual violence as a weapon of war and armed conflict. Below is a further excerpt from his acceptance speech in Oslo on December 10th:

"The Congolese people have been humiliated, abused and massacred for more than two decades in plain sight of the international community.

Today, with access to the most powerful communication technology ever, no one can say: "I didn't know.

The people of my country desperately need peace.

But:

How to build peace on mass graves?

How to build peace without truth nor reconciliation?

How to build peace without justice nor reparation?

I insist on reparations: the measures that give survivors compensation and satisfaction and enable them to start a new life. It is a human right."

In looking at some of the main historical events that have taken place in the nation known as Congo Free State – Belgian Congo – Republic of Congo – Zaïre – Democratic Republic of Congo over the course of the last approximately 125 years as part of this research project, the aim has been to highlight the ways in which a culture of plundering this country's resources has developed and been perpetuated by those seeking to benefit monetarily from these circumstances. Whether it be in relation to the rubber trade in the early 1900s, palm-oil in the 1920s, uranium in the 1930s, germanium in the 1980s or copper throughout much of the 20th century, moreover this is a country which 'has suffered decades of exploitation that has not benefited the vast majority of the population' (Hayes and Burge, 2003, p.42). As the world moved into the 21st century, the almost unfathomably high death toll as a result of conflicts which were raging mainly in the eastern provinces of North and South Kivu and which were associated with the mining of tantalum later to be used in the manufacture of transistor capacitors, bore a strong comparison to that of the early years of the 20th century when brutal colonialist policies were inflicted upon people.

The question of scale and scope of any potential reparations in this case has been expressed as such; 'if it is morally right for Germany to pay reparations to Israel for the atrocities committed by the Nazis against Jews and to people who were coerced into slave labour during the Second World War, and if Iraq should be forced to pay some reparations to some Persian Gulf countries because of the consequences of its invasions of Kuwait, why is it wrong for colonial powers such as Belgium to pay reparations for the heinous crimes committed in the African territories they administered?' (Nzongola-Ntalaja, 2002, p.23). To date, neither the Belgian monarchy, nor the Belgian state has ever officially apologized for the atrocities committed in the region during the time of King Leopold and subsequently although some small steps in this direction have taken place. For instance, in 2002, Belgium apologized for its role in the assassination of the Congolese Prime Minister Patrice Lumumba in 1961 (Van Assche at al., 2021). In June 2022, Belgian authorities officially returned Lumumba's gold tooth to his children. This was all that remained of him as his body had been dissolved in acid following his murder in 1961. Belgian prime minister Alexander De Croo stated in a ceremonial speech in Brussels on June 20th that "a man was murdered for his political convictions, his words, his ideals". Twelve days earlier during a speech delivered in Kinshasa, King Phillippe went further in acknowledging the atrocities committed by his country:

"In the past our relationships were based on exploitation and domination. It was an equal relationship, it was unjustifiable, it was marred by paternalism, by discrimination and by racism. It gave rise to certain humiliations and to violence.

Now during this, my first trip to the DRC, as I see the people of Congo and all those who still today are suffering from this past, I would like to reaffirm my deepest regrets for the wounds of the past, sincere regrets that I expressed in the letter I sent to you Mr president two years ago now for the 60th anniversary of your independence.

Even before independence, the future prime minister Lumumba was already talking about the importance of the unity of the Congolese nation. Today, instability in the east of the country where there is too much inhumanity and violence and unpunished violence remains a great concern for all of us, this situation cannot continue, it is our responsibility to remediate it, our responsibility yours and mine. You can count on the support of Belgium within international organisations to support any initiatives for the stability and development of the Great Lakes region, for a gradual re-opening of our military co-operation with this same logic."

In recent years, several cases have arisen at the International Criminal Court in the Netherlands in which those allegedly responsible for war crimes in Eastern DRC were put on trial having been subject to international arrest warrants. Notably, the ICC does not try individuals unless they are present in the courtroom. To date, of the 6 names for whom an arrest warrant has been issued, one is still at large, two have been acquitted and three have been found guilty of crimes committed in the province of Ituri, a region from which large quantities of gold have been mined and exported historically.

In 2003, Germain Katanga the alleged former commander of the Force de Résistance Patriotique en Ituri (FRPI) was found guilty as an accessory to one count of a crime against humanity (murder) and four counts of war crimes for which he received a sentence of 12 years. Reparations were also ordered to be paid to the victims although this was delayed until 2017 when 297 of 341 requests were granted with applicants receiving US$250 which was paid by the ICC's trust fund for victims (ICC, n.d.). In 2019, former deputy chief of staff and commander of operations of the Forces Patriotiques pour la Libération du Congo (FPLC) Bosco Ntaganda was sentenced to 30 years for 18 counts of war crimes which were said to have taken place between 2002-2003. In this case, the court set the liability fee at US$30 million with a plan for the distribution of these funds from the trust fund for victims set for late 2021 (ICC, n.d.). Of course, these legal pursuits have been useful in the attempt to address injustices which have taken place in the region. However, given the scale and magnitude of the conflict which has taken place in Eastern DRC and the Great Lakes region over the course of the last 25 years, these cases are largely symbolic. Moreover, these actions haven't gotten close to the beneficiaries of what have been recognised as war crimes, with the mobile technology sector having remained largely incommensurate. These investigations are said to have lacked co-operative arrangements with Congolese officials 'despite the prosecutor's repeated calls to harness ICC interventions in the service of 'positive complementarity', that is, to actively encourage and strengthen domestic accountability efforts' (Vos et al, 2015, p.11).

Other models aimed at tackling injustices among the industry of digital minerals have been focused on multi-stakeholder processes. The BBC's 2021 Panorama documentary entitled *the Cost of Going Green* highlights the actions of a local Christian organisation in Lubumbashi who have bought shares in Tesla in order to gain influence over the company's actions regarding the sourcing of cobalt. In 2014, in working towards the establishment of due diligence initiatives, it was noted that more than 50 stakeholders were involved in multi-stakeholder processes including organisations such as the World Bank, UN Group of Experts on DRC, the Responsible Jewellery Council and the International Tin Research Institute (Taka, 2014, p.140). Several legal cases are also underway focused on the sourcing of cobalt from DRC. These include criminal proceedings against Glencore who claim huge cobalt concessions in the south of the country. Work also continues on the part of some of the Non-Governmental Organisations included in this thesis such as Global Witness, the International Peace Information Service, Amnesty International, Make IT Fair, Resolve, the Pole Institute, the Enough Project and the Conflict Free Tin Initiative.

THE INTERNATIONAL RESPONSE

In 2022 in the east of DRC, a resurgence of conflict between Rwanda-backed M23 rebels and the DRC army Allied Democratic Forces has been escalating with each side accusing each other of firing over the border. M23 rebels have also reportedly attacked representatives from the United Nations High Commissioner for Refugees (UNHCR). The group derives its name from the date of March 23rd 2009 when a peace accord between the DRC government and the National Congress for the Defence of the People (CNDP) came into effect. Subsequent to the formation of the M23 group 3 years later in early April 2012, from 2017 onwards the organisation's military wing has been based in Rwanda and in Uganda with groups crossing into the forests of Eastern DRC allegedly to loot minerals. It is also alleged that these groups have received support from other proxy nations such as the US and UK. Although the United Nations Organisation Stabilisation Mission (MONUSCO) currently have more than 18000 troops on the ground in the Great Lakes region, initiatives towards peace have not succeeded. As the single biggest entity which acts as a representative of the international community, questions remain about the actions of the United Nations in DRC dating back several decades. Declared as being a necessary presence for the protection of civilians and to provide 'support for the stabilization, the strengthening of public institutions and the major governance and security reforms' (UN Security Council, 2019), it has been pointed out that the UN's largest peacekeeping operation, has not achieved sustainable peace despite over 20 years of involvement (Romansky, 2020, p.1) (Lopor, 2016). It has also been noted that in some cases 'internationally appointed peace-keepers are as likely to become embroiled in the trade and illicit activities as others, including widespread sexual crimes, than to do anything to diminish suffering' (Ayres, 2013, p.182).

It has been proposed that one way these issues could be tackled more effectively would be by addressing links which exist further afield with those who have a vested interest in the

mineral trade. Understandably, the people of Eastern DRC are fed up with continued conflict around natural resources affecting lives and livelihoods. An apparent lack of willingness on the part of what are considered the world's more powerful nations to address issues in the trade of rare earth minerals comes with its own set of questions.

To trace back to an earlier point in the development of conflict in the region and in reference to what are known as the first and second Congo wars between 1996-2003, it is startling that in an age in which greater access to information has been afforded to populations than at any previous time on a global scale, that the 'bloodiest war since the Second World War' (Turner, 2007, p.1) (Lalji, 2007) in which an estimated 5.4 million lives were lost (Mantz, 2008) could have manifested such limited awareness. One could ask whether this dichotomy has been the result of a policy among governments of what are often termed 'developed' nations to sublimate attention away from this humanitarian crisis, or on the other hand whether responsibility lay with the media industry, whose content is itself a medium reliant on the continuation of this very economy around natural resources to provide its physical infrastructure. Whether knowingly or not, the 'western media has significantly underplayed the war and its aftermath' (Lalji, 2007). One may also ask what level of responsibility rests with manufacturers and network providers who have knowingly created demand for products which perpetuate atrocities (Ayres, 2013, p.190). It has been expressed in a more general context that 'colonial violence and occupation are profoundly underwritten by the sacred terror of truth and exclusivity' (Mbembe, 2019, p.27).

Repercussions of the genocide which took place in Rwanda between 1994-1995 have been felt across the border in North and South Kivu during the decades which have followed and are still ongoing today. An incident which is said to have been a trigger at the start of the Rwandan genocide was the shooting down of a plane in which Juvénal Habyarimana and Cyprien Ntaryamira, the presidents of both Rwanda and Burundi respectively had both been travelling. In France, a public enquiry about the incident was abandoned in December 2018 with investigators citing a lack of evidence. In May 2021, President Emmanuel Macron made his response to allegations that the French state had somehow been involved in the incident in a speech in the Rwandan capital Kigali, stating that 'French officials armed, advised, trained, equipped, and protected the Rwandan government'. He went on to say 'I hereby humbly and with respect stand by your side today, I come to recognise the extent of our responsibilities' (Macron, 2021).

The international community and governments have been expressed as having 'frequently been bystanders to genocidal events through second half of 20th century', with inaction having been 'vital to those who carry out crimes against humanity' (Cameron, 2012, p.72). Indicative of this and in relation to circumstances surrounding the conflict in Rwanda in 1994, it has been asserted that 'the British government had a wealth of knowledge regarding insecurity and violence in Rwanda, and took a positive decision not to act to prevent or stop it, thereby omitting to fulfil its obligations in terms of the UN Convention on Genocide' (Cameron, 2012, p.70). In a global context, an important site of investigation when it comes to the proliferation of armed conflicts relates to the material means for war to take place, namely the weapons and tools utilised by warring parties. As has been

examined in earlier chapters of this thesis, during the 1990s the list of foreign states who were responsible for moving weapons into the Great Lakes region provides some indication. The initial refusal on the part of the international community to accept that was happening in Rwanda and then in Eastern DRC did constitute genocide meant that no state had yet held been held accountable to the genocide convention of 1948 - an international treaty which affirms states may not fail to act in the face of mass atrocities directed at the destruction of a particular group. United Nations Peacekeepers were eventually deployed to the region in February 2000.

It has been suggested that one reason why awareness globally about what was happening in Rwanda was much greater than the subsequent conflict in DRC 'was because U.S. companies wanted to control the Eastern Congo through their proxy, Rwanda' (Smith, 2011). The actions of organisations such as Africom, the United States Africa Command whose declared mission is to work with partners in countering transnational threats and malign actors, strengthening security forces and responding to crises 'in order to advance U.S. national interests and promote regional security, stability and prosperity' (Africom, n.d.) require special attention here. In another light, this discussion 'portrays how the Empire of digital culture is tied up with capitalist circuits of violence and necropower, and how such power shapes the subjectivities of those living under its strongest grip' (Wan, 2019). Furthermore, it has been asserted that what is urgently needed is 'a decolonial lens through which one could study the Empire of digital culture that addresses the longer histories of oppression and exploitation upon certain populations, and a posthuman ecological view that recognises the agency of earth itself and the labour it performs in producing the minerals' which are extracted from the earth (Wan, 2019).

DRC is a country with an incredible wealth of natural resources, yet its population are still among the poorest in the world. As has been examined earlier in this thesis vis a vis each of the case studies herein, attempts at bringing about greater fairness to the industry of digital minerals have made some progress although the pay gap ratio between European and African consumer brand workers is still believed to be in the region of 25 to 1 on average (Amnesty, 2016). A statistic which is indicative of a pattern across the supply chain of raw materials which originate from DRC whereby profits are made at each stage from the refinement to the manufacture of components and eventually at the point of sale of telecommunications products, there appears to be no mechanism under the current terms for these disparities to be addressed. In 2022, DRC's national debt is estimated to be in the region of US$7 billion, meaning that economic development continues to be constrained as it has been ever since the early days of President Mobutu. The term neo-colonialism, defined as the economic and political dominance of weaker nations by more powerful ones, was expressed in 1965 by Kwame Nkrumah, Ghana's first president following independence from Britain as the 'worst form of imperialism. For those who practise it, it means power without responsibility, and for those who suffer from it, it means exploitation without redress' (Nkrumah, 1965).

During the covid-19 pandemic the reliance of workforces and economies around the world on wireless telecommunications has seen an upsurge. Throughout this period of research, it

has been important to investigate the economic repercussions felt in DRC during a time in which this medium has increasingly provided the infrastructure for global monetary transactions. Due to events such as the blockage of the Suez Canal in 2021, the war in Ukraine in 2022, the global shortage of semi-conductors for use in manufacturing as well as the ongoing impact of climate change upon industries, awareness seems to have been growing in the western world about the potential volatility of supply chains at one time taken for granted.

THE TELECOMMUNICATIONS INDUSTRY

In spring 2001, the electronics and mobile telecommunications industries are said to have suddenly been approached by journalists asking what they intended to do about the fact that their products were fuelling a bloody war and destroying endangered wildlife in DRC. Industry representatives found themselves scrambling to limit the potential public relations fallout from an issue that they say totally blindsided them (Hayes and Burge, 2003, p. 13).

Some have made the case that mining industries associated to the global telecommunications and technology industries are vital to development in the region, not least because 'there are more than 1100 minerals and precious metals in DRC' and 'mining is a significant source of income for development' (Otamonga and Poté, 2019, p.1). The question of causality in relation to the territorial conflicts associated with these mining industries has also been raised. For example, 'the United Nations Integrated Bureau, estimated in 2011 that only 8% of all conflicts in DRC were related to access to natural resources, though this has subsequently been contested by critics' (Deibert, 2013, p.461). Others have argued that the militarized mineral trade is a symptom of the conflict and of an ill-functioning state (Seay, 2012) or a state which has limited authority (Cuvelier and Raeymaekers, 2002) rather than it being a cause of these things. Furthermore, it has also been expressed 'that linking resources to conflicts tends to turn a blind eye to other drivers of the Congolese conflicts' such as 'the presence of regional and criminal commercial networks and internal divisions pitting local communities against one another, for instance over land issues and identities' (Wakenge, 2021, p.22). In the view of many scholars, the cause of Congo's conflict is to be found in a complex range of factors, such as access to land, migration issues and contestation over traditional power (Deibert, 2013, p.461).

Moreover, the problem of undocumented or inaccurate export declarations has meant there has been a disconnect in attempts to highlight problems with the trade in minerals originating from DRC. Notwithstanding and partly as a consequence of the 'Wall Street Reform and Consumer Protection' (Dodd-Frank) act of 2010, in more recent times it has been asserted that 'the number of supply chain monitoring initiatives alone has become almost as dizzying as the list of armed groups involved in the conflict' (Wakenge, 2021, p.25). With hindsight, the Dodd-Frank act has been identified as exemplifying 'a mode of reformism oriented toward eliding the contradiction between the amelioration' of the

working conditions faced by Congolese miners and the maintenance of corporate profitability (Dowling, 2020, p.21).

As has been examined in earlier chapters, ramifications of Dodd-Frank have been felt on the ground in DRC. This legislation resulted in a de-facto ban on mining being temporarily implemented in DRC and despite its aims ostensibly being centred on bringing about greater fairness, it has subsequently been proposed that an ulterior motive was present, aimed 'at fostering transparency about commercial activities in foreign countries' (Seay, 2012). Notwithstanding, this bill has been one of the more significant events in bringing about an end to the industry around conflict minerals, its insertion into a field of ravenous demand for raw materials rendering limited potential for any success. In a comparable move actioned in December 2021, the US government's 'Competition and Innovation' legislation introduced a de-facto ban on the import of micro-chips manufactured in China Xinjiang province, citing concerns about the plight of factory workers, forced to work in inadequate conditions.

As with any other natural resource industry, supplies of each of the materials used in manufacture are finite, rendering questions regarding the sustainability of such practices as pertinent. However, in this context it seems more appropriate to re-define the use of the term sustainability as an emphasiser of concerns relating to the human cost among local populations rather than in a wider ecological sense. As has been expressed critically 'the Anthropocene as a politically infused geology and scientific/popular discourse is just now noticing the extinction it has chosen to continually overlook in the making of its modernity and freedom' (Yusoff, 2018, p.12). Some of the consequences of these mining industries include the abandonment of agricultural practices and mass migration. The result of an economic system which continues to take advantage of inherent inequalities which were established during the time of colonialism, these circumstances cannot be thought to be sustainable. The geological framework behind the ongoing drive towards decarbonisation which has for example resulted in a surge in demand for cobalt in recent years for use in the manufacture of batteries has been referred to as 'an inhuman proximity organized by historical geographies of extraction, grammars of geology, imperial global geographies, and contemporary environmental racism' (Yusoff, 2018, p.11).

As mentioned in earlier chapters of this text, one company who have made it their business to construct 'ethical' devices is Netherlands' based manufacturer 'Fairphone', whose products are designed with replaceable components. The Fairphone project has been expressed as 'a key example in the activism surrounding digital materialism' (Wan, 2019). A recent review of the Fairphone 4 product which was released in 2021 describe that it is ethically manufactured using sustainable materials and that it is truly repairable and solidly built. On the downside, it is said to have average performance, be more chunky than its competitors, more expensive for the specs with an average camera, weaker wifi/mobile signal and there's no headphone socket (Gibbs, 2021). Another manufacturer who has recently marketed itself as more ethical than its competitors when it comes to the generation of e-waste is 'Framework', who state on their website that 'consumer electronics

is broken and that ‘we need to improve recyclability, but the biggest impact we can make is generating less waste to begin with by making our products last longer’ (Framework, 2022).

Meanwhile a number of manufacturers of telecommunications technology as well as providers of online services have now surpassed a market value of one trillion US dollars for the first time in history. Companies such as Apple, Samsung, Huawei, Tesla, Meta, Amazon and Google’s parent company Alphabet are now all part of this club. Yet there still seems to be little to no knowledge or acknowledgement on the part of these firms of the trade in physical resources upon which their businesses are contingent. Corporate responsibility has largely been elusive thus far (Sutherland, 2016). The business partnership between military and private companies, in which private companies assist in exploiting, transporting and marketing natural resources from DRC, has been described as a form ‘military commercialism’, within which ‘the maintenance of insecurity has become a primary source of enrichment’ and strategy (Taka, 2011, p.33). The relationship between the profits of electronics capital and what has been termed ‘super-exploitation’ in the DRC has been described as ‘almost linear’ (Dowling, 2020, p.13).

The staggered and incremental release of products onto the market has largely been at the behest of maximising profitability above all else (Chun, 2016). Yet in relation to factors around sustainability, it has generally taken the industry a long time to make any improvements in designing features of hardware which can be replaced rather than the requirement for a whole new device to be purchased. Marshall McLuhan’s 1967 analogy in relation to update culture that ‘we look at the present through a rear-view mirror, we march backwards into the future’, has been recontextualised in relation the industry of digital minerals whereby ‘origin stories bury as much as they reveal about material relations and their genealogies’ (Yusoff, 2018, p.65).

EPILOGUE

I would like to conclude this thesis by presenting a series of 6 images which were created as a response to the evaluation I received during my viva assessment in April 2022. Although a variety of media forms such as documentaries and radio reports have been fed into this period of research, the methodology has largely been centred on literary sources. Thus, the intention behind the creation of these images is to offer an alternative angle or dimension in the representation of some of the key themes herein.

Consistent with the application of assemblage theory and its integral role within this work, these artworks are comprised of several different images sourced from within the bibliography which have been superimposed on top of each other to form a new image. The juxtaposition of the human and the organic with the technological, the scientific and the monopolistic is one of the key frames through which this creative process has taken place.

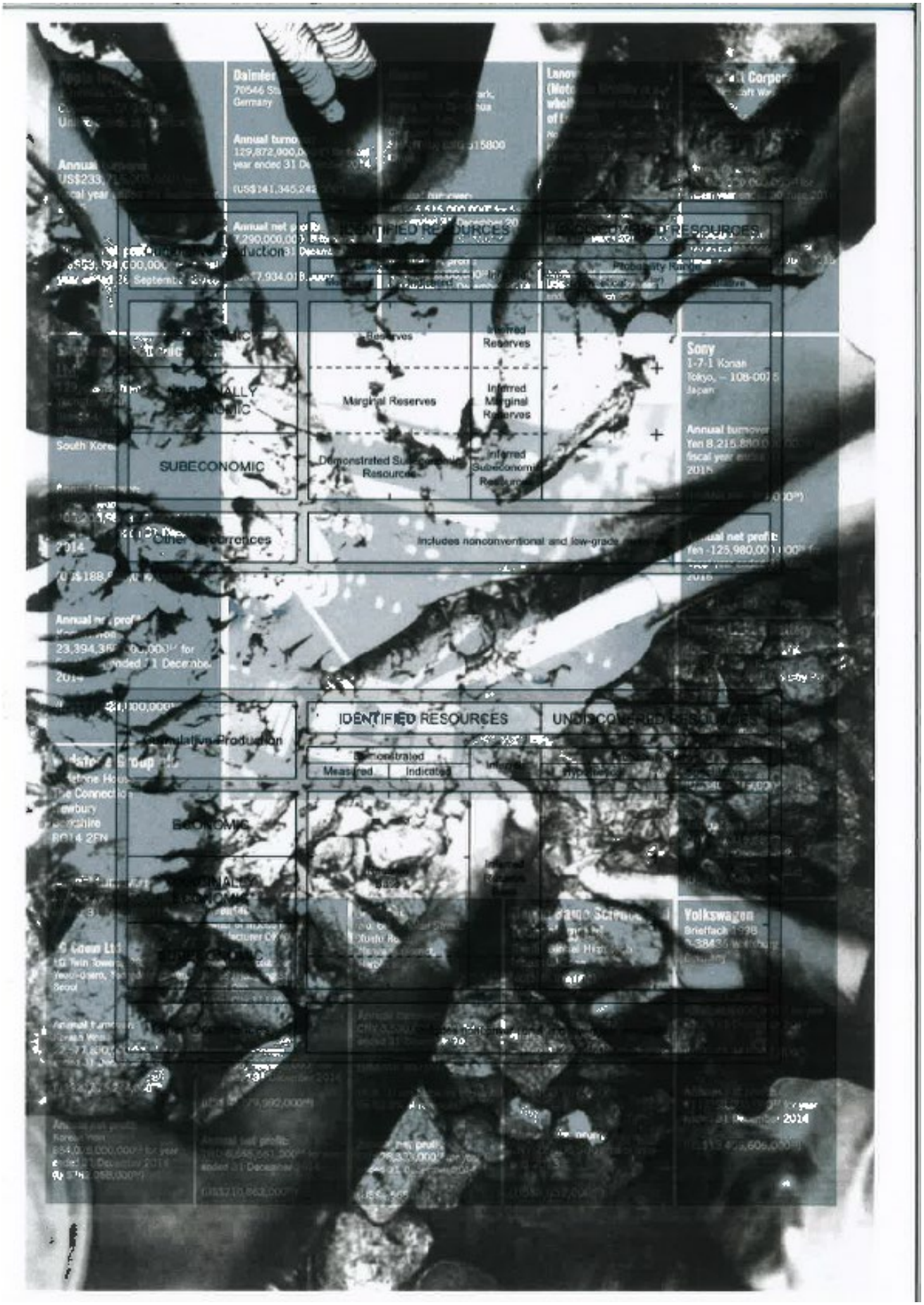
Concurrently, central to this project has been a representation of the journey of matter from the ground, through the hands of mine workers, through the refinement process, the

manufacture of components which later become devices which are both consumed and facilitate consumption, followed by a process of obsolescence. A representation of the movement among such supply chains in the form of a music video can also be accessed via the following link: https://www.youtube.com/watch?v=wdlvnJCGGtE .

Techniques of superimposition and layering in the making of the following images are meant to exemplify these stages and more particularly the way in which participants who are disparately separated by geography and out of sight from each other are somehow part of a wider whole. Resultant rhizomatic networks of communication facilitated by the physical manifestation of media devices may amount to the 'emergent properties' as referred to prevailingly in the theory of assemblages.

Other themes represented in these images include the child labour associated with the mining of digital minerals as well as the update culture behind the staggered and incremental release of telecommunications products and the conditioning of participants. The almost unfathomable scale of loss of life in Democratic Republic of Congo associated with these industries is also illustrated.

The first two images are of portrait orientation, with the third onwards being landscape.


Daimler
Germany
Sony
1-7-1 Konan
Tokyo, – 108-007
Japan
Annual turnover
Yen 8,215,880
fiscal year
2014
Annual net profit
Yen -125,980,00
Marginal Reserves
Inferred Marginal Reserves
SUBECONOMIC
Includes nonconventional and low-grade
IDENTIFIED RESOURCES
Measured
Indicated
ECONOMIC
Volkswagen
Brieffach
2014


120,000
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80,000
60,000
40,000
20,000
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Effects
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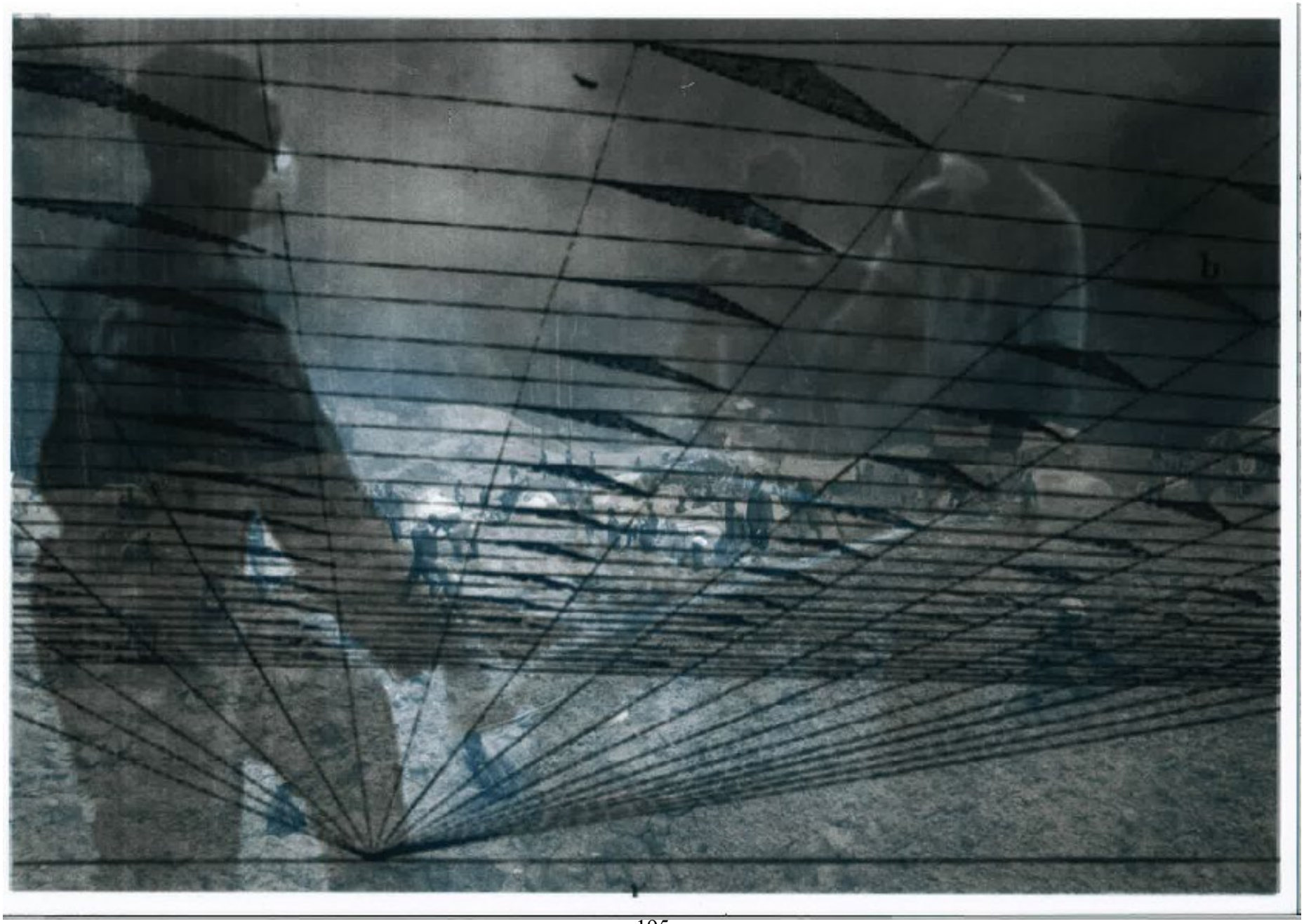
Reagents
Other Onsite
TCRC+Shipment
Royalty
11%
12%
25%
19%
31%




Information source
Transmitter
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Received signal
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Message
Noise source
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CRISIS
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ALS SUPPLY AFRICA LTD
New media are wonderfully
New media is
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WOLFRAM
new media is, at its best, wonderfully


ICI REPOSENT LES

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