Applying and assessing free market environmentalism to the Democratic Republic of Congo's coltan resources: Challenges and possibilities

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Abstract

Coltan is the commonly used term for tantalum, a metal used in electronics, when sourced from the Democratic Republic of the Congo (DRC). This article considers that a “resource curse,” where a resource-rich country paradoxically experiences low social and economic development, is occurring in the DRC with respect to this mineral. The school of economic thought known as free market environmentalism broadly prescribes free markets, individual property rights, and common-law liability as the incentives to reduce environmental problems. While it is a less-common and sometimes controversial perspective on solving environmental problems, an analysis of a free market environmentalist perspective of coltan mining in the DRC provides alternative perspectives on solving a “resource curse,” such as effective property rights as put forward by Moriss (2009). Considering the practicality of implementing free market environmentalist principles in a war-torn country with weak governance, this article theorizes that the Congolese government could respond to the recent Congo Conflict Minerals Act within the American Dodd-Frank Act (2010) by implementing licenses to mine coltan resources that closely resemble private property rights, drawing on Pearse (1988), in areas of the DRC less affected by conflict.

Keywords: Democratic Republic of Congo; coltan; tantalum; mining; free market environmentalism; property rights (privatization of)

Introduction

The growth of the coltan mining industry in the Democratic Republic of the Congo (DRC) over the past two decades has rapidly expanded amidst social conflict. Austesserre (2008) describes widespread clashes between Congolese rebel groups, militias, and foreign troops resulting in 3.3 million dead Congolese. As a result of the Congolese war and subsequent crisis, the economic, political, and social structures in the country have collapsed. This article focuses on coltan extraction in the DRC in the context of its instability and conflict. **Figure 1** provides a map of the DRC, highlighting the coltan-producing regions discussed in this article. Our purpose is to consider the environmental, social, and biophysical impacts of the coltan mining to alleviate these issues. We present evidence to indicate that methods of coltan mining are socially and environmentally unsustainable, contributing to the “resource curse” afflicting the DRC. Thus, through analysing the free market

environmentalist perspective on coltan, we propose that improved property rights in low-conflict areas would provide incentive for more sustainable coltan mining forms.

Contextualizing Coltan in the DRC

What is coltan?

The substance coltan, a term specific to the DRC, is known as tantalum in the world market. Coltan ore is a combination of two minerals referred to as columbite-tantalite and it is mined through open pit, small-scale, artisanal mines. The valuable element in coltan ore is the tantalum, which is extracted through refining. Tantalum is used to make circuit board capacitors for use in cell phones, computers, and other electronics.

Figure 1. Map of the DRC and coltan-producing regions. The majority of coltan mining occurs in the Eastern provinces of North (Nord) and South (Sud) Kivu. Virunga National Park is located near Goma in North Kivu Province. Reproduced with permission from USAID (2012).

Tantalum is valued for its resistance to corrosion and heat, and its superior electrical conductivity. Hayes and Burge (2003) describe that the content of tantalum pentoxide (Ta_2O_5) in mined coltan ore ranges from 10 to 40 percent, and the varying level of tantalum pentoxide content forms the basis of the ore's market price.

Political background of the DRC

The Democratic Republic of Congo has a long history of social conflict. Hayes and Burge (2003) note that conflict erupted between the new regime, Rwanda, and Uganda, in consequence of President Laurent Kabila's decision to force out Rwandan Military officers who helped overthrow former dictator Mobutu in 1997. The Congolese army received support from Zimbabwe, Chad, Angola, and Namibia to protect the sovereignty of the DRC against Rwanda and Uganda. In 1999, attempts at peace were made with the Lusaka Agreement. The Lusaka Agreement's goal was to facilitate discussion between various DRC groups about creating a transitional government and demobilizing and disarming forces. In 2001, President Laurent Kabila was assassinated and replaced by his son, Joseph Kabila. Carayannis (2009) states that almost all the countries involved in the war signed the Lusaka Accords in Zambia. Despite this, the accord was unsuccessful due to the uncooperativeness of President Laurent Kabila.

Presently, the DRC's conflict remains unresolved. Despite an official end of violence in 2002, the allowance of a transition period for the central government, and democratic elections in 2006, the reconstruction of the state remains incomplete (Tull 2010). There is little reason to believe that under President Joseph Kabila, the government has the ability to lead the state reconstruction process. According to Beswick (2009), in 2006, the first multiparty democratic elections were held in the DRC in more than 40 years. Beswick (2009) asserts the election's importance because it provided practical and symbolic functions. The people of the Democratic Republic of Congo hoped the elections would end the country's turbulent history and regional conflicts involving numerous rebel movements and eight African states. However, stability and conflict resolution is restricted by the country's natural resource abundance.

McFerson (2009) notes that the DRC continues to be one of the most corrupt countries in Africa due to the country's immense economic resources, poor governance, and violent history. Montague (2002) states that international competition for scarce resources such as coltan is a leading factor in the state's instability and perpetuation of war in the DRC. Montague (2002) also notes that the rebel movements leading the war are for the most part motivated by economic rather than political aims. Providing that rebel movements continue to gain from establishing profitable commercial relationships with international corporations, the war over resources will continue. Therefore, coltan mining in its present form undermines efforts to democratize the DRC and reconstruct the groundwork of a civil society.

Economic and Social Context of Coltan Mining

Economic context and market trends

Much of the activism surrounding coltan production has propagated a myth that 80 percent of the world's supply of tantalum is found within the Congo and neighboring countries, which is incorrect (Nest 2011). The British Geological Survey (2011) estimates that this number is closer to 9 percent for the DRC. In contrast, 40 percent of the world supply is estimated to be in Brazil, and 21 percent in Australia. Australia was the world's largest producer until the 2008 financial crisis, when its largest tantalum mine was closed temporarily. In **Figure 2**, taken from the British Geological Survey (2011), the shift to increased African tantalum production is visible in 2009 following the financial crisis. African sources now represent the majority of the global tantalum production. Total global production of tantalum was 2000 tonnes at its peak in 2001, and was approximately 900 tonnes in 2009 following the financial crisis (British Geological Survey 2011). Using US Geological Survey (2010) price data, an estimated \$66 million worth of tantalum was produced in 2009, compared to about \$1.5 billion in 2001. In 2009, the DRC produced an estimated \$5.9 million of this total value.

Figure 2. Global tantalum production (1997-2009). The graph shows the percentage of global tantalum production against the amount of tantalum produced by each major tantalum-producing country per year. *Reproduced with permission from British Geological Survey (2011).*

Figure 3. World tantalum prices (1964-2010). The graph shows price trends in global tantalum markets in constant US dollars (1998). *Reproduced with permission from the US Geological Survey (2011).*

The actual revenue to the DRC is unknown, as it has been difficult to gather accurate data in this region (Nest 2011).

World tantalum markets operate on long-term forward contracts between buyers and sellers in contrast to localized coltan trading in the Congo, which as Nest (2011) describes, operate on the spot market where coltan is traded and delivered immediately. Artisanal miners that sell raw coltan ore to “middle men” are usually unaware of its tantalite percentage content, and the spot price can fluctuate daily. This leaves small-scale operations vulnerable to be taken advantage of by coltan purchasers, because they may not

receive full information regarding the true market price. According to an International Peace Information Service report (2010), the average price paid to miners on the local spot market in mines in the Northern Katanga province was USD \$27/kg in 2010, compared to the world price of approximately USD \$111/kg USD in that same year.

Figure 3 shows two spikes in world tantalum prices. The most recent spike in 2000 had a significant impact on the DRC's economy. Referring to **Figure 3**, a large spike in the world tantalum price is visible coinciding with the war in the DRC. Nest (2011) describes the popular misconception that this spike was caused by a shortage of tantalum. The shortage of tantalum argument is largely inaccurate because the DRC had become a crucial source of tantalum in 2000 due to significantly increased demand for electronics containing tantalite. Nest (2011) states that the increasing demand for coltan coinciding with conflict forced many groups to engage in resource rent-seeking behaviour, which occurs when economic profits are extracted from resources in an exploitative way. Nest (2011) also argues that the surplus of coltan from the DRC in 2000 contributed to the sudden price drop in 2001. The price spike, due to increased global demand between 1977 and 1980 (as seen in **Figure 3**), did not have the same impact on the DRC because property rights at the time were more secure and coltan mining was only a by-product of the state-operated tin mines in Kivu province (Nest 2011). Though the price declined in the 2008 recession, it improved by 2010 and currently, tantalum world prices are once again on the rise. This is in part because of the influence of the Congo Conflict Minerals Provision of the 2010 Dodd-Frank Act, discussed later in this article.

International aid and intervention

Many countries have made attempts to stop the conflict in the DRC and alleviate its negative impacts through foreign aid. In 1999, the United Nations passed Resolution 1279 that initiated the United Nations Organization Mission in the DRC. It mandated an international attempt to reconcile social conflicts through peacekeeping missions and rebuilding political institutions (United Nations Security Council Resolution 1279, 1999). Between 1999 and 2010, the United Nations Organization Mission in the DRC cost over \$8.73 billion (United Nations, 2011).

The International Monetary Fund and World Bank (2010) have provided over \$12.3 billion in debt relief to the DRC, cutting the country's debt by 80 percent, in an attempt to restructure the country's economy. The DRC also received over \$735 million from USAID between 2008 and 2010 (USAID 2011). Despite internal and external efforts to remedy the DRC's conflict, Kodi (2007) notes a legacy of international aid money being mismanaged due to corruption. **Table 1** describes the background and motivations of many of these different agents and stakeholders involved in the coltan trade. So far, many of their political motives appear to be irreconcilable in the context of the current political framework.

Figure 4. The Human Development Index (HDI) of the DRC compared to that of the world (1980-2011). The HDI, often considered to be a more comprehensive indicator of economic wellbeing than Gross Domestic Product (GDP) includes per capita income (Gross National Income), life expectancy, and education rates. The disparity between the Congo and the majority of the world is visible in this graph. *Reproduced with permission from UNDP (2011).*

Social trends: The human development index and gender equity

The United Nation's Development Programme's Human Development Index (HDI) ranks countries based on their life expectancy at birth, education, living standards, and gross national income. The DRC has extremely low human development compared with the world average, which can be seen in **Figure 4**. The DRC ranks 187th out of 187 reported national Human Development Index values (United Nations Development Program, 2011). Mazalto (2009) notes that the lowest development index scores in the DRC occur around mining areas. The Gender Inequality Index of the DRC also ranks poorly.¹ Abuses against women through sexualized violence as a war tactic in the DRC are well known, but the coltan industry's gendered socio-economic impacts are less discussed. Nest (2011) states that the benefits from coltan production accrues more to men than women, and coltan mining camps increase the demand for prostitution, which is usually paid for in coltan ore. Nest (2011) argues that this partially contributes to lower living standards due to the spread of sexually transmitted diseases and related health impacts.

Biophysical Impacts

Artisanal mining: Environmental degradation and human health impacts

Mazalto (2009) describes the effects that artisanal open-pit mining can have on agricultural lands, such as water pollution and erosion. Where industrial mining has shifted to artisanal mines, some agricultural lands have grown sterile because of the pollutants from open-pit. The environmental degradation (water pollution, soil erosion, and the consumption of endangered species) caused by artisanal mining around Kahuzi-Biega National Park in South Kivu increased dramatically as the prices soared from 2000-2002 (see **Figure 3** for price trends). In addition to their drain on the local ecosystem for sustenance purposes, Nest (2011) asserts that these artisanal miners have little to no geological education and employ the most primitive and environmentally unsustainable means of coltan extraction. These methods result in stream degradation and environmental contamination from mining by-products.

However, it is not only the biophysical health of the local ecology that is at risk; the health of artisanal coltan miners is also adversely affected. Artisanal mining techniques place miners in close proximity to ore, and require sifting through ore by hand. A study by Mustapha (2007) shows that many miners have been exposed to harmful levels of naturally occurring radioactive material. Radionuclides such as radon, uranium, thorium and potassium are naturally present in coltan ore and can result in adverse health effects.

Table 1. DRC coltan stakeholders and their national origins and interests. *Reproduced with permission from Moyroud and Katunga (2002).*

DRC Coltan Stakeholders		
Category of Actors	Identity	Interests
Militia/Armed forces	Congolese rebels, armed forces of Rwanda and Uganda	<ul style="list-style-type: none"> ▪ Exportation of internal crisis ▪ State entrepreneurship ▪ Finance military campaigns and personal gain for high-ranking politicians and officers ▪ Serve the interest of multinational companies ▪ Coercive and dissuasive force for easy exploitation of coltan other minerals ▪ Protection of the mine zones against other interest groups ▪ Political and economic survival
Local/regional business community	Burundian, Rwandan, Ugandan, and Congolese	<ul style="list-style-type: none"> ▪ Earning a living ▪ Self-enrichment ▪ Evading taxes
Local communities in the mine zone	Coltan diggers and other local people	<ul style="list-style-type: none"> ▪ Earning a living ▪ Reclaiming their land
Other (international business, airlines, arms merchants, etc.)	American, Canadian, Belgian, German, Kazakhstan	<ul style="list-style-type: none"> ▪ Lucrative deals in the absence of government apparatus ▪ Access to strategic minerals to remain competitive ▪ Maintaining a presence in both rebel and government sides for future deals

Table 2. Distribution of coltan profits in the DRC and internationally (2002). It is important to note that 11 percent of the DRC's internal revenue from coltan is directed to armed groups involved in perpetuating conflict. *Reproduced with permission from Nest (2011).*

Distribution of Coltan Profits (2002)		
Actors in the supply chain	In the DRC	Globally
Team of creuseurs	17	2
Chief of mine	10	1
Petites négociants	10	1
Grosnégociants	13	2
Comptoir	10	1
Taxes to RCD-Goma	7	1
Other licenses and fees	22	3
Armed groups	11	1
Revenue in the DRC	100%	12%
Minerals Brokerage firm		14
Processor		27
Capacitor manufacturer		46
Global Revenue		100%

Coltan mining's impact on endangered species

Conflict in the DRC is unique because war has been sustained for two decades in a highly populated and ecologically sensitive region. Increasing coltan-mining camps have had a “massive impact on local wildlife through commercial hunting for food, including the wholesale killing of endangered species such as Grauer’s gorilla, which now faces extinction” (Hayes and Burge 2003, p 11). The local fauna of the DRC's jungles, commonly referred to as “bushmeat,” are the main food source for many people. Nest (2011) shows that exploitation of this food source has been so severe that between 1999 and 2001, residents had gone from eating large animals such as antelope, buffalo, and elephant to tortoises, small birds, and other progressively smaller game in order to find adequate sustenance. Coltan mining camps promote living in frontier environments where hunting local game for bushmeat is a necessity.

Coltan's National and International Governing Institutions and Policies

The Congolese Constitution of 2005 divides powers between the federal government (otherwise known as The Central Authority) and the provincial governments. Under Constitution Article 202, Section 36f, laws concerning mines and minerals fall under the jurisdiction of the Central Authority. Under Article 3 of the Congolese Mining Code (2002), “deposits of minerals are the exclusive, inalienable, and imprescriptible property of the state.” Extraction and ownership rights of mineral deposits are leased to private operators. Congolese legislation establishes a framework for the protection of coltan mining from devastating social and environmental exploitation, but in reality this framework is often unenforceable (Mazalto 2009). Mazalto (2009) also argues that even though the 2002 Mining Act mentions small-scale mines, there is little policy framework for this sort of production. The competing policy demands of different stakeholders, such as the international community, charitable organizations, and DRC militia has created irreconcilable policy in which coltan miners operate. **Table 1** provides different coltan stakeholder’s perspectives, and how they are irreconcilable in the current framework. Recently, international actors have grown concerned with sourcing tantalum from areas of conflict. In response, the United States has attempted to limit support for coltan that funds conflict through the Congo Conflict Minerals Act and Section 1502 in the Dodd-Frank Act (Government of the United States 2010). The provisions of this act require that American companies disclose the original source of tantalum in products they sell. The Dodd-Frank Act also requires manufacturers to perform due diligence in determining that the origin of the minerals they purchase is conflict-free (Government of the United States 2010).

Coltan's Challenges, Issues, and Controversies*Involuntary exchanges in artisanal mining*

Miners and civilians have incurred much of the human costs. In her report to the School of Advanced International Studies, Montague (2002) describes the intricate interplay between international mining companies and the invading forces from Uganda and Rwanda in 1998. The invasion effectively usurped the Kibila regime’s sovereignty over the coltan-rich and highly unstable North and South Kivu provinces, situated at the Eastern borders with Uganda and Rwanda. Noury (2010) reports that instability in these regions has had a negative impact on the economic wellbeing of local miners who most often operate small-scale “artisanal” mines. In many cases, Noury reports rebel soldiers arriving at the homes of those believed to have sold the mineral and confiscating their earnings. Also, Delawala (2010) reports the DRC is losing a significant tax revenue on coltan being smuggled into Rwanda and exported.

Weak government institutions

There is a dichotomy between the actual practice of coltan mining in the DRC and the idealized framework for extraction set out by governing institutions, such as the DRC’s Constitution Article 202, Section 36f) and the Congolese Mining Code (2002). The United Kingdom’s All Party Parliamentary Group (2002) reports that extensive political and military networks are heavily involved in widespread fraudulent and military exploitation in the DRC. As a result of weak government, the enforcement of private and state property rights in these regions has been ineffective. Vick (2001) reports military leaders illegally siphoning coltan away from regulated channels for sale on the black market in order to fund military and political campaigns. **Table 2**, the distribution of coltan profits, shows that at least 11 percent of the revenue generated within the DRC is received by armed groups.

Sinding (2005) observes that the majority of artisanal mining activity occurs illegally, because it ignores existing property rights, environmental regulations, and taxation systems. Since coltan extraction logically requires some form of protection, Sinding suggests that artisanal coltan miners are forming alliances with the national military and militia groups. Mazalto (2009) identifies that these protection groups are engaged in rent-seeking behavior, such as illegally taxing artisanal miners in a protection racket to fund their operations. There is an incentive for those paying the protection tax in order to mine coltan on land controlled by militants, because they have access to income and receive some form of protection. This mixture of corruption, industry, and politics hinder those who wish to develop formal, large-scale coltan extraction; this is supported by the DRC’s low ranking on the 2012 International Monetary Fund and World Bank’s Ease of Doing Business report (2012).

The DRC ranks 178th out of 183 countries in 2012. In terms of the ease of registering property, the DRC ranks 113th out of 183. In contrast, neighboring Rwanda, where coltan is often smuggled for international export, ranked 45th for overall ease of doing business.

Challenges to the Dodd-Frank Act and Congo Conflict Minerals Act

Determining coltan ore's precise origin is very difficult, and no recognized framework has emerged to document a coltan ore's geographic source. Aronson (2011) reports that the demanding process involved with securing conflict-free coltan supply chains has created the incentive for firms to bypass the DRC's coltan entirely, therefore creating a *de facto* embargo. As a result, legitimate conflict-free coltan providers in South Kivu DRC have inadvertently been penalized (Aronson 2011). This Dodd-Frank Act provision also has the potential to unwittingly benefit those willing to smuggle conflict coltan to areas where its sale will not be scrutinized. Firger (2010) argues that disclosure-based efforts contribute to misaligned incentives such as these. These will occur because, while the Congo Conflict Minerals Act requires that the State Department and NGOs must publish guidelines for companies for due diligence in their suppliers, there are no substantial punitive responses for companies that do not. If punitive measures could be effectively developed, it may increase incentives to ensure disclosure, contributing to the possibility of more formal coltan mine development in the DRC (Firger 2010).

"Resource curse": A diagnosis for social, economic, and environmental change

The "resource curse" refers to the paradoxical relationship in countries like the DRC that are resource-rich but remain socially, economically, and politically unstable or underdeveloped. Firger (2010) argues that the resource curse is caused by the complex interaction of multiple political and institutional failures that increase the likelihood of corrupt actors in commanding resource rents (economic profits made on natural resources). Ross (1999) considers that the state's failure to enforce property rights readily contributes to the lack of development in a resource-rich country. Resource dependence and poor economic conditions are exacerbated by the poor enforcement of property rights. Violent groups end up profiting from the lack of property rights enforcement, as occurs in the DRC's coltan industry. Ross (1999) states, "the rise of resource industries indirectly leads to further destabilization of property rights and hence the decline of non-resource industry" (p 321). In the DRC, artisanal coltan mining grew in popularity during the war, a period of social and economic instability. As Matti (2010) notes, this was in part because more long-term investments such as agriculture, which provide more long-term stability, were not viable in times of war. The DRC, with low development indicators and high economic vulnerability, is

experiencing the complex challenges that cause this "resource curse" because of conflict, particularly in the coltan industry. There is no simple solution to the problems faced in the DRC, but the following sections consider steps towards reducing the many challenges based on theoretical economic analysis.

Free Market Environmentalist Perspective

The free market environmentalist perspective is a critical response to the commonly held perception that environmental problems stem from market failures that require government intervention for correction. This intervention occurs through regulations and the government's "collective" ownership of resources, such as the DRC's state ownership of sub-surface minerals. Free market environmentalism proposes an alternative view to this resource allocation framework. Wolf (1979) advanced the concept of "non-market failures" to describe the comparable flaws in market and non-market systems, providing a critical assessment of the justifications for government intervention. Extending this analysis to the DRC, the "non-market failure" of the state ownership of resources, both during the Mobutu dictatorship and its successors, are evident. Free market environmentalists support an unhindered free market as the most effective method for allocating resources and reducing environmental impacts, generally holding that the free market has fewer failures than the planned non-market approach. This belief is founded by Hayek's (1945) argument that attempting to find the best uses for resources "is a problem of the utilization of knowledge not given to anyone in its entirety" (p 520). There exists a level of subjective knowledge that does not reveal itself prior to an actual market exchange and the price is the *only* way in which this subjective knowledge can be transmitted and therefore resource allocation can never be accurately planned. Thus, Hayek (1945) notes that although the free market is imperfect, it is the only functional system for resource exchange because of this "knowledge problem." This perspective shows that the "resource curse" in the DRC has been exacerbated by non-market failures in the corrupt central government, and warring militant groups controlling state-owned mineral resources. It can be interpreted as an extreme manifestation of perverse incentive structures in non-markets. Free market environmentalism provides three major prescriptions for effective free markets that offer tenable solutions to the social and environmental problems relating to natural resources.

Free market environmentalists Andersen and Leal (2010) emphasize the use of property rights, voluntary exchange, and common law liability as mechanisms to promote the function of the free market. Andersen and Leal (2010) propose market mechanisms unhindered by government intervention and complemented with comprehensive property rights as the best way to govern natural resources and prevent

environmental degradation. Andersen and Leal's (2010) approach to property rights under free market environmentalism contradicts the current approach of the DRC government, which has legal ownership of all sub-surface minerals. As a solution, Andersen and Leal (2010) prescribe that the initial ownership rights of subsurface minerals should be to the deed holders of a property as defined by geographic boundaries, and subsequently to those who consensually extract and trade them. Under the current regime in the DRC, artisanal miners usually mine on land of which they do not have legal claim. As such, there is little incentive to preserve the aboveground ecological functions of the mine sites, such as agricultural production. The free market approach of entitling landholders to the sub-surface minerals incentivizes the owner to maintain the integrity of the land in order to maximize profit. For example, artisanal miners' subsistence deforestation for firewood ignores timber's higher value in other industries like construction or manufacturing. The assurance of long term logging viability through effective property rights, in order to maximize profits, would be an incentive for landowners to extract coltan with the least detrimental effect on forest ecosystems.

Morriss (2009) argues that state ownership of natural resources invites corruption, the derailment of democratic processes, and the perpetuation of the "resource curse." Morriss (2009) proposes that it is possible to remedy this problem through effective property rights. As an example of this possibility, McFerson (2009) describes Botswana's mining sector as an analogous environment to the DRC with the exception of strong property rights contributing to the country's development. Botswana's comprehensive natural resource property rights provide a real-world contrast to the DRC's state-centric ownership of coltan, whereby Botswana has allowed good governance and resource abundance to sufficiently coexist and hence has successfully avoided its own "resource curse."

Free market environmentalism advocates for the voluntary exchange of goods and services (Andersen and Leal 2010). The artisanal coltan mining outside the government's knowledge, and without license, is illegal in the DRC. Therefore, under the current state ownership regime, the government is not voluntarily exchanging coltan to buyers. A free market environmentalist would choose to promote voluntary exchange through private ownership of resources rather than state ownership. Schlager and Ostrom (1992) explain that private ownership, and the accompanying bundle of rights, expects rightful owners to engage in consensual negotiations to trade their resources for their maximum benefit.

A free market environmentalist perspective also suggests the expanded use of common law liability to enforce property rights and voluntary exchange. Expanded and comprehensive property rights and voluntary exchange require a judiciary with the strength to uphold them. Common law liability incentivizes actors to not infringe on other actors' benefits, since lawsuits may be brought against them for reparation. Quasi-political militia groups that

currently usurp coltan through illegitimate means could be sued for damages under free market environmentalist ideals of expanded common law liability and tort law. Illegitimate means include labour coercion, trespassing, illegal harvesting, and committing violent acts in order to obtain coltan.

Evaluation of the Free Market Environmentalist Perspective

Applying free market environmentalist tenets within the DRC's coltan sector theoretically would alleviate several challenges identified in this article, but implementing free market environmentalism's property rights, voluntary exchanges, and common-law liability faces practical challenges in the DRC.

Improved property rights have been proposed as one solution to the "resource curse." Morriss (2009) argues that rent seeking is most likely to occur where governments have the most control over the resources, as occurred in the DRC between 1965 and 1997 during the Mobutu regime. The government's capacity to implement and enforce property rights is now further hindered because the government must contend with groups that illegally benefit from state-owned coltan reserves, as well as deal with corruption within its own structure. Morriss (2009) proposes several solutions to resource curse problems arising from government-owned land. In areas where there is explicitly publicly held land, Morriss advocates for free access, which grants title to whoever locates an unclaimed resource. This type of regime could apply to coltan resources in the DRC's Virunga national parks. However, free access is of concern in the Congo because of the military groups. Militants already have expropriated private lands for coltan mining and hence are not acknowledging any existing property rights. It is arguable that is not in the best interest for them to claim legitimacy of these rights under free access. Morriss's desired solution for the tragedy of the commons and the "resource curse" is a difficult prescription in this context.

The free market environmentalist emphasis on property rights may face higher costs in the coltan industry than it does in other locations. Morriss (2009) states, "the economic analysis of property rights suggests that property rights are always imperfectly specified because specification is costly. People will invest in more complete specification only to the extent that the cost of doing so is at least offset by the resulting benefits" (p 87). In a conflict zone, the benefits of long-term investments are difficult to reap. In addition, Hill (1997) proposes that the transaction costs to invest and enforce specific property rights increase based on the cultural factors of large, non-homogenous groups. The local context is particularly important in the case of the DRC due to its complex social issues and political history.

Leal (1998) draws on Ostrom's considerations for resource management in a local context, which describes that there must be sanctions against those who violate the rules.

The free market environmentalist ideal of voluntary exchange must be facilitated by a judicial system willing to uphold and enforce consensual exchange between individuals. In order for a free market to exist, an individual's liberty to trade coltan must be protected from coercion. According to Leal (1998), when collectively owned resources are opened to formalize property rights, who will get the rights is a valid concern. He thus advocates for the necessary investment in "the political process that allocates rights" (Leal 1998, p 287). Currently, the DRC does not have the policing infrastructure or court systems to adequately protect coltan shareholders from coercive exchange. Militant groups can usurp coltan through violence, coerced labour, and extract illegal taxes. Dewala (2012) notes that, "the Rwandan army made at least \$250 million over a period of 18 months through the sale of coltan, even though no coltan is mined in Rwanda." Hill (1997) explains how external shocks on a community, a frequent occurrence in the DRC, reduce its ability to maintain effective rules. When voluntary agreements are difficult, transaction costs can be reduced by governments, which have economies of scale and coercive power. Thus, while free markets and individual property rights may be the ideal solution to environmental degradation from coltan mining, there is justification within the DRC to attempt to strengthen government institutions and ownership of minerals to the extent that they protect individuals from militant groups stealing their property and reduce the illegal coltan trade overall.

Free Markets, Property Rights, and the Rule of Law

Free markets depend on private property rights, and private property rights depend on the rule of law in order to be protected. It would not be prudent to suggest a free market approach to remedy the DRC's environmental and social problems without explaining how a free market system can contribute to the rule of law.

In essence, we are confronted with a "chicken and egg problem" as to what comes first: private property or the rule of law. Private property permits markets to function, which in turn generates the tax revenue to uphold the rule of law and protections for private property. Even the staunchest proponents of free markets and limited government recognize the need for governments to protect the rule of law. In the absence of state protection, Hay and Shleifer (1998) identify private law as a means to fill the void, but the effectiveness of this is contingent on the privatization of the mineral grounds. According to R.C. Ellickson (1993), providing a fee-simple interest maximizes an owner's interest in their land over the long term. The issue is whether this would promote security and stability. If assume that the economy of scale required for a small scale artisanal farmer to defend his deposits from armed bandits would be inefficient. A "cooperative structured" business arrangement

could remedy this. Cooperatives are described by Porter and Scully (1987) as "voluntary, closed organizations in which the decision-control and risk-bearing functions repose in the membership, and the decision management reposes in the agent (manager), who represents the principal's interests." Cooperatives could leverage their size to provide private security and cut out middlemen. The distinction between the current situation and one in which cooperatives could flourish is that there is currently no private property interest recognized in coltan ore deposits. Ideally, the recognized fee-simple interest prompts owners to secure their land in order to recognize its value.

Private security could be the first step to establishing order. Russia is used an example by Hay and Shleifer as a place with unreliable state law enforcement but effective private security. The economic interests protected by private enforcement inevitably align with the public interest because enjoying the wealth created by coltan mining is an incentive for preserving life and liberty.

Conclusions and Recommendations

The preceding article has discussed the social, political and economic complexities of the conflicts within the DRC in the context of the coltan industry. Overall, the symptoms of corrupt governments, institutional policy failures, vulnerability to tantalum price shocks, and environmental degradation support a diagnosis that a "resource curse" afflicts the DRC. In analyzing the free market environmentalist perspective's emphasis on free markets as the most effective way to allocate resources, this article has considered how property rights, voluntary exchange, and common-law liability could benefit the coltan industry in the DRC. In evaluating these ideals, there are pragmatic considerations to be made in an area suffering weak governance and internal wars over mineral resource control.

Recent international pressure to reduce the support for "conflict minerals" has lead to the Conflict Mineral provisions of the Dodd-Frank Act that require a mineral's source be disclosed. This legislation theoretically diverts the purchase of tantalum away from areas such as the DRC and towards areas where it is not fueling conflict. The Congolese government, which has failed to effectively manage and assert ownership of its mineral reserves, could respond to this new regulatory framework by implementing some free market environmentalist ideas. As companies in the United States implement the transparency regulations of the Congo Conflict Mineral Act, they arguably improve incentives throughout the supply chain to source tantalum from areas with the most effective property rights.² While the implementation of the Congo Conflict Minerals Act has a number of flaws discussed previously, it also provides an incentive to rework the policy structure surrounding coltan resources in the DRC. As Moriss (1997) describes, because fixed investments are vulnerable to expropriation by state actors in areas afflicted by a resource curse, the DRC's

policy surrounding property rights can improve to reflect this. This could be done through improving the licensing process for coltan resources.

For example, Pearse (1988) provides recommendations for Canadian resource management based on natural resource licensing schemes that more closely resemble private property rights. These recommendations consider the transferability and duration of the terms of these "rights," as well as have improved integration with other "rights" to achieve balance between competing interest groups for use. For example, better integration between "rights" for agricultural production and water pollution from potentially neighboring coltan mining could be achieved with licenses similar to private property rights. Allowing a private property system to develop would incentivize owners of the mineral rights to internalize many of the costs currently externalized on society by developing more formal mining operations. Because the extraction of natural resources is capital intensive, particularly when the external "costs" are internalized, the longer that a mining operation can expect to profit from license to a mining area, the more they will be inclined to develop formal mines. Reductions in artisanal mining would occur in this case, as would the problems caused by it. Considering that conflict and illegal mining of coltan occur primarily in the North and South Kivu provinces, implementing long-term, transferable licenses to coltan minerals in areas least affected by conflict is the beginning of a partial solution. Katanga province, also rich in coltan resources, is a low-conflict zone of the DRC. Thus, the International Peace Information Service (2002) has collected information relevant to expansion of coltan production in areas such as this that can be used by mining companies as they respond to the international pressure to reduce conflict minerals.

Endnotes

1. The Gender Equality Index compares the life expectancy, education level, and estimated income in USD between males and females.
2. Using free market environmentalist logic, where there are the most effective property rights for mineral extraction, there will be the least unresolved conflict over these resources.

References

All Party Parliamentary Group on the Great Lakes Region and Genocide Prevention. 2002. Cursed by riches: Who benefits from resource exploitation in the Democratic Republic of the Congo. Available from: http://www.savethechildren.org.uk/sites/default/files/docs/cursed_by_riches_1.pdf

- Andersen T, Donald L. 2010. Free market environmentalism. New York (NY): Palgrave Publishing. 241 p.
- Aronson D. 2011. How congress devastated Congo. Available from: http://www.nytimes.com/2011/08/08/opinion/how-congress-devastated-congo.html?_r=0
- Autesserre S. 2008. The trouble with Congo: How local disputes fuel regional conflict. *Foreign Affairs*. 87(3): 94-110.
- Beswick D. 2009. The challenge of warlordism to post-conflict state-building: The case of Laurent Nkunda in Eastern Congo. *The Round Table: The Commonwealth Journal of International Affairs*. 98(402): 333-346.
- British Geological Survey. 2011. Commodity profile: Niobium-tantalum. Available from: <https://www.bgs.ac.uk/mineralsuk/statistics/mineralProfiles.html>
- Carayannis T. 2009. The challenge of building sustainable peace in the DRC. Available from: http://www.hdcentre.org/uploads/tx_news/69DRCpaper.pdf
- The Central Authority. 2005. The constitution of the Democratic Republic of Congo. Available from: <http://www.constitutionnet.org/files/DRC%20-%20Congo%20Constitution.pdf>
- Congolese Mining Code. 2002. Law No.007/2002 of July 11, 2002 relating to the mining code. Available from: http://mines-rdc.cd/fr/documents/codeminier_eng.pdf
- Cordato RE. 1997. Market-based environmentalism and the free market. *The Independent Review*. 1(3): 371-386.
- Delawala I. 2012. What is coltan? Available from: <http://abcnews.go.com/Nightline/story?id=128631>
- Draulans D, Krunkelsven E. 2002. The impact of war on forest areas in the Democratic Republic of Congo. *Oryx: The International Journal of Conservation*. 36(1): 35-40.
- Ellickson R. 1993. Property in land. *The Yale Law Journal*. 102(6): 1315-1400.
- Firger D. 2010. Transparency and the natural resource curse: Examining the new extraterritorial information forcing rules in the Dodd-Frank Wall Street Reform Act of 2010. *Georgetown Journal of International Law*. 41: 1043-1095.

- Gondola CD. 2002. *The History of Congo*. Westport (CT): Greenwood Press. 215 p.
- Government of the United States. 2010. Dodd-Frank Wall Street Reform and Consumer Protection Act, Section 1502. Available from: <https://www.sec.gov/about/laws/wallstreetreform-cpa.pdf>
- Hay J, Schleifer A. 1998. Private enforcement of public laws: A theory of legal reform. *American Economic Review Papers and Proceedings*. 88(2): 398-403.
- Hayek FA. 1945. The use of knowledge in society. *The American Economic Review*. 35(4): 519-530.
- Hayes K, Burge R. 2003. Coltan mining in the Democratic Republic of Congo: How tantalum-using industries can commit to the reconstruction of the DRC. Available from: <http://tierra.rediris.es/coltan/coltanreport.pdf>
- International Peace Information Service. 2002. Supporting the war economy in the DRC: European companies and the coltan trade. Available from: <http://www.ipisresearch.be/download.php?id=197>
- Hill PJ. 1997. Market-based environmentalism and the free market: Substitutes or compliments? *The Independent Review*. 1(3): 387-386.
- International Monetary Fund. 2010. IMF, World Bank support \$12.3 billion debt relief for DR Congo. Available from: <http://www.imf.org/external/pubs/ft/survey/so/2010/car070110a.htm>
- Kodi M. 2007. Anti-corruption challenges in post-election Democratic Republic of Congo. Available from: <http://www.chathamhouse.org/publications/papers/view/108381>
- Mantz J. 2008. Improvisational economies: Coltan production in the Eastern Congo. *Social Anthropology*. 16(1): 34-50.
- Matti S. 2010. Resources and rent seeking in the Democratic Republic of the Congo. *Third World Quarterly*. 31(3): 401-413.
- Mazalto M. 2009. Environmental liability in the mining sector: Prospects for sustainable development in the Development in the Democratic Republic of the Congo. In Richards JP, editor. *Mining, society, and a sustainable world*. Berlin (Germany): Springer-Verlag GmbH. p. 289-320.
- McFerson HM. 2009. Governance and hyper-corruption in resource-rich African countries. *Third World Quarterly*. 30(8): 1529-1548.
- Montague D. 2002. Stolen goods: Coltan and conflict in the Democratic Republic of Congo. *School of Advanced International Studies Review*. 22(1): 103-118.
- Moriss A. 2009. Politics and property in natural resources. *Social Philosophy and Policy*. 26: 53-94.
- Moyroud C, Katunga, J. 2002. Coltan exploration in Eastern Democratic Republic of the Congo (DRC) scarcity and surfeit: The ecology of Africa's conflicts. New Muckleneuk (Pretoria): Institute for Security Studies. 388 p.
- Mustapha AO, Mbuzukongira P, Mangala MJ. 2007. Occupational radiation exposures of artisans mining columbite-tantalite in the Eastern Democratic Republic of Congo. *Journal of Radiological Protection*. 27(2): 187-195.
- Nest M. 2011. *Coltan*. Cambridge (Eng): Polity Press. 220 p.
- Noury V. 2010. The curse of coltan. *New African*. 494: 34.
- Porter PK, Scully GW. 1987. Economic efficiency in cooperatives. *Journal of Law and Economics*. 30(2): 489-512.
- Ross ML. 1999. The political economy of the resource curse. *Work Politics*. 51(2): 297-322.
- Schlager E, Ostrom E. 1992. Property-rights regimes and natural resources: A conceptual analysis. *Land Economics*. 68(3): 249-262.
- Schlüter T, Trauth MH. 2008. *Geological atlas of Africa: With notes on stratigraphy, tectonics, economic geology, geohazards, geosites and geoscientific education of each country*. Berlin (Germany): Springer-Verlag GmbH. 308 p.
- Sinding K. 2005. The dynamics of artisanal and small-scale mining reform. *Natural Resources Forum*. 29(3): 243-253.
- Spittaels S. 2010. The complexity of resource governance in a context of state fragility: An analysis of the mining sector in the Kivu Hinterlands. Available from: <http://www.ipisresearch.be/fck/file/20101202KIVUGL.pdf>
- Stoinski TS, Steklis HD, Mehlman PT. 2007. *Conservation in the 21st century: Gorillas as a case study*. New York (NY): Springer. 378 p.

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- Tull D. 2010. Troubled state-building in the DR of Congo: The challenge from the margins. *The Journal of Modern African Studies*. 48(4): 643-661.
- United Nations. 2010. MONUSCO facts and figures. Available from: <http://www.un.org/en/peacekeeping/missions/monusco/facts.shtml>
- United Nations Development Programme. 2011. Human development index value. Available from: <http://hdrstats.undp.org/en/indicators/103106.html>
- United Nations Security Council. 1999. Resolution 1279 on the situation concerning the Democratic Republic of the Congo. Available from: <http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N99/368/17/PDF/N9936817.pdf?OpenElement>
- United States Agency International Development (USAID). 2011. Democratic Republic of Congo: Fact Sheet FY 2007-2009. Washington (DC): USAID.
- United States Agency International Development (USAID). 2012. Map of the DRC. Available from: <http://www.usaid.gov/crisis/democratic-republic-of-the-congo>
- Vick K. 2001. Vital ore funds Congo's war: Combatants profit from coltan trade. Available from: <http://www.globalpolicy.org/component/content/article/181/33397.html>
- Wolf C. 1979. A theory of nonmarket failure: Framework for implementation analysis. *Journal of Law and Economics*. 22(1): 107-139.
- The World Bank. 2012. Ease of doing business report: Doing business in a more transparent world. Economy profile: Congo, Democratic Republic. Available from: <http://www.doingbusiness.org/data/exploreeconomies/congo,-rep~>