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Mismanaged Minerals:

A Network Analysis of Corruption in the Ugandan Mining Sector

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**Abstract**

Uganda borders several countries known for using conflict minerals to finance violence and terrorism. Because of this, a recent boom in Uganda mining has been accompanied by allegations of corruption, collusion, and smuggling. Recent news reports have focused on highlighting on specific companies and their ties to either Ugandan officials or regional unrest. As a network of organizations with varying degrees of connection to the governing bodies of Uganda, however, the Ugandan mining sector has not been well examined. Past research on organizational structures has focused either on the intra-organizational networks of co-workers or the inter-organization flows of money or information. Network analysis methods traditionally applied to understanding business structures or financial flows can be applied to the Ugandan mining sector to understand the network, especially in relation to the companies that have been identified in news reports as related to corruption. From this, it is possible to examine the attributes that corrupt companies share, and to examine the impact that corrupt companies have on the structure of the mining network.

**Introduction**

Uganda borders several countries known for using mineral resources to finance violence and corruption (Villaecija and Blanco). Because of this, a recent boom in mining has received international scrutiny (Monks). Although by no means a failed state in which the government controls activity internationally considered unethical or illicit, Uganda still suffers from corruption and the effects of a civil war that have left many military elite in positions of power (Lindemann). Both local and international news articles about the corruption in the mining industry focus on specific companies and their ties to Ugandan politics. These accusations range from high-level political maneuvering to low-level bribery to increase the pace of licensing. One recent report by the watchdog organization Global Witness, titled “Undermined,” presents in-depth research on several companies in Ugandan mining and their ties to corruption. The companies outlined in this report are generally doing what they are licensed to do – mine the area. It is how they acquired these mining licenses that is suspect, as many seem to have used political connections to speed up the process or be granted special dispensations on what and where they are allowed to mine (Global Witness).

**Figure 1: Uganda Mining Cadastre**

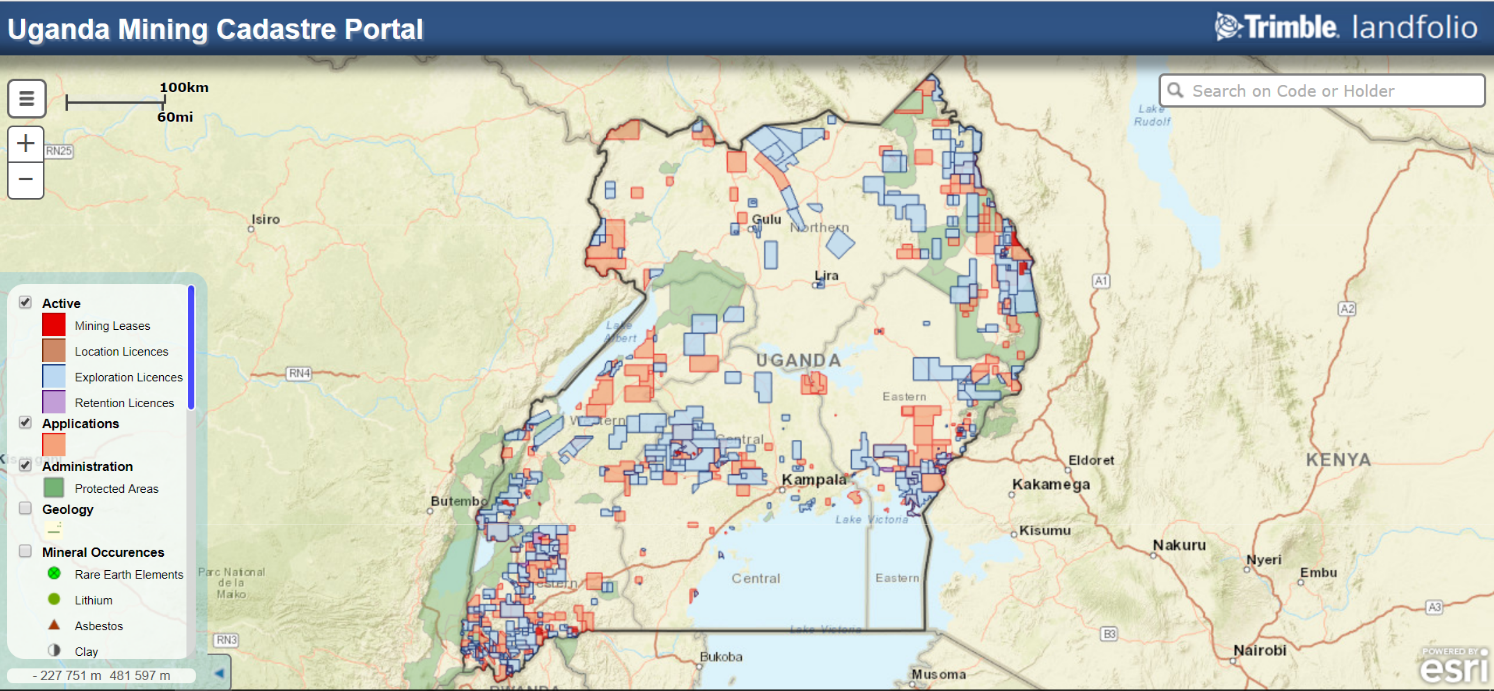


Figure 1, above, shows the mining cadastre in Uganda as of December 5, 2017 (FlexiCadastre). This snapshot in time is important and useful for investigations into specific companies or concession numbers. A network-level study of the industry, however, has not been attempted. In fact, “with a few notable exceptions very little work has been done on corrupt networks” in general because most studies of corruption tend to focus on the dyadic relationship between corrupt actors (Warburton). Although they do not trade with one another, the companies that make up Uganda’s mining sector can be considered a network through shared the attributes of concession number, address, mineral type, and general area. By looking at the mining sector as a network instead of a group of unconnected companies, it is possible to understand how the companies relate to each other, both through interlocking attributes and through their general activities. This paper will focus on two broad categories – the individual attribute network and the folded company x company network. By looking at individual attribute networks, we will be able to determine the characteristics key to the creation of the networks and examine the similarities in the companies that these characteristics tie to. By looking at folded organization x organization networks, we will be able to determine how the companies relate to each other and examine the networks around specific companies. Through both the individual attribute networks and the folded company x company networks, we try to understand the network of Ugandan mining companies, and how corruption has shaped it.

**Data Collection**

The data for this project comes from two sources. The first, the Uganda Ministry of Energy and Mineral Development, provides the companies and their information. The second, the Global Witness report “Undermined” provides the names of companies that have ties to corruption.

The Ministry of Energy and Mineral Development releases statistical abstracts every year that contain tables of companies licensed to do mineral extraction within Uganda. Online abstracts are available for the years 2011 to 2015. The abstracts for the years 2011 and 2012 are provided online by Bakara Consulting, a consulting agency based in Uganda that provides legal and database support for various countries (BarakaConsult). The abstracts for the years 2013 to 2015 are available online from the Ministry of Energy and Mineral Development website. There are two types of mining allowable mineral exploration in Uganda, through a prospecting or a non-prospecting license. A prospecting license is for exploration only; a company is not permitted to do commercial extraction of minerals on a prospecting license. A non-prospecting license allows a company to extract resources from the area, or concession, that they control. Although there have been claims that companies are using prospecting licenses to illegally extract minerals, I focused only on the non-prospecting licenses for the years 2011 to 2015. This was both because there is greater data availability (all abstracts available online contained this information, but not prospecting-only licenses) and because the nature of corruption in Uganda is less about doing illegal activity than improperly acquiring the permits to do legal activity.

Taken separately for each year, there are 5 tables of companies with non-prospecting mining licenses, leading to an aggregate table of 2683 rows. However, we are examining the company network as an aggregate of these years, not as individual years. There are 372 unique companies that held non-prospecting mining licenses in Uganda from 2011 to 2015. There are 1069 unique concession numbers, or individual parcels of land where the company is allowed to mine, during this time. It is not uncommon for a company to hold licenses for many concessions. Although reporting was not constant through the years, the contact persons, addresses, mineral type, and district of companies may be included.

To get data on which companies are engaged in unethical practices, we turn to Global Witness. Global Witness is a non-profit organization that focuses its work on exposing economic networks behind conflict, corruption, corruption, human rights abuses, and the exploitation of natural resources through undercover investigations and investigative journalism (Global Witness - About Us). In June 2017, it released a report, “Undermined,” examining levels of corruption in the Ugandan mining industry. The companies named in this report are the companies that this paper uses to understand corruption in the broader network of the mining sector. We acknowledge that many of these companies have never been formally accused of wrongdoing, but use the Global Witness report and the companies therein to gain an understanding of companies accused of corruption within the industry. There are 25 mining companies that the report mentions as having ties to corruption or high ranking political individuals. Again, the definition of “corruption” here varies from high level political maneuvering to basic bribes to local officials.

**Data Cleaning and Issues**

After collection, the primary task was organizing the statistical abstracts of the Ministry of Energy and Mineral Development into ingestible format. These abstracts come in pdf form, and much of the time spent on data processing was spent transferring the information from the various tables in the pdf to a single database. Although not difficult, this was the most time intensive part of the data collection and cleaning step. After formatting, there were still some major drawbacks with this data. The information in the abstracts is reported by the companies themselves, and then aggregated into a report by the Ministry of Energy and Mineral Development. This ministry did not, however, have the same reporting requirements over the years. This required additional cleaning, as well as an understanding of the limitations that this placed on attribute analysis. In 2015, companies were required to give information on their concession number, company type, telephone number, email, contact person, address, district, and mineral type. In 2011, by contrast, companies were simply required to provide the concession number, district of operation, and mineral type. Because we are not examining the network based on year, this was not an issue so much for companies that were included in the abstract over multiple years. In this case, it is assumed that, say, a company address for one year will remain the address for the other years unless otherwise stated. The aggregate information for that company remains the same. There are a significant number of companies, however, that are missing several attributes because they are only present in one or two year with minimal reporting requirements, or they under-reported some years. In addition, because of the self-reporting nature of the data, there were some inconsistencies in spelling or conventions. For example, many of the companies call themselves “Limited” one year, and “Ltd” another, requiring additional cleaning to ensure that companies that simply spelled their name differently or used a different abbreviation convention were counted as the same. This was occasionally difficult, as there could be many companies that have similar names in similar regions. The two companies “Rift Valley Minerals Ltd” and “Rift Valley Mines Ltd” presented a challenge, for example. In this case, because Rift Valley is a commonly mined region and it is likely that these two companies simply named themselves after the area, we determined that these companies are separate.

As is usually the case with using existing data for a network analysis, we must also keep in mind that the data was not collected with a network approach in mind. Although the data collected by the Ministry of Energy and Mineral Development is relatively thorough and provides, at least for some years, multiple attributes on which to build ties, it is still limited. Some examples of data that is not available but would be interesting to see include the exports by each of the companies, their imports (if any), their management information, and their shareholder information. Management and shareholder information could create stronger and more robust connections between the companies, than simply, say, sharing an address. Import and export data could provide an insight not just into how much these companies are gathering from their concessions, but trends into which types of companies are buying from and selling to the same places.

In terms of the data for the corrupt companies, data cleaning simply meant reading the report and extracting the names of the companies from the rest of the document. The overall task of creating a list of corrupt companies, however, poses some inherent problems. By their nature, illicit activities are meant to be hidden, and although they have done an excellent job of drawing out several companies that are linked to corruption, Global Witness is unlikely to have captured every mining company that has ties to corruption in Uganda. Because of this, there may be companies that are not listed as corrupt in our data, potentially skewing our interpretation of the results.

**Overall Network Analysis**

Our primary question was what influence the set of corrupt companies had on the mining industry as a whole. To do this, we needed to start by understanding the whole industry network. As mentioned above, there are 372 companies in the mining sector. Since “individual units exist not by themselves, but in relation to other units” in networks, it is the ties between these companies and their attributes that are most important (Powell). We examined these first through the individual attribute networks, made up of concession number, address, and contact name. In these company x attribute networks, we are particularly interested in the attributes that the companies may share, and the attributes that are bridges in the network. Generally, the contact names, telephone numbers, and email addresses were structurally similar. That is, if a name was put down as the contact, the same telephone and email address were also reported. Therefore, we focus only on the company x contact name network, instead of looking at all of them.

For the attribute networks, we were interested mostly in degree centrality. A high degree centrality is evidence that an attribute is highly connected in the network. Because we expect the mining industry to be fairly sparse when it comes to attribute networks, a high degree centrality is a good starting point to understanding the nature of corruption. In the company x contact name network, this produced the interesting results seen in Table 1 below. The name with the highest in-degree centrality was “Pravin Ghelani,” who is the contact person for eight companies. Although none of these companies have been accused of wrongdoing, “none of these companies have filled returns for their mining activities,” according to a journalist with the Uganda Radio Network (Muhumuza). A second interesting name that was brought forward by this analysis is “Muruli Muyambi,” and his associated email address, “johnmuruli@yahoo.com.” This name is listed as the contact person for four companies. Another name, “John Mary Muyambi (Jr),” is listed on two companies – one unique and another the same as “Muruli Muyambi”. John Muruli Muyambi is the former vice chairman of the Uganda Chamber of Mines and Petroleum (Mugalu). Although not originally in the Global Witness report, we added the companies associated with John Muruli Muyambi and his son to the list of corrupt companies.

**Table 1: Top 10 In-Degree Centrality in Company x Contact Name Network**

|  |  |  |  |
| --- | --- | --- | --- |
| **Rank** | **Name** | **Value** | **Unscaled** |
| 1 | Pravin Ghelani | 0.006 | 102 |
| 2 | Ranjeet Kumar Bhansali | 0.005 | 82 |
| 3 | Muruli Muyambi | 0.003 | 42 |
| 4 | Jenifer Hinton | 0.002 | 36 |
| 5 | Stan Chu | 0.002 | 35 |
| 6 | Abid Alam | 0.002 | 32 |
| 7 | John Mary Muyambi (Jr) | 0.002 | 29 |
| 8 | Mutebi David | 0.002 | 29 |
| 9 | Kyomugisha | 0.002 | 28 |
| 10 | Sabine A | 0.002 | 28 |

Another important result from this network was examining the crossover between those contact names with high in-degree centrality and the contact names for those already on the Global Witness list. For example, the contact name for the Tibet Hima Mining Company Limited, Stan Chu, appears as the contact person for six other companies. Operating within a protected area, Tibet Hima allegedly with the support of the president of Uganda, Yoweri Museveni. The Chinese company is also allegedly operating a mine without an Environment Impact Assessment, a requirement by law. This was one of the major company profiles in the report, detailing alleged political influence from the highest office impacting the mining industry. None of the other companies that Stan Chu represents are included in “Undermined,” but they are all searching for gold and base metals. Two of the companies also declared they are mining for iron ore, which, according to the Global Witness report, is illegal under current Ugandan law.

Examining the in-degree centrality of the company x address network also provided some interesting results. There are 82 companies that claim the address “PO Box 30330” as their address. However, 75 of them left “location” blank, indicating that these could be postal address boxes in different districts. The remaining seven companies specify their address as “PO Box 30330” in Kampala, Uganda. At first I thought this was a data collection issue, that the Ministry of Energy and Mineral Development supplied this address when there was none self-reported for a certain year. But the reporting of this address spans years and company types. An investigation of this address in Kampala indicates that this is the address of ABMAK Associates, a legal and consultancy firm in Kampala, Uganda (AMBAK). This firm was highlighted in the Global Witness report, as it is “run by the son of the Permanent Secretary to the Energy Ministry, Henry Kaliisa.” This firm also represents another company on the Global Witness list, Guangzhou Dong Song Energy Group Company Limited.

Another important way of examining a network is by looking at its latent groupings. Because many of the individual attribute networks were so sparse, I created a multi-modal folded network to do group analysis on. The modes of this network are company name, contact name, concession number, and address. As mentioned above, in the different modes were structurally similar, connecting to the same nodes as other attributes. We left the network unweighted rather than counting how many times a company has a link because the irregularities in reporting would create inaccurate weights. A multi-modal network, however, ensured that the aggregate of these sparse networks was studied.

The Louvain community detection algorithm found 51 groups, only a few of which had more than ten members. The most common group by far, with 157 members, was the isolate group. Because the mining industry is not inherently well-connected, it is understandable that the largest group of nodes are isolates. Another 70 members are in another, densely connected, group. Many of the corrupt companies fall into this category. A third interesting category is drawn out when we look at more of the corrupt companies, one that holds just eleven companies. Of these eleven, however, six of the companies were named in the Global Witness report. Another, “Kamuntu Investments Limited,” appears to be connected to Moses Kamuntu, who was in the report “Undermined” for buying time to speak with the president of Uganda, and for bribing officials into letting him export iron ore. Another, “Mashonga,” is represented by John Mary Muyambi (Jr) but was not discovered in the company x contact name analysis because of a spelling error in the data. That leaves three companies in this group comprised mainly of corrupt companies. The Louvain community detection algorithm works by finding unusually dense clusters of nodes, in this case companies (Blondel, Guillaume and Lamboitte). Although it is far from clear that these companies are doing any wrong, it would be interesting to investigate why only they have made it into a “corrupt” community subgroup. Unfortunately, there is no immediate reason in the network data, and further investigation is beyond the scope of this paper.

**Subgroup Network Comparison**

The companies in the Global Witness report, the “corrupt companies,” are a subset of the entire mining structure. To analyze their specific impact on the network, we compare them to another subgroup, the person-based concessions of the network. Concessions are mostly held by limited liability companies, but a handful are held by 59 individual people. The group of corrupt companies based on the Global Witness report was 25, but we added to this number based on the companies that shared attributes from the key entity analysis of addresses and contact persons. With these additions, the list of corrupt company has grown to 46 companies. Because the group of person-based concessions who own concessions is larger, and because we do not want to compare overlapping groups, we will remove the names of individual people who are also on the list of corrupt companies. This brings the individual person subgroup down to 51. In total, the subgroup of corrupt companies is 12.4% of the entire network. The subgroup of individual-based companies is 13.7% of the total. We assessed the impact of the subgroups on two folded company networks, the company x address x company and company x mineral x company networks. These networks are very different in original makeup, making them interesting examples to compare across. Figure 2, below, illustrates the networks with the subgroup nodes colored.

The primary method of comparison between these subgroups was individually removing each and measuring its impact on the folded company x company network. This provides an understanding of how robust the network is without them. In the case of corrupt companies, we are looking to see if these are the only things bringing together the mining network, or if they are simply part of a larger, interconnected system. Examining this in terms of the company x address x company network, we see a slight difference between the removal of the two subgroups. The original network had a density of 0.055. There were 182 isolates, and the maximum component has 109 companies. Because it was a sparse network, the characteristic path length was 28. After removing the corrupt organizations, the network has a density of 0.45, with 175 isolates and a maximum component of 76. After removing the person-based organization, the network has a density of 0.054, with 158 isolates and a maximum component of 94. The largest component can be explained primarily through PO Box 30330, which is listed in the original data 82 times. The 12 companies that specified their PO Box as located in Kampala were added to the list of corrupt companies. The other 70 companies, however, were left in the network, remaining a large component even when the corrupt companies are taken out. From the structures of the two subgroup networks, we can see that removing the corrupt companies removes a larger portion of this main component. This is possibly because corrupt companies are more likely to list multiple addresses, leading to a more densely connected folded network. As we remove the corrupt companies, this component becomes smaller because the remaining mining companies are otherwise independent.

**Figure 2: Company x Company Networks Colored by Attribute**

|  |  |  |
| --- | --- | --- |
|  | **Company x Address x Company** | **Company x Mineral x Company** |
| **Corrupt** |  |  |
| **Person-Based** |  |  |

This is not a phenomena unique to the company x address x company network. In the company x mineral x company network, we see that the corrupt companies have a larger impact than the individual-based concessions do. In the original network, there is a density of 0.52 with just 5 isolates and a component of 366. In this network, the characteristic path length is 10.2. When we remove the individual-based concessions, the density actually increases to 0.54, with the largest component being 316, and the characteristic path length 10.6. It is interesting that the density of the network is being held back by the individual owners of mineral concessions. By contrast, removing the corrupt companies changes the density to be 0.50 with a maximum component of 320 and a characteristic path length of 9. So, when we remove the corrupt companies the density drops, implying that these corrupt companies played a part in how connected the network is. The corrupt companies were not confined to one particular mineral, but did tend to favor searching for “Gold and Basemetals.” This is not particularly surprising given the boom in gold mining in Uganda recently. It is conceivable that people who do not specialize in mining or have not done it before would want to get in on the boom, leading to potentially corrupt practices to get there.

**Conclusions**

The major aim of this analysis was to understand the mining industry in Uganda, and to examine effect that corruption has on it. From both a general analysis and from the subgroup network comparison, it is clear that corruption plays a part in this sector of the Ugandan economy. From the company x attribute analysis, it is clear that there are specific attributes that several corrupt companies share. Because we expect the mining industry to not be dense in these networks, the high-degree of the attributes is cause for inspection. As we found, many of the contact names that arose from the key entity analysis were in fact connected in some ways to the corrupt companies. From the subgroup network comparison, we see that in some cases the corrupt subgroup acts differently than a normal subgroup would. This conclusion, however, is weakened by the non-random choice of subgroup comparison and the impossibility of knowing if our list of corrupt companies captures the reality of corruption in Ugandan mining. Future research could focus on comparison of the group of corrupt companies against a random subgroup. It might also find a country-level comparison to a country in a similar environment that has not been accused of widespread corruption. Overall, however, there appear to be specific attributes that seem to enable corruption, like PO Box 30330 or contact person Muruli Muyambi, but the network of non-prospecting companies in Uganda is still sparse and not overly affected by removing the corrupt company subgroups. We can conclude, then, that corruption is neither widespread nor unmanageable.

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