A Guide into Rough Diamonds from the Central African Republic:

Central African Republic Diamond Blockchain:

"The story of a diamond, as unique as the diamond itself"

### Introduction

An overview of the Central African Republic Economy

The Central African Republic (CAR) economy is small and dominated by agriculture and forestry.<sup>1</sup> Over 70% of the small population of [4.8 million]<sup>2</sup> live in rural areas and exist by subsistence farming.<sup>3</sup> The agricultural sector accounts for over 50% of the GDP<sup>4</sup> of 2.03bn US\$ estimated for 2020<sup>5</sup>. Export earnings are dominated by forestry (40% per 2018)<sup>6</sup> and diamond sales (2% per 2018).<sup>7,8</sup> Since 2018, Diamond exports have remained around 2% of exports from the CAR, or about 0.47% of GDP, on average, since the ban on diamonds was lifted<sup>9</sup>. Prior to the ban on exports diamonds represented, on average, about 3.13% of GDP.<sup>10</sup>

<sup>&</sup>lt;sup>1</sup> Page 23: Study on impacts of artisanal gold and diamond mining on livelihoods and the environment in the Sangha Tri-National Park (TNS) landscape, Congo Basin

<sup>&</sup>lt;sup>2</sup> World Bank (2020) Population, total - Central African Republic | Data (worldbank.org)

<sup>&</sup>lt;sup>3</sup> Page 23: Study on impacts of artisanal gold and diamond mining on livelihoods and the environment in the Sangha Tri-National Park (TNS) landscape, Congo Basin

<sup>&</sup>lt;sup>4</sup> Ibid

<sup>&</sup>lt;sup>5</sup> World Bank (2020) <u>Population, total - Central African Republic | Data (worldbank.org)</u>

<sup>&</sup>lt;sup>6</sup> Overview of timber sector of Central African Republic | Timber Trade Portal

<sup>&</sup>lt;sup>7</sup> <u>Central African Republic | KimberleyProcess</u> & Diamond Value CAR.xlsx

<sup>&</sup>lt;sup>8</sup> Page 23: Study on impacts of artisanal gold and diamond mining on livelihoods and the environment in the Sangha Tri-National Park (TNS) landscape, Congo Basin

<sup>&</sup>lt;sup>9</sup> File: Diamond Ban Update

<sup>&</sup>lt;sup>10</sup> Diamond Value CAR.xlsx

Figure 1: GDP v. Exports (USD) since 2004



Figure 2: Diamonds as a percentage of GDP since 2004





Figure 3: Diamond Exports (USD) v. Total Exports (USD) since 2004

The following statistics about Rough Diamond exports from CAR and CAR GDP since 2004 were collected from the KP and World Bank websites, respectively.<sup>11,12</sup>

 <sup>&</sup>lt;sup>11</sup> <u>The Kimberley Process (KP) | KimberleyProcess</u>
 <sup>12</sup> <u>World Bank Open Data | Data</u>

Year	GDP (USD)	Export (USD)	Diamond Export	Diamond % of Export	Diamond Percent of
			(USD)		GDP
2004	\$1,270,080,250.65	\$177,784,785.78	\$51,592,358.80	29%	4.06%
2005	\$1,337,362,392.15	\$178,708,437.53	\$60,572,403.27	34%	4.53%
2006	\$1,460,561,215.44	\$209,094,018.80	\$59,066,866.33	28%	4.04%
2007	\$1,697,565,948.65	\$239,616,991.83	\$59,857,870.53	25%	3.53%
2008	\$1,985,240,986.19	\$218,449,261.65	\$47,749,282.87	22%	2.41%
2009	\$2,059,094,048.26	\$202,648,827.38	\$46,701,768.31	23%	2.27%
2010	\$2,142,591,539.44	\$249,093,430.16	\$49,789,401.00	20%	2.32%
2011	\$2,437,982,706.58	\$320,053,983.75	\$60,843,286.76	19%	2.50%
2012	\$2,510,126,509.99	\$289,922,950.42	\$62,129,596.70	21%	2.48%
2013	\$1,691,544,110.69	\$253,274,134.98	\$0.00	0%	0.00%
2014	\$1,894,813,389.88	\$315,975,056.09	\$0.00	0%	0.00%
2015	\$1,695,825,714.24	\$289,437,777.68	\$0.00	0%	0.00%
2016	\$1,825,018,144.46	\$270,501,993.11	\$17,742,255.10	7%	0.97%
2017	\$2,072,349,974.15	\$357,682,917.05	\$6,505,454.22	2%	0.31%
2018	\$2,220,979,144.52	\$419,401,359.89	\$10,123,462.73	2%	0.46%
2019	\$2,220,307,318.75	\$364,422,370.63	\$6,042,939.18	2%	0.27%
2020	\$2,303,078,337.57	\$364,522,487.61	\$7,359,116.92	2%	0.32%
2021	\$2,516,498,299	\$357,002,527.89	\$ 11,378,659.49	3%	0.45%

# Table 1: CAR GDP, Exports, and Diamond Exports (2004 – 2021)

The Climate of the Central African Republic

The climate of CAR consists of two seasons: a dry season and a wet season.<sup>13,14</sup> Resolutions, Peace Accords, the 2021 Election, and Organizations working in the Central African Republic

In 2018, UN Resolution 2399 was lifted, allowing intrastate travel in CAR.<sup>15</sup> In 2019, the seventh peace accord titled "Political Agreement for Peace and Reconciliation in the Central African Republic (Khartoum Accord)" was signed, in CAR's capitol, Bangui, to settle the intrastate conflicts from 1996.<sup>16</sup> The full "Khartoum Accord" was published online.<sup>17,18</sup> As of the 2021 election, incumbent president Faustin Arachange Touradera was elected to serve for a second term.<sup>19,20</sup>

A number of organizations are working within CAR's territory: Deutsche Gesellschaft fur Internatoinale Zusammenarbeit (GIZ)<sup>21</sup>, Food and Agriculture Organization of the United Nations (FAO)<sup>22</sup>, United States Agency for International Development (USAID)<sup>23</sup>, United Nations Peacekeeping (UN MINUSCA)<sup>24</sup>, and the Wagner Group<sup>25</sup>. The funding requirements of CAR have increased since 2013. "CAR is not a priority on the agenda of the international community. From 2014 to 2017, the [Humanitarian Response Plan] HRP received respectively 68.2%, 53.5%, 37.9% and 36.5% of requested funds."<sup>26</sup> As of 2018, the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA)

<sup>&</sup>lt;sup>13</sup> Page 54 Study on impacts of artisanal gold and diamond mining on livelihoods and the environment in the Sangha Tri-National Park (TNS) landscape, Congo Basin

<sup>&</sup>lt;sup>14</sup> WhatsApp Conversation

<sup>&</sup>lt;sup>15</sup> File: UN 2399 Travel Ban – use proper citation for file

<sup>&</sup>lt;sup>16</sup> PA-X: Peace Agreements Database

<sup>&</sup>lt;sup>17</sup> <u>https://www.peaceagreements.org/viewdocument/3187</u> (francophone)

<sup>&</sup>lt;sup>18</sup> <u>2147 (peaceagreements.org)</u> (anglophone)

<sup>&</sup>lt;sup>19</sup> <u>Central African Republic - Final results of the presidential election released and transport corridor under attack</u> (DG ECHO, UNHCR) (ECHO Daily Flash of 20 January 2021) - Central African Republic | ReliefWeb

<sup>&</sup>lt;sup>20</sup> <u>Central African Republic President Touadéra wins re-election | Africanews</u>

<sup>&</sup>lt;sup>21</sup> Central African Republic (giz.de)

<sup>&</sup>lt;sup>22</sup> FAO Country Profiles: Central African Republic | Food and Agriculture Organization of the United Nations

<sup>&</sup>lt;sup>23</sup> <u>Central African Republic | U.S. Agency for International Development (usaid.gov)</u>

<sup>&</sup>lt;sup>24</sup> <u>Firsthand Perspective: Witnessing the Work of UN Peacekeepers</u> | unfoundation.org

<sup>&</sup>lt;sup>25</sup> Wagner Group - Wikipedia

<sup>&</sup>lt;sup>26</sup> Page 5 The Future of Central African Republic is Still At Risk File: The Future of the Central African Republic is Still at Risk

funded amount was \$181.4 million USD of the \$497.3 million requested.<sup>27</sup> As of 2019, the UNOCHA funded amount was \$240.6 million USD of the \$515.6 million requested, serving 1.9 million people of the 2.9 million people in CAR that required assistance.<sup>28</sup> Additionally, there is an estimated 573,000 refugee population from CAR in neighboring countries.<sup>29</sup>

### Cumulative Reported Earnings versus Mining Potential

I examined the mining potential of CAR from 2004 to 2027. I established the annual growth rate of each year since 2004, relative to 2004, and then took the average from 2005 to 2012. The average annual growth rate was 108.23% from 2005 to 2012. The grey line represents a return to the average growth rate of 2005 to 2012, relative to the mining level of 2004: 18.11% average, and a geometric mean of 17.76%. The blue line represents the growth rate established by examining the annual growth rate from 2016 on.

Figure 4: Reporting Mining Earnings v Potential Mining Earnings



<sup>&</sup>lt;sup>27</sup> Page 10 File: UNOCHA2018

<sup>&</sup>lt;sup>28</sup> Page 8 File: UNOCHA2019

<sup>&</sup>lt;sup>29</sup> Ibid Page 50

The main route for supplies to enter CAR on land is from Cameroon; see figure 5.<sup>30</sup>

Figure 5: Main Supply Route to CAR from Cameroon



Alluvial Diamond Mining in the Central African Republic

The alluvial diamond mining potential in CAR has been calculated to 840,000 carats per year<sup>31</sup>,

and the estimate of 39,000,000 carats remain as of 2010.<sup>32</sup> This figure was calculated using the

following calculation:

Volume and Grade Approach:

$$P = (VxT_1) + \left(\frac{1}{4}V * T_2\right)$$

Where,

P: estimated diamond resource potential

V: volume of alluvium

 $T_1$ :"basic" grade applied to entire alluvial flat

 $T_2$ : "concentration" grade of alluvial gravels<sup>33</sup>

- <sup>31</sup> Page 1 Alluvial Diamond Resource Potential and Production Capacity Assessment of the Central African Republic File: Alluvial Diamond Resource Potential 2010 CAR
- 32 Ibid

<sup>&</sup>lt;sup>30</sup> Central African Republic humanitarian convoy | ICRC

<sup>&</sup>lt;sup>33</sup> Ibid, Page 12

The " $T_2$ " "grade accounts for the fact that diamond occurrences are not uniformly consistent throughout the entire deposit."<sup>34</sup> "Four types of alluvial placer deposits have been observed in this region, including channel deposits, alluvial flat deposits, low terrace deposits, and high terrace deposits."<sup>35</sup> Figure 5 shows the location of these deposits.

Figure 6: Figure 3<sup>36</sup>



Figure 3. Diagram showing geomorphic units of channel, alluvial flat, and terrace, which are related to the distribution of diamond deposits in the Central African Republic. m, meters.

The percentage of estimated rough diamond production in Kimberley Process (KP)-compliant

zones that is legally exported from CAR was at 8%, as of the baseline year of 2018. Since then it has

grown to 24 percent in 2021, as listed in Figure 6.<sup>37</sup> By applying the 2018 baseline statistic to the Table

1's 2018 statistics, diamonds would account for 5.4% of GDP.<sup>38</sup> 5.4% of the figure reflects the full

potential of diamond mining as diamond production statistics prior to 2012 do not account for ~30% of

<sup>&</sup>lt;sup>34</sup> Ibid, Page 12-13

 <sup>&</sup>lt;sup>35</sup> Page 4The Central African Republic Diamond Database - A Geodatabase of Archival Diamond Occurrences and Areas of Recent Artisanal and Small-Scale Diamond Mining File: CAR Diamond Database
 <sup>36</sup> Ibid, Page 5

<sup>&</sup>lt;sup>37</sup> Page 23 Artisinal Mining and Property Rights: Under the Strengthening Tenure and Resource Rights II (STARR II) IDIQ – Quarterly Progress Report File: ASM\_Property Rights\_CAR

<sup>&</sup>lt;sup>38</sup> (\$10,123,462.73/0.08)/(\$2,220,979,144.20 - \$10,123,462.73 + \$10,123,462.73/0.08) \* 100% = 5.4%

diamonds that would leave CAR through clandestine means. As of 2010, it was estimated that 30% of diamonds left CAR through clandestine measures which evade the KP.<sup>39</sup>

Figure 7: Percentage of estimated rough diamond production in KP-compliant zones that is legally exported from CAR<sup>40</sup>

N°	PERFORMANCE INDICATOR	BASE- LINE	YI TARGET	YI RESULT	Y2 TARGET	Y2 RESULT	Y 3 TARGET	Y3 RESULT	LOP TARGET	COMMENTS ON PROGRESS
I	Percentage of estimated rough diamond production in KP-compliant zones that is legally exported from CAR	8%'	15%	12%	25%	11%	40%	24%	60%	Data updated from the MMG annual report of January to December 2020.
2	Percentage of major diamond-mining sub- prefectures in the Western part of the country authorized by the KP to export rough diamonds	31%2	50%	50%	50%	50%	75%	50%	100%	As above
3	Number of licensed (registered) artisanal miners	1,000 <sup>3</sup>	1,500	1,458	2,000	1,006 <sup>4</sup>	2,000	73	3,000	Artisanal miners in the KP compliant zones of Berberati (53), Boda (14), and Carnot (6).

A rough estimated value of annual production of diamonds in CAR

The Y1 Target in Figure 7 is from 2018. In Table 1, the value of diamonds mined in CAR was \$10,123,462.73. In Figure 7, 8% is the proportion of diamonds which were in KP-compliant zones and legally exported. The percentage of major diamond-mining subprefectures in the Western part of the country authorized by the KP to export rough diamonds was 31%. In the footnotes of page 23 of ARTISANAL MINING AND PROPERTY RIGHTS UNDER THE STRENGTHENING TENURE AND RESOURCE RIGHTS II (STARR II) IDIQ, I found the west represents 32 of the 72 prefectures containing diamonds. Thus, I have done the following calculation to estimate the annual production of diamonds in CAR as of 2018, assuming all prefectures have the same average value of diamonds (which they do not): Value of annual diamond production, per 2018, which were in KP-compliant zones:

$$10,123,462.73 * \frac{1}{0.08} = 126,543,284.13$$
 USD

<sup>&</sup>lt;sup>39</sup> Page 77, Central African Republic: A Conflict Mapping File CAR Mapping Conflict 2018

<sup>&</sup>lt;sup>40</sup> Page 23, File: ASM\_Property\_Rights\_CAR

Value of annual diamond production, per 2018, in western prefectures:

$$126,543,284.13 * \frac{1}{0.31} = 408,204,142.34$$
 USD

Value of annual diamond production, per 2018 in all prefectures assuming all other goods, ceterus paribus (AOG, CP):

$$408,204,142.34 * \frac{72}{32} = 918,459,320.26$$
 USD

Seeing that center-east diamonds are roughly double the value of western diamonds, per the confidential audit cited in this paper, I estimate the annual production value of diamonds from CAR to be:

$$408,204,142.34 + 408,204,142.34 * \frac{72 - 32}{32} * 2 = 1,428,714,498.19$$
 USD

With this number being stated, I think it is important to note that it is only as good as the assumptions which go into the prices used to establish the initial export value of \$10,123,462.73. I think this rough estimate is also underestimated. The country of CAR has the capacity to export a value of diamonds which exceeds other exports by roughly four times.

Estimated Value of Remaining Diamonds to be Mined at Retail Value:

By using a 5% growth rate, and about 30 years left of diamond mining in CAR, I estimate the

value to be the summation of CAR's annual production to be:

2023	\$ 1,428,714,498.19	\$ 3,727,405,421.84
2024	\$ 1,500,150,223.10	\$ 3,913,775,692.93
2025	\$ 1,575,157,734.25	\$ 4,109,464,477.57
2026	\$ 1,653,915,620.97	\$ 4,314,937,701.45
2027	\$ 1,736,611,402.02	\$ 4,530,684,586.53
2028	\$ 1,823,441,972.12	\$ 4,757,218,815.85
2029	\$ 1,914,614,070.72	\$ 4,995,079,756.65
2030	\$ 2,010,344,774.26	\$ 5,244,833,744.48
2031	\$ 2,110,862,012.97	\$ 5,507,075,431.70
2032	\$ 2,216,405,113.62	\$ 5,782,429,203.29
2033	\$ 2,327,225,369.30	\$ 6,071,550,663.45
2034	\$ 2,443,586,637.77	\$ 6,375,128,196.62
2035	\$ 2,565,765,969.65	\$ 6,693,884,606.45
2036	\$ 2,694,054,268.14	\$ 7,028,578,836.78
2037	\$ 2,828,756,981.54	\$ 7,380,007,778.62
2038	\$ 2,970,194,830.62	\$ 7,749,008,167.55
2039	\$ 3,118,704,572.15	\$ 8,136,458,575.92
2040	\$ 3,274,639,800.76	\$ 8,543,281,504.72
2041	\$ 3,438,371,790.80	\$ 8,970,445,579.96
2042	\$ 3,610,290,380.34	\$ 9,418,967,858.95
2043	\$ 3,790,804,899.35	\$ 9,889,916,251.90
2044	\$ 3,980,345,144.32	\$ 10,384,412,064.50
2045	\$ 4,179,362,401.54	\$ 10,903,632,667.72
2046	\$ 4,388,330,521.61	\$ 11,448,814,301.11
2047	\$ 4,607,747,047.70	\$ 12,021,255,016.16
2048	\$ 4,838,134,400.08	\$ 12,622,317,766.97
2049	\$ 5,080,041,120.08	\$ 13,253,433,655.32
2050	\$ 5,334,043,176.09	\$ 13,916,105,338.09
2051	\$ 5,600,745,334.89	\$ 14,611,910,604.99
2052	\$ 5,880,782,601.64	\$ 15,342,506,135.24
Total:	\$ 94,922,144,670.59	\$ 247,644,520,403.31

# My hypothesis

The goal of this paper is to establish the true cost breakdown of ASM mining, as many of the costs of producing kimberlite diamonds are not associated with the operating expenditures of ASM mining. According to figure 33 Bain's "The Global Diamond Industry: Lifting the Veil of Mystery" report,

kimberlite mining of rough diamonds has both operating costs as well as construction costs. Exploration of kimberlites, which is not accounted for in this operating expenditure, proves to be a hit-or-miss operation. Operating costs contain: indirect costs, overburden rock removal, processing costs, energy, transport & contractors, as well as other costs. Construction capital expenditures include: administration, design & procurement, transport, taxes & fees, indirect construction costs, buildings & maintenance, as well as test production, and other fees.<sup>41</sup> Since these fees are not factored in to the methods used to appraise a rough diamond, yet ASM rough diamonds represent a very small percentage of rough diamonds mined, annually, the following question should be asked: Are the diamonds undervalued while relying on a system that places most of the value on costs associated with exploration and construction costs? Even if the direct costs are assumed to be the same for production of kimberlites and ASM mined rough diamonds, energy accounts for 20% of the total. Little or no technology or infrastructure is required for ASM mining in CAR.<sup>42</sup>

The next goal is to establish a blockchain for ASM alluvial rough diamonds from CAR. This can be done by following each stone through the value chain from "mine to finger".<sup>43</sup>

The next goal is for an ASM miner to receive a minimum 100% increase in pay per stone, on average and under current pricing constraints, from 9% to 18% of the cut and polished stone.<sup>44</sup> I plan to do this by assessing the value of a rough diamond by identifying inclusions beneath the surface of both "makeable" and "saweable" rough diamonds.<sup>45</sup> This entails a deep investigation into each stone purchased, and finding the miner after the fact, or making this assessment in the field. To successfully determine the true value of a rough diamond, the required cuts to turn the rough diamond into a cut and polished stone must be identified prior to sale.

<sup>&</sup>lt;sup>41</sup> Page 37 File: Bain Report The Global Diamond Industry

<sup>&</sup>lt;sup>42</sup> Page 3, SSA Verite Commodity Report Diamonds.pdf

<sup>&</sup>lt;sup>43</sup> Ibid, Page 19

<sup>&</sup>lt;sup>44</sup> Need source

<sup>&</sup>lt;sup>45</sup> Page 9, File: SODIAM CAR Audit

The next goal would be to make the mining industry more robust through implementing the appropriate financial modeling tools required to honor the religious practices of the "miner", "digger", "diver", "collectuer".<sup>46</sup> Also, how could widespread use of the internet, smart phones and digital scales improve the supply chain? My concept of blockchain is very similar to GemFair in Sierra Leone, by DeBeers.<sup>47</sup>

The next goal is to find the opportunity cost of purchasing a box of rough diamonds, and the amount of time each diamond spends in the supply chain during each step. According to Lisa Bernstein, the projected time to cut and polish a box of rough diamonds is about three to four months<sup>48</sup>. A box of rough diamonds is 12,000 carats, on average.

The next goal is to establish the value of a "collectuer" and a "comptoir" in the rough diamond process in CAR. What goes into the process of a "select" rough diamond versus a rough diamond that is still gem quality?<sup>49</sup> This may prove to intersect with the notion of establishing the value of identifying the inclusions in the field, setting up a differences-in-differences research design.

The next goal is to find the true value of cutting and polishing without the costs of financing factored in. This entails looking at both purchase financing as well as receivables financing, such as A/R loans, factoring, and other forms of financing. The lifecycle of a diamond from "mine to finger" is 235-300 days, after 0-5 days at the mine. This inventory spends anywhere between 90-100 days with the cutter and polisher.<sup>50</sup>

Fixed effects will be employed by analyzing the cutting and polishing stage, along with jewelry creation, as well as retail sales in various countries.

Morphology of Alluvial (Placer) Diamonds

 <sup>&</sup>lt;sup>46</sup> See Sukuk structures, and investigate if 'Animist' religious practices require any particular financial tools.
 <sup>47</sup> https://gemfair.com

<sup>&</sup>lt;sup>48</sup> Page 118 "Opting Out of the Legal System: Extralegal Contractual Relations In The Diamond Industry"

<sup>&</sup>lt;sup>49</sup> Conversations from WhatsApp

<sup>&</sup>lt;sup>50</sup> Page 16 The Global Diamond Industry 2019 File: Bain Report Global Diamond 2019

The most common type of diamond-bearing rock volcanic rock is kimberlite.<sup>51</sup> Diamonds found in CAR are alluvial, placer, diamonds. "These placer deposits can contain diamonds from more than one kimberlitic source, and form in different geological environments. Most frequently, diamonds are concentrated in riverbeds where they form alluvial deposits"<sup>52</sup> Diamonds in placer deposits are often high quality because the transport has reduced the number of stones with imperfections.<sup>53</sup>



Figure 8: The Placer Diamond Deposit in CAR<sup>54</sup>

This transport of diamonds along riverbeds created four types of alluvial placer deposits:

channel deposits, alluvial flat deposits, low terrace deposits and high terrace deposits, per figure 6.55

The following description of rough diamonds came from a leaked confidential report on "Red

Zone" Eastern goods from CAR:

Figure 9: Description of Rough Diamonds from Eastern provinces in CAR<sup>56</sup>:

 <sup>&</sup>lt;sup>51</sup> Page 5 Diamonds in Nature: A Guide to Rough Diamonds File: Diamonds in nature – A guide to rough diamonds
 <sup>52</sup> Ibid, Page 10

<sup>&</sup>lt;sup>53</sup> Ibid, Page 11

<sup>&</sup>lt;sup>54</sup> Ibid, Page 7

<sup>&</sup>lt;sup>55</sup> Page 4 The Central African Republic Diamond Database - A Geodatabase of Archival Diamond Occurrences and Areas of Recent Artisanal and Small-Scale Diamond Mining File: CAR Diamond Database

<sup>&</sup>lt;sup>56</sup> Page 9 File: Sodiam CAR Audit. I found the audit in three occurrences on the web from a broken link in an Amnesty International paper.

	Description
Size	Avg. weight/stone: 0.7ct; 2ct common; >3-4ct less common; >10ct frequent; exceptionally ~100ct.
Crystal Morphology	Saweables (Octahedrons rare): 70-75% Makeables: 25-30% (incl. up to ~30% broken crystals). Mostly rounded, slightly flattened crystals with shiny surface. Many with (alluvial) transportation damage.
Quality	~85-90%: High & Medium: Mostly greenish-yellowish, Greenish coatings common. Mostly commercial. Rarely colourless. Mostly cleanish. ~10-15%: Low: dark and heavily included crystals.
Value	Sam Ouandja: ~ 200\$/ct; Bria: 200-250\$/ct; Nzako: >300\$/ct
Production Capacity	Sam Ouandja: ~ 10,000ct; Bria: 40,000-50,000ct; Nzako: ~ 5,000 - 7,500 ct

Figure 2. KP Footprint for Eastern goods

Figure 9 demonstrates that the crystal morphology of the rough diamonds being audited are saweable octahedrons (70-75%), and makeable (25-30%) which are mostly rounded, slightly flattened crystals with a shiny surface, many of which have transportation damage.<sup>57</sup>

Octahedrons are monocrystalline diamonds<sup>58</sup>; the most common growth habit of natural

diamonds.<sup>59</sup> "Monocrystalline diamonds consist of single diamond crystals, but some aggregates, twins,

and other intergrowths also belong to this type. In any case, the number of individual crystals is small."60

Mostly rounded, slightly flattened crystals with a shiny surface, many of which have transportation

damage may still be monocrystalline diamonds. The rounded, slightly flattened crystals with a shiny

surface, with transportation damage may be rounded-dodecahedral diamonds. Rounded-dodecahedral

diamonds are usually formed from resorption.<sup>61</sup>

The resorption is usually linked to the exposure of the diamond to the kimberlitic magma during transport to the Earth's surface. Kimberlitic magmas can contain high concentrations of oxidizing agents, namely CO2 and H2O. At high temperatures, these oxidizing agents are detrimental to the diamond and can partially or completely resorb an octahedral diamond.<sup>62</sup>

<sup>&</sup>lt;sup>57</sup> A makeable diamond needs little to no cutting or polishing to make the gem ready for jewelry. A saweable diamond needs cutting and polishing to make the gem ready for jewelry.

<sup>&</sup>lt;sup>58</sup> Page 16 "Diamonds in Nature: A Guide to Rough Diamonds" File: Diamonds in nature – A guide to rough diamonds

<sup>&</sup>lt;sup>59</sup> Ibid, Page 17

<sup>&</sup>lt;sup>60</sup> Ibid, Page 15

<sup>&</sup>lt;sup>61</sup> Ibid, Page 16

<sup>&</sup>lt;sup>62</sup> Ibid, Page 18

Figure 10: A diamond octahedron with minor resorption at the crystal edges<sup>63</sup>



**2-03:** Diamond octahedron with minor resorption at the crystal edges (1.08 ct). The crystal faces exhibit several triangular etch pits (trigons).

The following graph demonstrates the pressure required to form octahedrons.

# Figure 11: Figure 2-17 from Diamonds in Nature<sup>64</sup>



The next portion examines a rough diamond's morphology through its fluorescence.

<sup>&</sup>lt;sup>63</sup> Ibid, Page 17

<sup>&</sup>lt;sup>64</sup> Ibid, Page 24

Fluorescence in diamonds is often caused by the interaction of the ultraviolet portion of light with elemental impurities and imperfections. This results in the emission of various faint background colors in the visible spectrum. Fluorescence colors are often diagnostic for specific types of impurities or imperfections. For example, the common blue fluorescence of diamonds ... is caused by nitrogen impurities. Other fluorescence colors include yellow, green, orange, and white.<sup>65</sup>

Diamonds in the Eastern and Center-Eastern Provinces of CAR

Most of the diamonds in the confidential audit were listed as having greenish hues.

Diamonds with transparent green body colors are extremely rare. Although high concentrations of nitrogen impurities can cause a greenish tinge in some Type Ib diamonds, a green body color is generally the result of natural irradiation. The irradiation is caused by radioactive elements, such as uranium and thorium, that are present in the environment of the diamond.<sup>66</sup>

From a translated report on the minerals in CAR, uranium is present in CAR's mineral constituency.<sup>67</sup>

Small Scale Artisanal Mining (ASM) in CAR

ASM mining is not like the mining of kimberlites. Since the diamonds are in the soil, instead of

bedrock, ASM mining pulls diamonds from the ground by teams of diggers hired and supervised by

licensed mine works.<sup>68</sup> A mining site is a 100 m x 100 m site licensed for mining using nonmechanized

methods.<sup>69</sup> In addition to a digger, there is a diver. A diver shovels sand from the bottom of rivers to

the surface.70

The following is an image of an ASM site in CAR taken from satellite imagery.

<sup>&</sup>lt;sup>65</sup> Ibid, Page 48

<sup>&</sup>lt;sup>66</sup> Ibid, Page 60

<sup>&</sup>lt;sup>67</sup> CAR Minerals Resources Translated.docx

<sup>&</sup>lt;sup>68</sup> Page 8 The Central African Republic Diamond Database - A Geodatabase of Archival Diamond Occurrences and Areas of Recent Artisanal and Small-Scale Diamond Mining File: CAR Diamond Database

<sup>&</sup>lt;sup>69</sup> Ibid, Page 8

<sup>&</sup>lt;sup>70</sup> Page 13 Gold and diamonds in the Central African Republic File: Gold and Diamonds in the Central African Republic

Figure 12: Figure 8 taken from DigitalGlobe's WorldView-2 satellite in 2016<sup>71</sup>



Figure 8. Photographic interpretation of artisanal and small-scale mining pits is partly based on tonal and hue differentiation, where bright white, tan, or red colors indicate excavation activity and are distinctive from the darker hues of undisturbed vegetated areas. Satellite imagery of an area in the Amada-Gaza subprefecture of CAR from DigitalGlobe's WorldView-2 satellite, February 21, 2016.

Figure 13 contains ASM sites with water pits.

<sup>&</sup>lt;sup>71</sup> Page 14 The Central African Republic Diamond Database - A Geodatabase of Archival Diamond Occurrences and Areas of Recent Artisanal and Small-Scale Diamond Mining File: CAR Diamond Database

Figure 13: Figure 10 Bria Subprefecture of CAR from DigitalGlobe's GeoEye-1 satellite<sup>72</sup>



Figure 10. Pits may contain bright or dark-toned water, which can be used to indicate the recency of mining activity at that pit when supported by additional mining indicators. Satellite imagery of an area in the Bria subprefecture of CAR from DigitalGlobe's GeoEye-1 satellite, March 24, 2015.

Figure 14 contains an image of an active mining pit near a river in Berberati, CAR.

Figure 14: Figure 11 Berberati, CAR taken from DigitalGlobe's WorldView-2 satellite<sup>73</sup>



Figure 11. Example of a barrage built into a river channel to stem the flow of water to allow for the digging of pits. Satellite imagery of an area in the Berberati subprefecture of CAR from DigitalGlobe's WorldView-2 satellite, March 27, 2016.

<sup>&</sup>lt;sup>72</sup> Ibid Page 15
<sup>73</sup> Ibid Page 15

The Financial Costs of ASM mining in CAR

The USD to CFA exchange rate fluctuates around 580 CFA. The following are the costs of mining

# in CAR:74

Grant 1 000 000 F CFA (~\$1724 USD
Renewal
2 - Research Permit
Grant 3,000,000 CFA francs (\$5,172 USD
First Renewal
Second Renewal
Transfer
3 - Large-scale industrial exploitation license
Grant 10,000,000 F CFA (~\$17,241
USD)
Renewal
Assignment, transfer, leasing, transfer
4 - Small-scale industrial exploitation license
Grant
Renewal
Assignment, transfer, leasing, transfer
5 - Semi-mechanized artisanal exploitation license
Grant
Renewal
Transfer, transfer, lease, transfer
6 - License for the exploitation of dumps, mine heaps and guarry residues
Grant
Renewal
Transfer
7 - Prospecting Authorization
Grant
Renewal
8 - Authorization of artisanal exploitation 100 000 CFA (~172 USD)
The fixed amounts of the fees fixed on authorizations to search for deposits of guarry substance
and on the operating authorizations are fixed as follows:
Authorization to search for a guarry substance deposit 100,000 CFA (~\$172 USD)
Permanent guarry permit
Granting
USD)
Renewal
Transfer
- Temporary quarry permit 1.00 000 F CFA (~\$1,724 USD)

<sup>&</sup>lt;sup>74</sup> CAR Permit Conditions.docx

The surface taxes must be paid by the holder upon receipt of the bill of rights noted with the manager.

Amounts: Authorization to exploit quarries:
The surface taxes on mining titles and authorization are set as follows:
1- Research permit
The first two years:
Third and fourth years
USD/Km2/Year)
Fifth year
From the sixth year
USD/Km2/year)
2 - Authorization for artisanal exploitation
USD/Km2/ha/year)
3 - Semi mechanized artisanal permit First year 10,000 F CFA / ha /
year (~\$1,724 USD/ha/year)
Next years
4- Industrial exploitation permit for small-scale or large-scale mines 60,000 F CFA / km2/year
(~\$103.45 USD/Km2/year)

To create a purchasing office, which can buy diamonds within CAR and sell diamonds outside

the country, the following fees must be paid:<sup>75</sup>

- a deposit of 50,000,000 FCFA (~\$86.21 USD);

- a share capital of 50,000,000 FCFA (~86.21 USD);

- an annual license of 18,500,000 FCFA (~\$31.90 USD)

To become a mining artisan, the licensing fee of 30.050 FCFA (~\$51.81 USD) and a 2000 FCFA

(~\$34.45 USD) production notebook with five worker cards must be purchased at 2000 FCFA each

(\$34.45 USD). <sup>76</sup>

A mining cooperative may export diamonds if a 40,000 FCFA (~\$69.97 USD) fee is paid.<sup>77</sup>

There are a number of penalties associated with not paying these fees.<sup>78</sup>

CAR Ministry of Mines Structure

<sup>&</sup>lt;sup>75</sup> CAR Mining Code Guide.docx

<sup>&</sup>lt;sup>76</sup> Ibid

<sup>77</sup> Ibid

<sup>78</sup> Ibid

The Ministry of Mines reports directly to the president of CAR.

Figure 15: Structure of Ministry of Mines<sup>79</sup>



DPDM: Directorate of Promotion and Mining Development DR: Research Direction DCI: Directorate of Marketing and Industry DRMG: Regional Directions of Mines and Geology (4): Berberati, Bouar, Bria, Bangassou.

There are three central directorates<sup>80</sup>:

- 1. Research Directorate
- 2. Directorate of Marketing and Industry
- 3. Department of Promotion and Mining Development

There are four Regional Directorates<sup>81</sup>:

- 1. South-West: Berberati
- 2. North-West: Bouar
- 3. North-East: Bria
- 4. South-East: Bangassou

The Exportation of Rough Diamonds from CAR

The following image is from the confidential audit, and it displays the required stamps to export

from CAR:

<sup>&</sup>lt;sup>79</sup> Page 3 Annual report of the General Management of Mines and Geology File: CAR Rapport Annuel Translated

<sup>&</sup>lt;sup>80</sup> Ibid

<sup>&</sup>lt;sup>81</sup> Ibid

# Figure 16: Diamond Export Sheet<sup>82</sup>

	Données o	le l'Exportation	
Société:	SODIAM	Date:	10/09/2013
Période d'Achat:	26/05/13 AU 10/09/13	Export Nº	005/KPC/T 027/2013
Taux de change:	495	Mercuriale:	15-juil-02
Caratage et Valeur d'Achat:	6 925,42	Cts en CFA:	431 287 000
Evaluation de	6 925,79	Cts en CFA;	425 437 596
a here		1 / AL	
Т	otal Expertise	é de l'Exportatio	n
Caratage Exportable	Valeur d'Expertise en \$	Valeur d'Expertise en CFA	Valeur Taxable en CFA
6 925,93	859 860,67	425 631 032	431 287 000
	0		
DOUANE	BREREDE	BECDOR	EXPERTS
Row X	Caller Tr	A CONTRACTOR	and the second
Color () A		A COOR )	The second
AS YY	fort	El V	E ITT
Carl-C	ALL DE DE MARY	AL AN	

According to SODIAM's procedure's manual, which was taken from their website, the following list is

required for export<sup>83</sup>:

- The name of the seller
- The name of the SODIAM C.A.R. buyer
- The date
- The license number of the seller
- The quantity and quality of the goods
- The amount paid
- The location of the transaction

<sup>&</sup>lt;sup>82</sup> Page 13 File: Sodiam CAR audit

<sup>&</sup>lt;sup>83</sup> Page 3 SODIAM-Procedures-Manual

Illicit Exportation of Rough Diamonds from CAR

Most of the rough diamonds leave CAR through clandestine measures. "Statistics still show a

majority of rough diamonds leave the country through clandestine methods."84

One reason for the high levels of smuggling in the diamond sector is the existence of numerous illegal buying houses offering preferential rates in locales such as Gamboula, Kentzou and Garoua-Boulai. In Gamboula, for example, two "clean" carats can reportedly fetch 1.2 million FCAF, as opposed to 800-850,000 FCAF offered in Bangui, which includes CAR taxes. Indeed, whilst Cameroon technically imposes advantageous export taxes on diamonds, all Central African stones appear to be evading official Cameroonian flows and therefore taxes.<sup>85</sup>

Since the publication of "Central African Republic: A Conflict Mapping", CAR has lowed it's export tax to

4% to compete with buying houses in neighboring countries.<sup>86</sup> This competition is to incentivize miners

and collectuers to sell their diamonds to buying houses in CAR.

## The Kimberley Process

The Kimberley Process is a certification scheme implemented in 2000 to prevent "conflict

diamonds" from entering the supply chain.

WELCOMING voluntary self-regulation initiatives announced by the diamond industry and recognising that a system of such voluntary self-regulation contributes to ensuring an effective internal control system of rough diamonds based upon the international certification scheme for rough diamonds;<sup>87</sup>

The following defines a conflict diamond:

CONFLICT DIAMONDS means rough diamonds used by rebel movements or their allies to finance conflict aimed at undermining legitimate governments, as described in relevant United Nations Security Council (UNSC) resolutions insofar as they remain in effect, or in other similar UNSC resolutions which may be adopted in the future, and as understood and recognised in United Nations General Assembly (UNGA) Resolution 55/56, or in other similar UNGA resolutions which may be adopted in future;<sup>88</sup>

<sup>&</sup>lt;sup>84</sup> Page 1 Artisinal Mining and Property Rights: Under the Strengthening Tenure and Resource Rights II (STARR II) IDIQ – Quarterly Progress Report File: ASM\_Property Rights\_CAR

<sup>&</sup>lt;sup>85</sup> Page 93 Central African Republic: A Conflict Mapping File: CAR Mapping Conflict 2018

<sup>&</sup>lt;sup>86</sup> CAR Government Initiates Complete Reform of its Diamond Mining Sector (gjepc.org)

<sup>&</sup>lt;sup>87</sup> Page 2 Kimberley Process Certification Scheme File: Kimberley Process certification Scheme

<sup>&</sup>lt;sup>88</sup> Page 3 Ibid

Each rough diamond certified by the Kimberley Process must be accompanied by a Kimberley Process Certificate:

KIMBERLEY PROCESS CERTIFICATE means a forgery resistant document with a particular format which identifies a shipment of rough diamonds as being in compliance with the requirements of the Certification Scheme;<sup>89</sup>

The Kimberley Process defines a rough diamond as:

"ROUGH DIAMONDS means diamonds that are unworked or simply sawn, cleaved or bruted and fall under the Relevant Harmonised Commodity Description and Coding System 7102.10, 7102.21 and 7102.31;"<sup>90</sup>

7102.10 is unsorted diamonds, simply sawn, cleaved, or bruted, 7102.21 is industrial diamonds,

unworked or simply sawn, and 7102.31 is non-industrial diamonds, unworked or simply sawn, cleaved or

bruted.91

Participation is entirely voluntary, however trading rough diamonds can be extremely difficult

without being a part of the Kimberley Process. The following dictates participation as open and non-

discriminatory:

Participation in the Certification Scheme is open on a global, non-discriminatory basis to all Applicants willing and able to fulfill the requirements of that Scheme.<sup>92</sup>

To be a part of the Kimberley Process, quarterly reports must be made:

to keep and publish within two months of the reference period and in a standardised format, quarterly aggregate statistics on rough diamond exports and imports, as well as the numbers of certificates validated for export, and of imported shipments accompanied by Certificates<sup>93</sup>

Since it is difficult to trace the origins of a diamond, the Kimberley Process implemented a

"System of Warranties". The most recent update of the "System of Warranties" includes the following

language with every shipment of rough diamonds:

<sup>92</sup> Page 4 Kimberley Process Certification Scheme File: Kimberley Process certification Scheme

<sup>93</sup> Ibid Page 16

<sup>&</sup>lt;sup>89</sup> Ibid Page 3

<sup>&</sup>lt;sup>90</sup> Ibid Page 4

<sup>&</sup>lt;sup>91</sup> Page 4 The Kimberley Process Certification Scheme one year ahead: state of affairs in the European Union File: The Kimberley Process Certification Scheme One year ahead

The diamonds herein invoiced have been (sourced) purchased from legitimate sources not involved in funding conflict, in compliance with United Nations Resolutions and corresponding to national laws (where the invoice is generated) as per the System of Warranties Guidelines. The seller hereby guarantees that these diamonds are conflict free."<sup>94</sup>

## The Kimberley Process & Alluvial Rough Diamonds

In 2005 the Russian Federation made the "Moscow Declaration" which is the shortened name of

"Improving Internal Controls over Alluvial Diamond Production":

In order to promote concrete steps towards more effective internal controls over alluvial production and the trade in alluvial diamonds, and based on the report of the sub-group, Plenary has identified a number of key policies and actions which, if implemented by alluvial producers, would significantly enhance their ability to guarantee that only diamonds produced and traded in accordance with national legislation and the standards of the KPCS can be exported.<sup>95</sup>

The recommendations are as follows:

- Ensure that full records of production are kept on daily basis by artisanal diamond miners, and back these requirements up with adequate provisions for penalties in cases of false record-keeping;
- Ensure regular cross-checking of these production records against sales records to be kept by diamond buyers at the local level; and
- Ensure that precise indications (plot) of the origins of a particular lot of diamonds are indicated on all invoices and documentation accompanying the diamonds to the point of export<sup>96</sup>

The regulation of ASM participants are encouraged to: maintain up-to-date information on production

areas and mining licenses granted, carryout geological surveys, ensure that there are adequate numbers

of mining inspectors, apply the appropriate legislation so only licensed miners can engage in ASM.<sup>97</sup>

Measures were suggested to encourage miners to move into the formal economy as well.<sup>98</sup>

<sup>&</sup>lt;sup>94</sup> Page 3 Reform to the System of Warranties File: WDC Reform to the System of Warranties

<sup>&</sup>lt;sup>95</sup> Page 1 Improving Internal Controls over Alluvial Diamond Production "Moscow Declaration" File: 2005 Administrative Decision Moscow Declaration on alluvial diamond production 0

<sup>&</sup>lt;sup>96</sup> Ibid Page 2

<sup>&</sup>lt;sup>97</sup> Ibid Page 2

<sup>&</sup>lt;sup>98</sup> Ibid Page 3

The Clean Diamond Trade Act

On April 25, 2003, the United States passed Public Law 108-19: the "Clean Diamond Trade Act". This law was enacted after the Kimberley Process was launched. This law implemented audits of diamond traders in the United States.<sup>99</sup> The law also made the United States Customs and Border Protection (CBP) the administrator of rough diamond imports into the U.S,<sup>100</sup> and made import violations subject to U.S. law.<sup>101</sup>

#### Extractive Industries Transparency Initiative (EITI) Action Plan in CAR

The EITI is considered to be the global standard for good governance in oil, gas, and other mineral resources. According to the EITI, CAR has made inadequate progress, or is suspended, from being a member in the EITI.<sup>102</sup> As of the 2017 EITI Action Plan, the total cost of resuming activities in CAR was \$246,000,000 USD.<sup>103</sup> This fee includes operational support, evaluation of results and impact of EITI implementation on natural resources and governance, as well as fees for the restoration of EITI-CAR activities.<sup>104</sup> As of July 2021 there has been a new report produced by EITI for CAR that states CAR is due for readmission into the EITI, should it make adequate steps towards the goals set forth by the EITI<sup>105</sup>.

The importation of rough diamonds:

All physical inspections of rough diamonds are to be recorded on video.<sup>106</sup>

<sup>103</sup> EITI Updated Plan of Action for the Revival of Activities in 2017 translated .xlsx file

<sup>104</sup> Ibid

<sup>&</sup>lt;sup>99</sup> Page 4 Public Law 108-19-Apr. 25, 2003 (US Law) File: Clean Diamond Trade Act

<sup>&</sup>lt;sup>100</sup> Ibid Page 4

<sup>&</sup>lt;sup>101</sup> Ibid Page 5

<sup>&</sup>lt;sup>102</sup> www.eiti.org/countries

<sup>&</sup>lt;sup>105</sup> EITI 2021-2024 Plan.docx, translated version

<sup>&</sup>lt;sup>106</sup> Page 17 The Kimberley Process Certification Scheme one year ahead: state of affairs in the European Union File: The Kimberley Process Certification Scheme One year ahead

How to appraise a rough diamond

As of today, the process of appraising a rough diamond relies primarily on the "4 C's": carat, cut, color, and clarity. I believe the process can be improved by identifying inclusions that are easily removed when cutting and polishing. The use of a SARIN or a Sarine machine prior to the sale of a rough diamond would drastically improve the quality of the sale.<sup>107</sup>

### What's a box?

A box is approximately 12,000 carats of rough diamonds<sup>108</sup>. A box is a tamper-resistant container.





Since a carat is 0.2 grams, a box is approximately 2.4 kilograms, or 5.28 pounds. These

diamonds are packed loose, which means there may be no "paper" separating them. "Paper" is a white

<sup>&</sup>lt;sup>107</sup> Sarine Diamond Technologies - A World leader in the diamond industry

<sup>&</sup>lt;sup>108</sup> I found this figure by finding the "average" of "imports" over "counts" on a website a few years ago. The number came in a little less than 100 carats under 12,000. Since I cannot find this particular website (which I believe was a bourse site from Belgium), I have examined the major diamond importing countries' carat count over the KPC count on the KP website, and found the ratio to be, on a weighted average, 8980.23 carats, with a standard deviation of 6733.50 carats from 2004 to 2020.

<sup>&</sup>lt;sup>109</sup> From WhatsApp Conversation

piece of paper with plastic on the inside, to protect the gemstone.<sup>110</sup> A box of rough diamonds is a great way to trade high volumes of diamonds. Since the industry is based on largely reputation, the sale of a box is based on the quality of previous outcomes of sales. Thus, the better the cut and polished stones are from a seller's box, the more negotiating power a seller of a box has on the next sale.

The Sale of Rough Diamonds

Most kimberlites are sold through long-term contracts. Auction and spot sales are used mostly to sell alluvial rough diamonds.<sup>111</sup> Sightholders play many roles in various steps of the value chain of rough diamonds.<sup>112</sup>

#### **Cutting and Polishing**

Figure 18: Figure 13: Labor and financing are key factors in the manufacturing costs of polished diamonds



Figure 13: Labor and financing are key factors in the manufacturing costs of polished diamonds

<sup>&</sup>lt;sup>110</sup> I saw a loose diamond in "paper" in 2019

<sup>&</sup>lt;sup>111</sup> Page 12 The Global Diamond Industry: Lifting the Veil of Mystery File: Bain Report The Global Diamond Industry

<sup>&</sup>lt;sup>112</sup> A sightholder can appraise a rough diamond upon sight at auction

Table 2: Cost Structure of Cutting and Polishing

	Small (0.2 -0.3 carats)	Medium	Large (1.0+ carats)
		(0.3-1.0 carats)	
Financing	\$ 5.76	\$ 25.26	\$95.83
Selling, General & Admin (SG&A)	\$10.71	\$21.19	\$35.00
Production	\$54.35	\$61.93	\$78.33
Total:	\$70.82	\$108.38	\$209.16

These figures were ascertained to be average cutting costs in India by measuring the pixel height of each Financing, SG&A, and Production of the bar graphs in Figure 14. If these charts are to scale, these numbers would present as the average cost of cutting and polishing various stones, in India. What leads to Production costs being relatively stable for Small Size, Midsize, and Large Size diamonds? I imagine the size of cuts increases as carat size increases, but financing costs increases exponentially as do SG&A costs. Does this account for risk of inclusions in the cut and polished stone? Is there a lag in time of sale for larger diamonds? I imagine financing is not paid until a stone is sold, and if it sits on the "shelf" for a longer duration of time, financing costs would increase. If sold with velocity, profit would be higher, since the cost of financing decreases, as prices are determined from the sale of previous gems relative to the time of the current stone being sold.

According to figure 1 of Bain's 2019 report, the bargaining power at this stage is low, and the financing comes from specialized diamond banks.<sup>113</sup> According to figure 16 of the same report, a purchasing loan is used to finance the sale from miner to the cutting and polishing stage, and a receivables financing loan is used to finance the stage between the cutter & polishing and retailer.<sup>114</sup> The duration of the former is 90-100 days, and the duration of the latter is 150-200 days.

 $<sup>^{113}</sup>$  Page 3 The Global Diamond Industry 2019 File: Bain Report Global Diamond 2019  $^{114}$  Ibid Page 16

According to figure 18, hedge funds and other players are offering four to seven year maturity rates, guaranteeing stable costs over the financing period.<sup>115</sup> Additionally, banks in the United Arab Emirates (U.A.E.) and the Middle East are offering more financing options.<sup>116</sup> The "traditional" midstream financing banks along with Antwerp are limiting their exposure and operations.<sup>117</sup> Indian banks have reduced their outstanding debt with more conservative financing approaches and less exposure in Antwerp, in 2019.<sup>118</sup> "Furthermore, in 2019 ABN AMRO in Antwerp and Stanic Bank in Botswana declared temporal withdrawal of financing for certain new rough purchases due to worsening profitability of the midstream."<sup>119</sup>

Cut Diamond Pricing: Establishing the average value of the diamond value chain under current market constraints

By combining Figure 3 of the Bain 2018 report, Figure 6 of the Bain 2019 report, and Figures 18 & 19 of the 2010 Bain Report, "Lifting the Veil of Mystery", I was able to derive the spreadsheet 1 carat valuation.xlsx with the following percentages for each stage of the diamond value chain calculated with \$60 billion USD as the denominator, per "Lifting the Veil of Mystery".

I began with the low numbers, and put \$12 billion over the \$60 billion for the rough stage to derive 20% of the revenue going to rough production. I attributed the middle number of 2% for rough diamond sales between 1-3% for the margin at RD Sales. Cutting and polishing received 5/60, or 8.33% per the value of \$18 billion USD less the previous stage of Rough diamond sales, \$13 billion USD. Jewelry received 17/60, or 28.33%, as \$35 billion less \$18 billion leaves \$17 billion USD remaining from the ~\$60 billion USD industry.

- <sup>116</sup> Ibid Page 17
- <sup>117</sup> Ibid Page 17
- <sup>118</sup> Ibid Page 17
- <sup>119</sup> Ibid Page 17

<sup>&</sup>lt;sup>115</sup> Ibid Page 17

To derive the high values, I made sure to incorporate polished sales into the equation. To accommodate the existence of margins at polished sales, production was decreased 95.83% to 19.17% of the value chain. Rough diamond sales was reduced 47.92% to a little less than 80 basis points. Cutting and polishing was decreased 95.83% to 7.99%. Polished sales were increased to 1.12% of the value chain. Jewelry was increased 102.60% to 29.07%, and Retail was increased 100.47 to 41.86% of the value chain.

The denominator for which I applied the Rapaport pricing to was calculated as Production + RD Sales + C&P + Jewelry, because I believe the Rapaport Report represents the value of a cut and polished diamond before it is sold at Retail.

Production was calculated as follows:

Production Production + RD Sales + C&P + Jewelry

RD Sales was calculated as follows:

RD Sales Production + RD Sales + C&P + Jewelry

C&P was calculated as follows:

C&P Production + RD Sales + C&P + Jewelry

Jewelry was calculated as follows:

Jewelry Production + RD Sales + C&P + Jewelry

Retail was calculated as follows:

 $\frac{\textit{Retail Purchase}}{1-\textit{Retail}}*\textit{Retail}$ 

*Retail Purchase* + *Retail* should equal the total price. If the purchase price of a good plus its margin equals the total price, then dividing the purchase price by its complement will derive the final price. For example, a VS1-G loose diamond is purchased from the Jewelry stage at \$5076.9231, will be

sold for \$8,703.2967 (\$5,076.9231/(1 - 0.4167). To obtain the margin at the retail stage, I multiply this outcome by the percentage of the margin (\$5,076.9231/(1 - 0.4167) \* 0.4167) = \$3,626.3736. This made sense to me, because I checked the price of loose diamonds on info-diamond.com and found IF/FL D-color 1ct diamonds trading for a few dollars under \$15,000. This means that a diamond set in jewelry sells at retail for a price between \$1,054.9451 (I3 M-color) and \$22,135.6522 (IF/FL D-color) for a pear, and \$1,450.5495 (I3 M-color) and \$34,744.000 (IF/FL D-color) for a brilliant round.

The Rapaport Pricing is from a WhatsApp conversation with a colleague in 2019. Since diamonds generally trade 15-30% below the Rapaport price guide,<sup>120</sup> prices have been adjusted to reflect this. It is not uncommon for some diamonds to trade at prices above Rapaport's pricing guide. According to the two discounted models of "1 carat valuation.xlsx", the mean retail price of a diamond ranges from \$5,560.0400 to \$7,252.1455 under the given constraints, while the median price lies between \$4,681.3187 and \$6,106.0000. The color and clarity are marked in gold and red for median and mean prices, respectively on the Rappaport Pricing for 2018. This implies that the data has a right skew. Figure 19: Pricing for 1 carat Pears on 2018 Rappaport Report

PEARS		RAPA	PORT	(1.0	0 - 1.	49 C	T.):	09/1	4/18	l.		
	IF.	VVS1	VVS2	V51	VS2	Sil	SI2	513	11	12	13	
D	148	110	98	80	75	65	56	45	34	22	13	D
E	110	98	84	75	70	63	54	43	33	21	12	E
F	97	85	75	70	68	61	52	41	32	21	11	F
G	78	72	69	66	64	58	50	40	30	20	10	G
н	66	60	57	56	54	52	46	38	29	19	10	н
	54	52	50	49	47	45	41	34	27	18	10	
L	48	45	43	41	39	37	35	29	24	16	9	J
к	39	36	35	33	31	30	28	24	20	15	9	к
L	33	31	30	29	27	26	25	21	18	13	9	L
M	28	26	24	23	22	21	20	19	15	11	8	м
	PE	ARS		PEA	RS		PE	ARS			PEA	RS

Figure 20: Pricing for 1 carat Rounds on 2018 Rappaport Report

<sup>&</sup>lt;sup>120</sup> Page 118 Opting out of the Legal System: Extralegal Contractual Relations In The Diamond Industry" 1992

R	DUN	DS	RA	PAPOR	et : (1	.00 -	1.49	CT.)	: 09	/14/1	8		
3		IF.	VV51	VV52	VSI	VS2	5/1	512	513	п	12	13	
5	D	202	159	141	122	108	86	70	58	47	27	17	D
4	E	152	140	117	108	96	82	67	56	45	26	16	E
4	F	130	120	107	102	90	79	64	54	44	25	15	F
3	G	107	102	95	90	83	74	60	52	42	24	14	G
3	н	90	85	82	80	76	68	57	49	40	23	14	н
2		76	72	70	68	66	62	53	46	36	22	13	T.
1	J	63	61	60	59	57	53	48	42	33	20	13	J
0	к	53	51	49	47	45	43	39	36	31	18	12	ĸ
9	L	48	46	45	43	41	38	35	33	29	17	11	L
В	м	43	41	39	38	36	34	30	28	26	16	11	м

Establishing a value chain where Rough Diamond Miners receive double the pay

In order to make sure diamond prices are not inflated, I anchored all prices relative to the retail prices under current market constraints. I did this by taking the final price of the retail stage under current market constraints, and adjusting the price of each stage of a diamond's journey from "mine to finger". Thus, the final price of a diamond set in jewelry and sold at retail remains unchanged regardless of the asking price.

Since the rough diamond production value was ~19.17%, I doubled it to 38.33%. Also, since rough diamond sales are based on commission, and to ensure that sales offices receive a fair share of the prices, I kept commission of rough diamond sales the same, but used the high-end margin commission of three percent (3%) to give the sales office a fair share of the final price as well. Rough diamond sales offices receive 1.2% of the final product sold at retail:

((38.33% \* 1.03) - 38.33%) \* 100% = 1.15%

In order to find out the "true" value of cutting and polishing, I removed the value of financing a diamond weighing over one carat. I also removed the sales, general & administration (SG&A) fee at this

stage as it is factored in in the next step. By taking the weighted average of all three pricing structures ascertained under the "old" pricing model, I derived the value of cutting and polishing to be<sup>121</sup>:

 $\frac{Mean C\&P | Pear, Round: Low, High, Rappaport}{Mean Retail | Pear, Round: Low, High, Rappaport} * \frac{\$78.33}{\$209.16} * 100\% = 3.03\%$ 

Or:

$$0.0809 * \frac{\$78.33}{\$209.16} * 100\% = 3.03\%$$

Cut and polished diamond sales were calculated to be the following:

$$\frac{Mean Polished Sales | Pear, Round: Low, High, Rappaport}{Mean Retail | Pear, Round: Low, High, Rappaport} * 100\% = 0.79\%$$

Or:

$$0.0079 * 100\% = 0.79\%$$

The jewelry stage received the weighted average of:

 $\frac{\textit{Mean Jewlery | Pear, Round: Jewlery Low, High, Rappaport}}{\textit{Mean Retail | Pear, Round: Retail Low, High, Rappaport}} * 100\% = 28.86\%$ 

This means that retail was left with the compliment of the preceding stages for it's margin:

100% - (40% + 1.2% + 3.71% + 0.79% + 28.86%) = 27.84%

Comparing the "old" pricing structure to the hypothetical pricing structure:

Table 3: Comparing the "Old" model to the "Hypothetical" model

	Share of Total	Share of Total	Percentage Point	Percent
	"Old: High"	"Hypothetical"	Change	Difference
Production	19.17%	38.33%	+19.17%	100.00%
RD Sales	0.79%	1.12%	+00.40%	44.00%
Cut & Polish	7.99%	3.03%	-4.96%	-53.60%

<sup>&</sup>lt;sup>121</sup> I am acknowledging that this weighted average accounts for the "high" value of cutting and polishing twice and the "low" value of cutting and polishing once

Polished Sales	1.11%	0.79%	-0.33%	-29.08%
Jewelry	29.07%	28.86%	-0.21%	00.74%
Retail	41.86%	27.84%	-14.02%	-33.50%

Under the hypothetical pricing structure, Jewelry receives a 0.74% increase in pay, RD sales sees

a 44.00% increase, and production sees a 100.00% increase. Cut & Polishing, Polished sales, and Retail

absorb the cost of doubling the pay to miners.

The following are mean and median prices under the "hypothetical" model:

Figure 21: Mean and median prices under for pears under hypothetical model

PE	ARS		RAPA	PORT	(1.0	0 - 1.	49 C	I.):	09/1	4/18				
		IF.	VVS1	VVS2	VS1	V52	511	SI2	513	11	12	13		
	D	148	110	98	80	75	65	56	45	34	22	13	D	
	E	110	98	84	75	70	63	54	43	33	21	12	E	
	F	97	85	75	70	68	61	52	41	32	21	11	F	
	G	78	72	69	66	64	58	50	40	30	20	10	G	
	н	66	60	57	56	54	52	46	38	29	19	10	н	
	1	54	52	50	49	47	45	41	34	27	18	10		
	J	48	45	43	41	39	37	35	29	24	16	9	J	
	ĸ	39	36	35	33	31	30	28	24	20	15	9	к	
	L	33	31	30	29	27	26	25	21	18	13	9	L	
	м	28	26	24	23	22	21	20	19	15	11	8	м	
PEARS					PEA	RS	PEARS					PEARS		

Figure 22: Mean and median prices for rounds under hypothetical model

R	OUN	DS	RA	PAPOR	RT : (1	.00 -	1.49	CT.)	: 09	/14/1	8	1	-
3		IF.	VV51	VV52	VST	VS2	SII	512	513	п	12	13	1
5	D	202	159	141	122	108	86	70	58	47	27	17	D
4	E	152	140	117	108	96	82	67	56	45	26	16	E
4	F	130	120	107	102	90	79	64	54	44	25	15	F
3	G	107	102	95	90	83	74	60	52	42	24	14	G
3	н	90	85	82	80	76	68	57	49	40	23	14	н
2	1	76	72	70	68	66	62	53	46	36	22	13	I.
1	J	63	61	60	59	57	53	48	42	33	20	13	J
0	к	53	51	49	47	45	43	39	36	31	18	12	к
9	L	48	46	45	43	41	38	35	33	29	17	11	L
в	м	43	41	39	38	36	34	30	28	26	16	11	м
			W: 111.36 = 0.00%			0		T: 58.40 = 0.009					

Where the hypothetical model falls short

Due to the fact, that this can be considered an Environmental, Social, and Governance (ESG) investment, people would be willing to pay a higher price for the diamonds under this model. Thus, for an IF clarity, D-color diamond, I would not be surprised if the value of the retail would command a \$9,672 margin with a retail purchase of \$19,221.7610 purchase price. Thus, the margin could still be as high as 33.47%, and not the weighted average prediction of 27.84%. In other words, the Retail price of a diamond would sell at roughly a 20% loss compared to "old" model. I derived these numbers by using the Retail (Low) purchase price along with the Retail (Rappaport) high purchase price. I believe it is all in how the story of the diamond is told.

### Fancy Color Diamonds

Fancy color diamonds are unlike "colorless" diamonds. Due to the vibrant nature of their color, pricing does not rely on inclusions, but most of the value is placed on color.

Figure 22 122



Figure 23<sup>123</sup>



 $<sup>^{122}</sup>$  Page 93 Characterization and Grading of Natural-Color Yellow Diamonds  $^{123}$  Ibid, Page 93