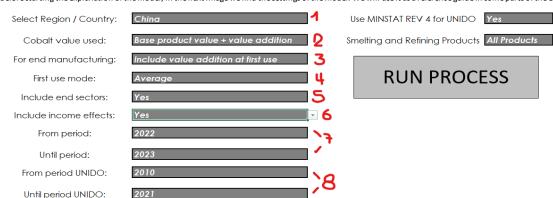
Methodology Main Model

The main goal of the model is to provide the effect the Co increasing industry as average historical and forecast:

- Labour Income - Employees - Tax Contribution

- Output

 $Before \ starting \ the \ explanation \ of \ the \ model, \ in \ the \ next \ image \ we find \ the \ settings \ of \ the \ model. \ We \ will \ use \ it \ as \ a \ reference \ guide \ in \ some \ parts \ of \ the \ explanation$



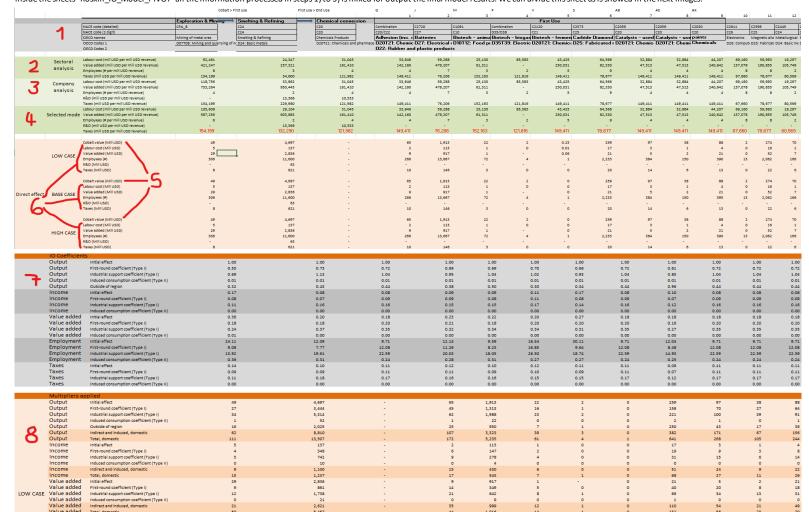
The explanation is divided into the next sections and it is sorted regarding the current flow of proccesing:

 $\textbf{1)} \ \textbf{Calculating the OECD's multipliers: see sheet "Methodology Main Model-OECD"}\\$ 2) Calculating the Unido averaged indicators: see sheet "Methodology Main Model-UNIDO" 3) Getting the Prices and Co data: see sheet "Methodology Main Model-Co Data" 4) Putting all together and getting final results 5) Global region vs individual region

4) Putting all together and getting final results

6) Summary sheet results

 $Inside the sheets "Roskill_IO_Model_PIVOT" all the information processed in steps 1) to 3) is mixed for output the final model results. We can divide this sheet as is showed in the next images: the sheet are showed in the next images in the next images in the next image. The sheet are showed in the next images in the next image in t$



(1) This is the header of the sheet. Basically, it contins the description of each application for MSR, First Use, End Use and Recycling applications. The descriptions are used for get the values from OECD (see point 7 below) In case of a description has two OECD's codes, the values are averaged to get the final value from OECD.

(2) Sectorial Analysis information: The process gets the final indicators from Unido (see the section "c) Calculating the final averaged indicators for each application: "inside sheet "Methodology Main Model-UNIDO") in each row in here for each application.

(3) Company Analysis: The process gets the final indicators from Co Data (see the section "c) Calculating the final averaged indicators for MSR:" inside sheet "Methodology Main Model-Co Data") in each row in here for "Mining" and "Smelting and & Refining" applications. Because the "Representative Companies Analysis" just have data about MSR, for the First Use, End Use and Recycling applications the value is equal to the value from Sectorial Analysis This way, the MSR applications are the only ones that have both point of view. For the rest, the value to take in care is the Sectorial Analysis

(4) This section consolidates the information from "Sectorial" and "Representative Companies" Analysis, depending of what option is currently setting in the initial configuration "First Use Mode" (item 4 of filter image)

Basically, the next rule or formula is applied: - If the value of the filter is "ISIC sectoral analysis", then the process takes the value of point (2). Also, the R&D will be 0 for MSR and First Use applications

- If the value of the filter is "Representative Companies", then the process takes the value of point (3) - If the value of the filter is "Average", then the process takes the average between the value of point (2) and the value of point (3). The R&D is equal to the value of point (3)

(5) Cobalt Value: Represents the average per year of cobalt's production value, considering the years filtered from "FROM PERIOD" to "TO PERIOD" (item 7 of filter image).

One important observation is that this value is the same for historical data, so, basically, if we limit the "FROM PERIOD" and "TO PERIOD" to historical years, we will the same result for each scenario. This way, we can emulate the result of the original model without taking into account any forecasting component

(6) The "Direct Effect" result. Basically, each row is the result of multiplier the Cobalt Value (point (5)) with each of the indicators in point (4). Conceptually, each of the indicators in point (4) represents the relation between Labour Cost, Value Added, Employees, Taxes and R&D with the Total production value. So, multiplying each of this with the Cobalt Production Value (point (5)), the process calculates which is the effect of Cobalt Production in Labour Cost, Value Added, Employees, Taxes and R&D. In a few words, it calculates what is the portion of each indicator that could be explained only by Cobalt Production

 $(7) \ IO\ coefficients: This\ is\ taken\ from\ OECD\ final\ results\ (see\ sheet\ "Methology\ Main\ Model-OECD").\ Basically,\TBD$

(8) This, together with (6), are the final output of the model. The results are calculated multiplying the IO Coefficients (point (7)) and the Cobalt Value Production (point (5)). Conceptually TBD

5) Global region vs individual region

 $If we select a particular region that is not "Global", then, the calculations performed are the descripted above. This final results are pasted into the sheet "Roskill_IOModel", that is where anyone can find the final output. The final results are pasted into the sheet "Roskill_IOModel", that is where anyone can find the final output. The final results are pasted into the sheet "Roskill_IOModel", that is where anyone can find the final output. The final results are pasted into the sheet "Roskill_IOModel", that is where anyone can find the final output. The final results are pasted into the sheet "Roskill_IOModel", that is where anyone can find the final output. The final results are pasted into the sheet "Roskill_IOModel", that is where anyone can find the final output. The final results are pasted into the final output. The final results are pasted into the final output. The final results are pasted into the$ For the case of Global Region, what is saved in this sheet is the sum of each of the calculations performed for each of the individual regions. Is important to observe that the result of the calculations above over the processed data for Global Region is not equal to the result of the sum. Because of this, the process has to do the calcutions per each region, and not do the calculations just filter the Global region

6) Summary sheet results

In the summary sheet we will see two main tables (see images below):

a. The table with the final output for each indicator and each scenario. In this case, the data is getting from point (8) of "4) Putting all together and getting final results", and is processing like:

1) For "Production of cobalt", the process sum the applications of MSR 2) For "Direct applications", the process sum the First Use applications

3) For "End Manufacturing", the process sum the End Use applications 4) For "Reciclyng", the process takes the final output for Reciclyng application 5) In "Total", the process sum the results for all the applications in the upper points

	LOW CASE					BASE CASE					HIGH CASE				
	Production	Direct	End			Production	Direct	End			Production	Direct	End		
	of cobalt	applications	manufacturin	Recycling	Total	of cobalt	applications	manufacturin	Recycling	Total	of cobalt	applications	manufacturin	Recycling	Total
Value addition															
Direct effect	3,651	1,231	623	150	5,656	4,564	1,539	779	188	7,070	5,477	1,847	935	225	8,484
First-round requirement	1,132	589	668	102	2,491	1,415	737	835	127	3,114	1,698	884	1,002	152	3,737
Industrial support	2,279	1,061	1,165	162	4,667	2,849	1,326	1,456	202	5,833	3,419	1,591	1,747	243	7,000
Income effect	28	14	14	2	58	35	17	17	2	72	42	21	21	3	87
Total	7,091	2,895	2,470	416	12,872	8,863	3,619	3,088	520	16,090	10,636	4,343	3,705	624	19,308
Labour income															
Direct effect	180	179	145	183	687	225	224	181	229	859	270	269	218	275	1,031
First-round requirement	457	254	297	43	1,052	572	318	371	54	1,314	686	381	445	65	1,577
Industrial support	973	467	518	73	2,031	1,217	583	648	91	2,538	1,460	700	777	109	3,046
Income effect	14	. 7	7	1	28	17	9	8	1	35	21	10	10	1	43
Total	1,624	907	967	300	3,798	2,030	1,134	1,209	375	4,748	2,436	1,360	1,450	450	5,697
Employees															
Direct effect	14,096	23,699	15,659	1,597	55,051	17,620	29,624	19,573	1,996	68,814	21,144	35,549	23,488	2,396	82,577
First-round requirement	48,046	28,818	32,361	4,966	114,191	60,057	36,022	40,451	6,207	142,738	72,069	43,226	48,542	7,449	171,286
Industrial support	120,798	59,344	66,010	9,651	255,804	150,997	74,180	82,513	12,064	319,754	181,197	89,016	99,015	14,477	383,705
Income effect	1,924	951	945	137	3,957	2,405	1,189	1,181	171	4,946	2,885	1,427	1,417	205	5,935
Total	184,864	112,812	114,975	16,351	429,002	231,080	141,015	143,719	20,439	536,253	277,296	169,218	172,463	24,527	643,504
Tax contribution															
Direct effect	818	286	558	63	1,724	1,022	357	697	78	2,155	1,227	429	837	94	2,586
First-round requirement	556	286	326	47	1,215	695	357	408	59	1,518	833	428	490	70	1,822
Industrial support	1,104	507	555	75	2,242	1,381	634	694	94	2,803	1,657	761	833	113	3,363
Income effect	11	. 6	6	1	23	14	7	7	1	29	17	8	8	1	35
Total	2,489	1,084	1,445	186	5,204	3,111	1,355	1,806	232	6,505	3,734	1,626	2,167	279	7,806

b. The summary table and charts of Cobalt focused information

The table is splited into "Value of Cobalt" and "Volumes of Cobalt" 1) For "Value of Cobalt", the process takes the values from point (5) of "4) Putting all together and getting final results", for each scenario.

2) For "Volumes of Cobalt", the process takes the information directly from Co Data (sheets "Co_MSR", "Co_First_Use", "Co_End_Use" and "Co_Recycling". Basically, these values are the sum of Cobalt Production volumes for each of the applications (depending of the column, it could be Mining, Smelting and Refining, First Use, End Use or Reciclyng) averaged by the "PERIOD FROM"-"PERIOD TO" filters

