World Bank's Assessment Is Flawed - Manufacturing Is Viable in Iraq Additional Reflections on Iraq's Industry. By Humam Miscone*

These additional reflections are prompted the article of Dr. Amer Hirmis entitled "World Bank's Assessment Is Flawed: Manufacturing Is Viable in Iraq… Preliminary Brief Comments!" (Hirmis, 2021), which provided critical assessment and comments and challenged some of the analyses and recommendations provided in a recent WBG document entitled "Breaking Out of Fragility A Country Economic Memorandum for Diversification and Growth in Iraq" (WBG Memorandum) (October 2020). Initially, I would like to recognize and record my general agreement with the arguments and comments of Hirmis (2021).

The WBG Memorandum's envisaged a vision for Iraq's economic diversification and growth that, while concentrated on agriculture and agroindustry, completely ignored the manufacturing industry that flourished in Iraq in the 1960s - 1980s. Instead, the WBG Memorandum vision actually brings Iraq's economy back 70 years ago, to the early 1950s, when Iraq used to be net exporter of crude oil, wheat and dates and had nascent industrial sector, limited to textile and some construction material industries.

These additional reflections are intended to support the arguments on Hirmis (2021) regarding the manufacturing industry and to provide information and evidence that manufacturing industry, particularly mining, mineral and chemical industries, could be of equal importance to agriculture, agroindustry and even oil industry and could ensure the aspired economic diversification, growth, job creation as well as integrated and balanced territorial development.

The much - needed economic diversification that the WBG Memorandum re - stressed, must consider the entire potential of the natural, human and cultural resources that Iraq have. Yet, the WBG Memorandum completely overlooked that Iraq has an enormous and diversified wealth of industrial rocks and minerals and construction raw material that became, over the period of the 1960s - 1980s, the basis for the massive chemical, fertilizer and construction materials industries.

Since the mid - 1950s, Iraq's Development Board initiated the geological survey and reconnaissance mineral exploration programme. These were then complimented with extensive detailed mineral prospecting and development that led to the exploitation of several industrial rock and mineral resources, including native sulfur deposits in Al Mishraq, Ninawa Governorate (1970), phosphate rock (1977 - 1987), silica (quartz) sands (1962), kaolin (1962 - 1987), bentonite (1984 - 1987), flint clay and bauxitic clays (1990 - 1996), montmorillonite (1983 - 1987), attapulgite (palygorskite) (1983 - 1987), porcellanite (1987), quartzite (1990), heavy minerals (zircon and ilmenite) (1984 - 1987), all in Al Anbar Governorate, globurite (sodium sulfate) (1994 - 1998) in Salahaddin Governorate, dolostones (1972 - 1990) in Kurdistan Region, Ninawa and Al Anbar Governorates, feldspathic sands (1996) in Al Najaf Al Ashraf Governorate and native salt (1978 - 1986) in Al Muthan'na and Al Basra Governorates.

Iraq has also huge resources of building raw materials, including brick clay in the central and southern parts, aggregates (gravel and sand) all over Iraq, gypsum in the central and southern parts, marble and dimension stones in Kurdistan Region, Ninawa and Al Anbar Governorates, cement raw material (limestone, clay and gypsum) in Kurdistan Region, Ninawa, Kirkuk, Al Anbar, Al Najaf Al Ashraf and Al Muthan'na Governorates, all have been only partially exploited. However, all prospecting, development and mining activities ceased almost completely since 2003 except for cement raw material, brick clays and aggregates.

This huge and diversified wealth of industrial minerals and rocks have been and could be exploited to produces numerous industrial products that could satisfy the increasing demand in the domestic market as well as export.

Although this short comment isn't intended to provide extensive details on Iraq's mineral raw material - based industries, I will provide some short and selected examples only.

An Integrated Fertilizer Industry

Over the period 1970 - 1990, Al Mishraq Sulfur Mine (M1) produced an average 250,000 - 400,000 tons per annum, mostly used to produce sulfuric acid in several plants, including Al Mishraq Sulfur Mine itself, Al Qaim and Sad'dat Al Hindiya (Babil Governorate). In addition, and over the same period, Iraq produced about 100,000 tons per annum of sulfur from hydrogen sulfide associated with crude oil in the Sulfur Extraction Plant, Kirkuk Governorate. Then Iraq used to export native sulfur, with India, China as key customers. However, with Al Qaim Fertilizer Plant commissioned in 1983, it consumed most of the sulfur produced to make sulfuric acid, which was used in extracting P_2O_5 from the phosphate rock and transform to phosphatic fertilizer at a capacity of one million tons per annum. Main final products included over one million tons per annum of phosphatic fertilizers (normal superphosphate and triple superphosphate), phosphoric acid, sulfuric

acid, ammonia in addition to several by-products of considerable value (fluoride salts and trace elements concentrates).

With the vast resources of natural gas, the raw material for nitrogen fertilizers (ammonium nitrates), 9,529 million tons total reserves of phosphate rock, and the availability of potash in the neigbouring Jordan, Iraq had, and still, the potential of producing compound (NPK) fertilizers, a vital requirement for agriculture, whether for domestic use or for export.

However, what is ironic is that the WBG Memorandum concluded that reviving agriculture and agroindustry will "serve as a pillar of a more diversified and private sector–led economy" and will achieve the aspired economic diversification, but ignored that fertilizers are an essential requirement for agriculture, and that Iraq has the raw material and the facilities for integrated fertilizer industry that needs rehabilitation now, then upgrading and expansion later!

Note also, for instance, the case of Khor Al Zubair Fertilizer Plan (KZFP) in Al Basra Governorate. The KZFP comprise 2 trains and had a design capacity of 1.06 million tons per annum of urea in addition to liquid ammonia as intermediate product and liquid nitrogen and ammonium hydroxide as by-products. Urea production capacity exceeded domestic demand then, with the excess exported to India and Southeast Asia. However, the production capacity declined to about 280,000 tons per annum in 2004 and stopped almost completely in 2007 due to shortage in natural gas, the key raw material. In 2008, MoIM and JBIC (JICA as of October 2008) initiated Khor Al Zubair Fertilizer Plant Rehabilitation Project (IQ-P6) at a total cost of US$ 156 million under the US$ 3.5 billion ODA Loan Scheme to Iraq. In 2017, one of the 2 trains (each has 1,600 tons per day design capacity) resumed production at 300,000 tons per annum, which is about 70% of the design capacity. With urea sold to the Ministry of Agriculture at IQD 450,000 per ton, the State Fertilizer Co. - Southern Region achieved IQD 135 billion (then about US$ 114 million) of urea sale revenues in 2018 and satisfied about 30 - 35% of domestic demand. This example confirms that manufacturing is fundamental to Iraq's economic diversification and development and, particularly, to create the much-needed jobs.

A Lesson from Saudi Arabia and Iran

Both Kingdom of Saudi Arabia (KSA) and Iran have, to various extents, oil dominated economies and both enjoy vast and diversified mineral resources, including metallic ores, that much exceed Iraq's mineral resources. Yet, despite their mineral wealth, Saudi Arabia and, to some extent, Iran, managed to attain economic diversification via extensive mining and mineral industries.

As of March 2018, KSA's mineable mineral resources had a market value of US$ 1.3 billion [1], and included a variety of metallic ores (gold, copper, base metals), industrial rocks (bauxite, phosphate, silica sand, clays) and construction raw material (marble, granite, basalt). The contribution of the manufacturing sector, which included aluminum, fertilizers, petroleum refining, and steel production, amounted to 12.4% of the GDP in 2015.

KSA plans to make mining and mineral industry the third pillar of the economy, alongside oil and downstream petrochemical production and is seeking to increase mining and mineral industry contribution to GDP from an average of US$ 3 billion over the period 2013 - 2018 to US$ 64 billion by 2030 and create +25,000 new jobs by then.

KSA started producing phosphatic fertilizers in 2011, and has now 2 plants in operation with a total capacity of 2.9 million tons per annum of DAP and 440,000 tons per annum of downstream products [2]. Most of the production is exported. A new phosphate fertilizer plant will be commissioned in 2022 and will produce various phosphatic fertilizers and downstream products at a total capacity of 3 million tons per annum[3].

Since 2014, KSA si producing 1.8 million tons per annum of alumina (aluminum oxide) using the massive bauxite deposits in Qaseem. The alumina is used to extract aluminum metal at a capacity of 839,000 tons per annum [4].

Moreover, KSA produced an average of 11.63 metric tons of gold per annum over the period 2017 - 2019 from 6 gold mines in Al Hijaz and 24,970 metric tons of copper metal in 2018 from one mine in Al Hijaz as well.

In addition to expanding the existing mining and mineral processing facilities, KSA's Mining and Mineral Industry Strategy 2025 envisages exploitation of the vast non - metallic

[1] International Trade Administration - U.S. Department of Commerce, 2019. Saudi Arabia - Country Commercial Guide: Mining and Minerals. https://www.trade.gov/knowledge-product/saudi-arabia-mining-and-minerals#:~:text=The%20most%20developed%20and%20lucrative%20sector%20of%20the,in%202017%2C%20and%20produced%20275%2C000%20ounces%20in%202018 (accessed on March 29, 2021)

[2] Taib, Mowafa, 2019. The Mineral Industry of Saudi Arabia. United States Geological Survey (USGS) 2015 Minerals Yearbook, pp. 60-1 to 60-10. https://prd-wret.s3-us-west-2.amazonaws.com/assets/palladium/production/atoms/files/myb3-2015-saudi-arabia.pdf (accessed on March 29, 2021).

[3] Saudi Arabia Mining Co. (Ma'aden). Our Business: Phosphate. https://www.maaden.com.sa/en/business/phosphate (accessed on March 29, 2021).

[4] Taib, Mowafa, 2019. The Mineral Industry of Saudi Arabia. United States Geological Survey (USGS) 2015 Minerals Yearbook, pp. 60-1 to 60-10. https://prd-wret.s3-us-west-2.amazonaws.com/assets/palladium/production/atoms/files/myb3-2015-saudi-arabia.pdf (accessed on March 29, 2021).

mineral s and industrial rocks, including feldspar and feldspathic sands, silica sands, mineral fillers, limestone and basalt [5].

Iran has huge resources of some 68 types of metallic ores and industrial minerals and rocks, totaling to about 37 billion and 57 billion tons of proven and potential tons reserves, worth US$ 770 billion in 2014. In 2005, mining contributed 0.6% to GDP while mineral industries contributed about 4% [6]. In 2014, these contributions increased modestly to 1% and 5% respectively, probably due to international and U.S. imposed sanctions, and the associated investment shortfall [7]. In 2014, with a total production of 29,467,156 tons of industrial minerals, Iran ranked 8th in the world and contributed 3.76% of world production [8].

In 2015, Iran's mining and mineral industry produced [9]:

- 355,000 tons of aluminum metal and 241,000 tons of alumina using Jajarm bauxite deposits;
- 39.4 million tons of iron ore, exported 13.1 million tons and produced 22 million tons of steel;
- 450,000 tons of zinc and 420,000 tons of lead from 60 active mines and processing sites;
- 170,000 tons of magnesite (magnesium carbonate);
- +500,000 tons of barite (barium sulfate), planned to be increased to one million tons per annum;
- 2.3 million tons of sulfur using H_2S associated with natural gas and as by-product of metallurgical processes;
- 1.47 million tons of coal, which is only 54% of the overall production capacity of 2.7 million tons per annum;
- 21 tons of uranium ore out of 1,390 tons of indicated reserves and 3,134 t of inferred reserves. New resources have been discovered in 2015 and probably exploited,
- An estimated 21,000 kilograms of gemstones and turquoise.

[5] Ibid and Michaelsen, Frederik and Al Ohali, Mosaed, 2020. Saudi Arabian Mining Company (Ma'aden) Investor Presentation –Q3 2020 Results. https://argaamplus.s3.amazonaws.com/8a189bee-2283-4e79-8574-9813d2838afb.pdf (accessed on March 30, 2021)>

[6] Wikipedia, the Free Encyclopedia. Mining in Iran. https://en.wikipedia.org/wiki/Mining_in_Iran (accessed on March 29, 2021).

[7] Hastorun, Sinan, 2019. The Mineral Industry of Iran - United States Geological Survey (USGS) 2015 Minerals Yearbook, pp. 50-1 to 50-14. https://s3-us-west-2.amazonaws.com/prd-wret/assets/palladium/production/mineral-pubs/country/2015/myb3-2015-ir.pdf (accessed on March 30, 2021).

[8] Ganji, Alireza, 2016. Iranian Industrial Minerals: An Exciting Future for the Industry. Industrial Minerals International Congress and Exhibition 2016, Prague, Czech Republic. http://www.indmin.com/events/download.ashx/document/speaker/8915/a0ID000000Zwx72MAB/Presentation (accessed on March 30, 2021).

[9] Hastorun, Sinan, 2019. The Mineral Industry of Iran - United States Geological Survey (USGS) 2015 Minerals Yearbook, pp. 50-1 to 50-14. https://s3-us-west-2.amazonaws.com/prd-wret/assets/palladium/production/mineral-pubs/country/2015/myb3-2015-ir.pdf (accessed on March 30, 2021).

Saying the above Iran, and particularly KSA, managed to achieve considerable level of economic diversification via extensive mining and establishing mineral processing and utilization industries and value chains, whereby hydrocarbon resources served either as raw material or source of relatively inexpensive energy. This integrated approach is needed and should be seriously considered for Iraq.

What about Iraq?

The table that follows provide condensed summary of Iraq's industrial minerals and rocks, resources and reserves and extant and potential industrial uses. The information provided in the table indicate that Iraq, just like Iran and KSA, can achieve economic diversification and job creation via the exploitation, processing and extraction of the huge and diversified mineral resources.

Revitalizing and developing Iraq's mineral industries will definitely require massive investment, technical assistance and improved business environment on the intermediate - and long - terms. And this is where Iraq's international development partners, including the WBG and JICA, may provide support. But on the short - term, Iraq needs specific and targeted interventions that can create relatively "quick wins" that attract and encourage private investments, whether as PPPs in existing plants and facilities or as new, exclusively private investments. In this regard, the WBG, including the IFC, and JICA may consider, as priority, and in collaboration with MoIM, rehabilitating and upgrading the Phosphatic Fertilizer Plant in Al Qaim, Akshat Phosphate Rock Open Cast Mine, Al Mishraq Sulfur Mine and the relevant service infrastructure, particularly Beiji - Akashat - Al Qaim railway and a 400 KV power transmission line.

In addition to the above, exploiting Iraq's resources of industrial minerals and rocks will provide an excellent opportunity for the so - called "small scale mining", which will contribute to regenerating local economies and create the much-needed job opportunities. And this will be the subject of a forthcoming article.

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#	Mineral Raw Material	Resources [a]/ Reserves [e]				Uses		Remarks
		Measured [b]	Indicated [c]	Inferred [d]	Total	Extant	Potential	
1.	Phosphate (ton)	4,853,165,537	3,878,339,630	797,584,833	9,529,090,000	Phosphatic fertilizers (normal superphosphate and triple superphosphate), phosphoric acid, sulfuric acid, ammonia fluoride salts and trace element concentrates	NPK fertilizers, pelletized organo-mineral **fertilizers** POMF)	7 deposits in the Western Desert, Al Anbar Governorate, only one (Akashat) exploited. P_2O_5 17.50 - 21.94%
2.	Native Sulfur (ton)	281,665,016	173,580,300	295,398,244	750,643,560	Sulfuric acid, alum (using bauxitic and flint clays as raw material), fungicide,	Agrochemicals, pharmaceuticals, fungicides, pesticides, bactericide, vulcanization agent, etc.	5 deposits (Al Mishraq 1, 2, 3, 4 and Laz'zaga) in Ninawa Governorate and one in Al Fat'ha, Salahaddin Governorate
3.	Kaolin							
	a. White Kaolin (ton)	----------	93,238,749	6,000,000	99,238,749	Ceramics, refractories, white cement		2 deposits in the Western Desert, Al Anbar Governorate
	b. Colored Kaolin (ton)	2,040,664	609,264,021	113,965,910	725,270,595	Ceramics, roofing tiles	Extraction of alumina	6 deposits in the Western Desert, Al Anbar Governorate
4.	Silica (Quartz) Sand (ton)	10,156,000	----------	297,654,735	307,810,735	Glass sheets, glassware, ceramics, metal casting molds	Optical glass, monocrystalline and polycrystalline silicone, metallurgical silicon, silicon alloys (ferrosilicon and magnesium ferrosilicon), silicon carbide	4 deposits in the Western Desert, Al Anbar Governorate, all of optical - grade
5.	Bentonite (ton)	341,121,000	957,867	369,906	342,448,773	Drilling mud for oil wells, purification of native sulfur, filler in sulfur agrochemicals, water pond and foundation liner	Pharmaceuticals, cosmetics, adhesives, cleansers, detergents, metal casting molds, waste disposal sites liner	4 deposits in the Western Desert, Al Anbar Governorate
6.	Montmorillonite (ton)	9,177,152	18,982,568	8,830,395	36,990,115	Drilling mud for oil wells, water well and pond sealant	Oil cracking catalysts, pharmaceuticals, cosmetics, cleansers, detergents, metal casting molds, waste disposal site sealant	3 deposits in the Western Desert, Al Anbar Governorate
7.	Bauxite (ton)	----------	1,250,000	----------	1,250,000	Refractories. alum		One deposit in the Western Desert, Al Anbar Governorate. Limited reserves
8.	Bauxitic Clays (ton)	----------	9,065,186	----------	9,065,186	Refractories. alum		One deposit in the Western Desert, Al Anbar Governorate
9.	Flint Clays (ton)	----------	985,701	----------	985,701	White cement, refractories, glass, ceramics		One deposit in the Western Desert. Al Anbar Governorate
10.	Attapulgite (Fuller's Earth) (ton)	46,996	95,417	165,725	308,138		Pharmaceuticals, absorbent in oil well drilling and oil refining, thixotropic agent for coatings, adhesives, industrial absorbents, paints and fertilizers, filler, binder and carrier in paper, pesticide and cleansing products	One deposit in the Western Desert, Al Anbar Governorate
11.	Porcellanite (ton)	----------	72,811	----------	72,811		Light weight aggregate, manufacturing of light weight cement, super filler and absorbent	One Location in the Western Desert, Al Anbar Governorate
12.	Quartzite (ton)	----------	425,000	----------	425,000		Decorative stone (wall tiles, roofing tiles, kitchen countertops, stairsteps), manufacturing of ferrosilicon and silicon carbide	
13.	Heavy Minerals (ton)							2 Locations in the Western Desert
	a. Zircon (Zirconium Silicate)	29,451					Opacifier, extraction of zirconium metal, super refractories, nuclear fuel rods, catalytic fuel converters	One location in the Western Desert, Al Anbar Governorate
	b. Illmenite (Titanium Iron Oxide)	453,622					Extraction of titanium, extraction of titanium dioxide (massively used as white pigment in paints and surface coatings, plastics, and paper and paperboard), ferrotitanium alloys	One deposit in the Western Desert, Al Anbar Governorate
14.	Felspar Sand (ton)		2,300,000		2,300,000	Ceramics and special glass		One deposit in Al Najafi Al Ashraf Governorate
15.	Sedimentary Iron Ore (ton)	33,787,984	39,693,170	1,300,000	74,781,154	Manufacturing of sulfate - resistant cement		2 deposits in the Western Desert, Al Anbar Governorate
16.	Halite (Salt) (ton)	19,558,000	53,576,000	42,369,860	115,503,860	Nutrition and food industry	MoIM conducted feasibility study and completed the detailed design in 2001 for Sodium Carbonate (Soda	15 deposits and locations all over Iraq except the Western Desert, Resources practically unlimited

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		Measured [b]	Indicated [c]	Inferred [d]	Total	Extant	Potential	
							Ash) Plant that uses Halite and Limestone as ingredients, both abundant in Iraq	
17.	Sodium Sulfate (Globurite) (ton)	5,013,860	----------	6,593,877	115,503,860	Manufacture of powder detergents	Paper pulping, laxative agent, manufacturing of starch	One Location in Al – Shara'a Salt Pan, Salahaddin Governorate
18.	Limestone (Cement - Grade) (ton)	469,330,000	202,291,000	8,417,541,000	9,089,162,000	Various types of cement		38 deposits all over Iraq except Mesopotamia. Resources practically unlimited
19.	Dolostones	5,000,000	167,638,000	416,372,000	589,010,000	Dimension Stone	Glass industry, refractories, extraction of magnesia	7 deposits all over Iraq except Mesopotamia. Resources practically unlimited
20.	Clays (Cement - Grade) (ton)	63,593,530	403,159,827	44,929,563	511,682,920	Various types of cement		24 deposits, all exploited
21.	Gypsum (ton)	76,777,380	30,702,512	182,091,520	289,571,412	Various types of cement, decorative stone		17 deposits all over Iraq except the Western Desert. All exploited
22.	Aggregates (Gravel and Sand)	----------	2,112,000,000	----------	2,112,000,000	Concrete mix, road bases and coverings, asphalt mix, water purification, landscaping	Roofing shingle	Huge resources all over Iraq
23.	Brick Clays (m^3)	67,470,563	258,964,398	240,815,087	567,250,048	Clay brick industry		At least 22 locations mostly in Mesopotamia
24.	Limestone as Dimension Stone (m^3)	3,990,000	6,290,000	240,026,000	250,306,000	Dimension and decorative stone		At least 8 deposits being exploited

(a) Mineral Resource is a concentration or occurrence of material of intrinsic economic interest in or on the Earth's crust (a deposit) in such form and quantity that there are reasonable prospects for eventual economic extraction.

(b) Measured Mineral Resource is that part of a Mineral Resource for which tonnage, densities, shape, physical characteristics, grade and mineral content have been estimated with a high level of confidence, based on detailed and reliable exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits and drill holes. The locations spaced closely enough to confirm geological and/or grade continuity.

(c) Indicated Mineral Resource' is that part of a Mineral Resource for which tonnage, densities, shape, physical characteristics, grade and mineral content can be estimated with a reasonable level of confidence, based on exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings, and drill holes. An Indicated Mineral Resource has a lower level of confidence than that applying to a Measured Mineral Resource, but has a higher level of confidence than an Inferred Mineral Resource.

(d) Inferred Mineral Resource is that part of a Mineral Resource for which tonnage, grade and mineral content can be estimated with a low level of confidence. Such Mineral Deposit is inferred from geological evidence and assumed but needs to be verified for geological and/or grade continuity. Estimation of Inferred Resources is based on information gathered through appropriate techniques from locations such as outcrops, trenches, pits and drill holes which is limited or of uncertain quality and/or reliability. An Inferred Mineral Resource has a lower level of confidence than that applying to an Indicated Mineral Resource.

(e) Mineral Reserve is the economically mineable part of a Measured or Indicated Mineral Resource. Appropriate assessments, including feasibility studies, have been carried out and include consideration of and modification by realistically assumed mining, metallurgical, economic, marketing, legal, environmental, social and governmental factors.