INTERNATIONAL ALUMINIUM

Employment in the Global Aluminium Industry, 2019

May 2021

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Objectives

The purpose of this study, by the International Aluminium Institute, is to better understand the economic contribution of the aluminium industry by collating existing information relating to direct and indirect jobs globally.

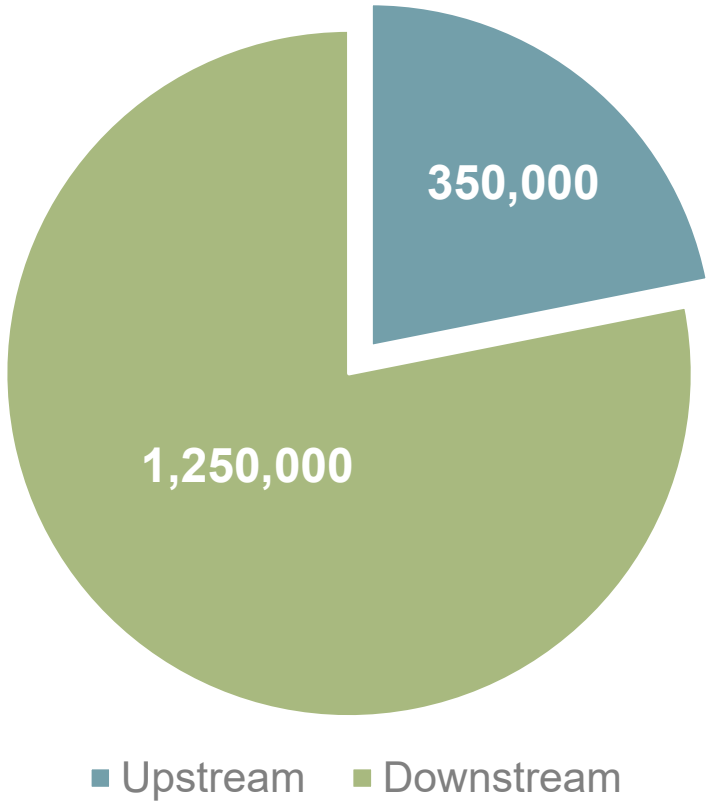
Employment numbers were developed for three sectors of the industry:

- upstream (mining, refining & smelting)
- downstream
- indirect employment

This study also identifies where employment data gaps exist and the best way to address such gaps.

Total employment in the aluminium industry, 2019

Direct employment:



x3.7*

Multiplier effect

Indirect employment:

5,925,000

Total direct + indirect:

7,525,000

*A multiplier effect of **3.7** was identified and used to calculate indirect employment.

Upstream regional employment of the aluminium industry, 2019

This table shows 2019 upstream employment numbers by region and country. The data is described in more detail on page 15 and the methodology is explained on page 14.

REGION	COUNTRY	2019 EMPLOYMENT	REGION TOTAL
GULF	Bahrain	3,181	18,414
	Qatar	1,200	
	UAE	7,236	
	Oman	975	
	Saudi Arabia	5,822	
CHINA	China	129,553	129,553
EAST & CENTRAL EUROPE	Russia	20,163	22,989
	Ukraine	2,826	
AFRICA	Mozambique	1,072	16,293
	Ghana	1,084	
	Egypt	516	
	Sierra Leone	357	
	South Africa	2,043	
	Guinea	11,101	
	Nigeria	120	

Continues...

Estimated upstream jobs (2019):

~350,000

Upstream regional employment / continued…

REGION	COUNTRY	2019 EMPLOYMENT	REGION TOTAL
NORTH AMERICA	Canada	8,805	15,925
	USA	3,100	
	Jamaica	4,020	
SOUTH AMERICA	Brazil	26,887*	28,815
	Guyana	529	
	Argentina	1,399	
OCEANIA	New Zealand	992	16,036
	Australia	14,816	
	Solomon Islands	228	
WEST EUROPE	EU28+EFTA	19,500*	19,500
ASIA (EX. CHINA)	Indonesia	3,956	82,168
	Malaysia	1,718	
	India	68,000	
	Kazakhstan	2,408	
	Tajikistan	250	
	Iran	824	
	Azerbaijan	232	
	Vietnam	4,052	
	Turkey	728	

* Includes secondary (recycled) aluminium production

Downstream regional employment of the aluminium industry, 2019

The table shows 2019 downstream employment numbers by region. The data is described in more detail on page 15 and the methodology is explained on page 14.

REGION	ROLLING	EXTRUSIONS	CASTINGS	RECYCLING	REGION TOTAL
China	143,017	189,022	137,015	151,942	**620,996**
Europe		62,000*		13,330	**75,330**
Japan		59,131*			**59,131**
South America	11,167	4,267	8,015	23,014	**46,463**
Middle East	9,525	5,743	2,672	10,203	**28,142**
North America		165,000*			**165,000**
Asia ex. China	22,258	62,622	30,448	71,812	**187,140**
Other	8,625	9,878	24,687	39,391	**82,581**

* Direct figures

Estimated downstream jobs: ~1,250,000

Case Studies

- United Arab Emirates
- United States of America
- European Union 28 (EU28) + European Free Trade Association (EFTA)
- Brazil

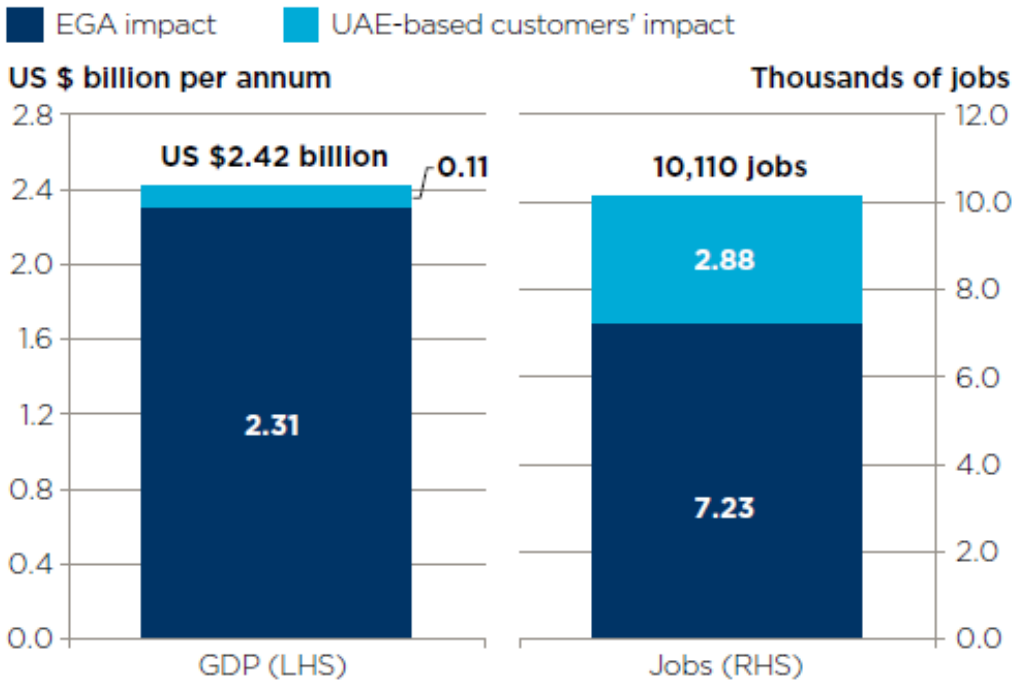
Case Study

United Arab Emirates (UAE)

'**The Impact of the Aluminium Sector on the UAE Economy**' by Oxford Economics (2018) examines the contribution that both Emirates Global Aluminium (EGA) and the wider aluminium sector make to the UAE economy.

The study found that for every individual working in the sector, a further five workers are supported in other parts of the UAE economy, due to the industry's expenditure with local suppliers and payment of wages which are then spent in the local consumer economy (indirect and induced impact).

Fig. 5: The direct GDP and jobs impacts of the UAE aluminium sector



Source: Oxford Economics

Case Study

United Arab Emirates (UAE) / continued…

Fig. 4: A standard economic impact assessment model

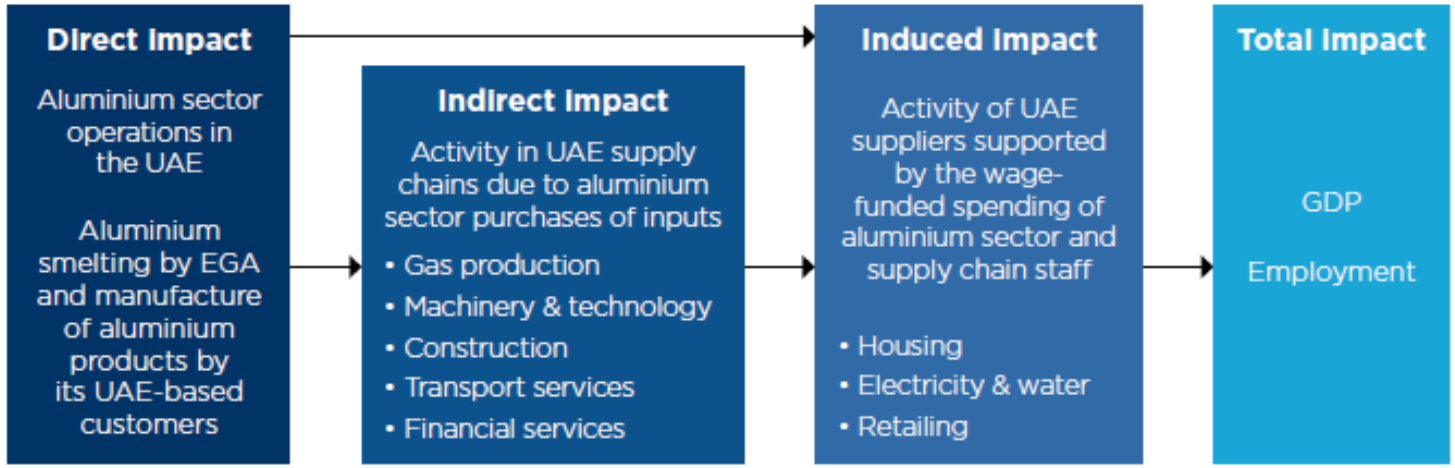
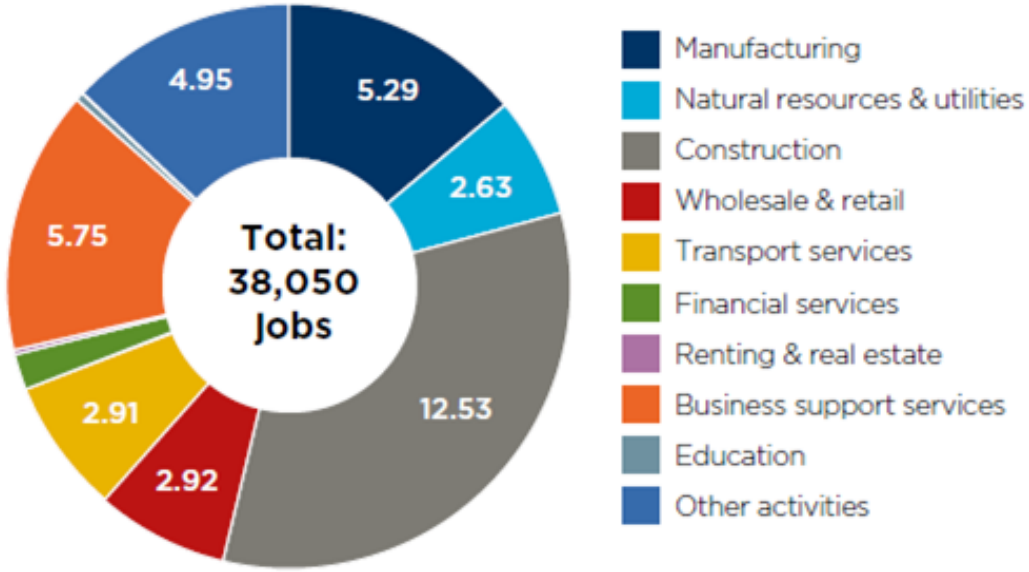


Fig. 14: Indirect Jobs Impact by sector of employer

Thousands of jobs



Source: Oxford Economics

Case Study

United States of America (USA)

'**2020 Economic Impact of the Aluminum Industry**' by John Dunham & Associates (prepared for The Aluminum Association, 2021) measures the following:

- number of jobs in the industry;
- wages paid to employees;
- total economic output;
- federal and state business taxes generated.

The study found that economic activity started by the aluminium industry generates output (and jobs) in hundreds of other industries, often in sectors and states far removed from the economic origin.

Table 1 – Economic Contribution of the Aluminum Industry[7]

	Direct	Supplier	Induced	Total
Jobs (FTE)	166,228	229,653	264,061	659,942
Wages	$12,786,133,600	$16,964,798,200	$14,960,436,700	$44,711,368,500
Economic Impact	$70,136,296,800	$54,295,856,700	$47,471,931,100	$171,904,084,600
Taxes				$15,934,382,600

Table 2 – Aluminum Industry Employment by Sector: 2013-2020 Models

	2013 (revised)	2016 (revised)	2018 (revised)	2020	growth 2018-2020	growth 2013 - 2020
Primary	12,787	4,879	3,131	4,829	54.2%	-62.2%
Secondary	9,428	9,507	9,412	8,691	-7.7%	-7.8%
Sheet+Extrusion:	61,806	62,327	63,757	62,883	-1.4%	1.7%
Foundry*	45,234	50,867	51,364	50,551	-1.6%	11.8%
Forging	10,328	10,462	10,888	10,464	-3.9%	1.3%
Coating	2,814	3,132	2,838	2,664	-6.1%	-5.3%
MSC	23,142	24,631	26,563	26,146	-1.6%	13.0%
Total Direct	165,539	165,804	167,953	166,228	-1.0%	0.4%

*2013-2016 revised estimates include addition of 8,750 jobs, representing the foundries missed in prior studies (largely captive).

Case Study

European Union 28 (EU28) + European Free Trade Association (EFTA)

'**Sustainable Development Indicators 2015 full data set**' by European Aluminium (2017) provides a comprehensive industry dataset of the European Union, covering economic performance, environmental performance and socio-economic contribution.

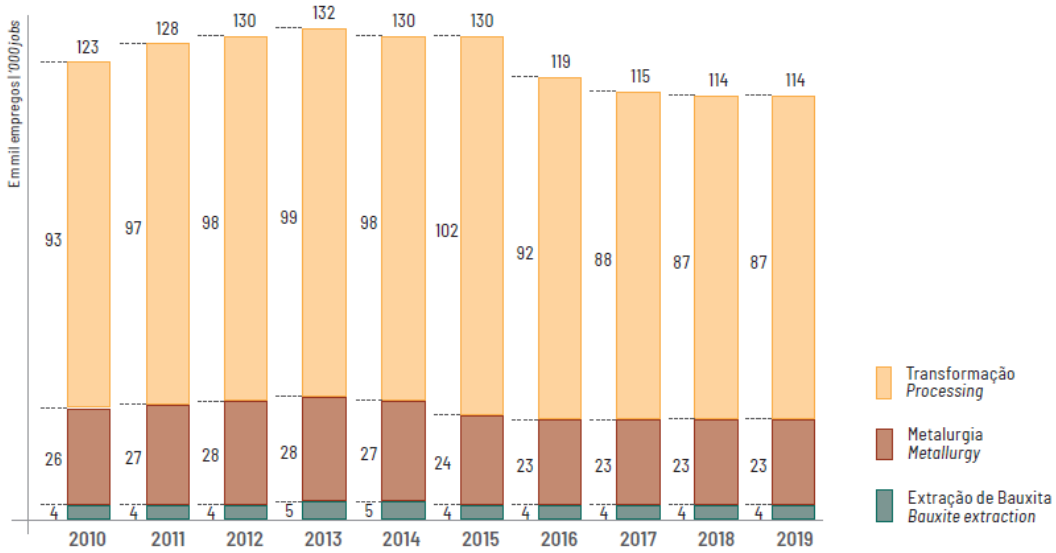
	NUMBER OF EMPLOYEES IN R&D POSITIONS							
	1997	2002	2005	2008	2009	2012	2014	2015
Alumina & Metal supply	L.D.	622	959	741	688	662	823	759
Semi-fabrication	L.D.	974	678	679	645	1.371	1.640	1.652
Aluminium industry	L.D.	1.595	1.637	1.420	1.334	2.033	2.463	2.411

	NUMBER OF EMPLOYEES							
	1997	2002	2005	2008	2009	2012	2014	2015
Alumina & Metal supply	32.450	31.051	29.614	28.235	25.932	20.579	19.350	19.732
Semi-fabrication	57.101	60.901	57.960	67.367	62.534	62.300	62.652	61.737
Aluminium industry	89.551	91.952	87.574	95.602	88.466	82.879	82.002	81.469

Case Study

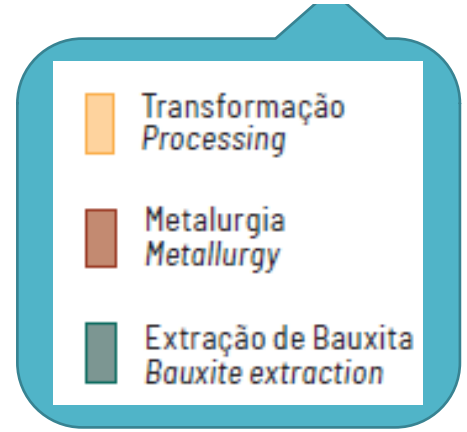
Brazil

'**Aluminum Statistical Yearbook 2019**' by ABAL - the Brazilian Aluminum Association (2020) provides a comprehensive profile of the Brazilian aluminium industry. The dataset covers jobs (direct and indirect) as well as other economic factors, such as revenue, investments, paid taxes and consumption per capita.



Jobs

	2010	2011	2012	2013	2014	2015	2016	2017	2018[r]	2019
Empregos diretos | *Direct jobs* [1]	122 523	127 877	130 107	131 609	129 655	130 288	119 444	114 972	113 827	114 015
Extração de bauxita *Bauxite extraction*	4 050	4 132	4 434	4 513	4 372	4 041	3 957	3 930	3 864	3 978
Metalurgia | *Metallurgy* [2]	26 090	27 077	27 701	27 882	27 235	24 538	22 925	22 595	22 587	22 909
Transformação | *Processing*	92 383	96 668	97 973	99 214	98 048	101 709	92 562	88 447	87 377	87 128
Indiretos | *Indirect* [3]	267 331	275 156	283 574	288 905	292 189	293 306	295 764	297 943	334 237	370 867
Total | *Total*	**389 854**	**403 033**	**413 681**	**420 514**	**421 843**	**423 594**	**415 208**	**412 915**	**448 064**	**484 882**



Methodology

To accurately assess employment numbers, relevant information held by regional associations was reviewed. The data was then collated, gaps identified, and a calculation method was implemented to fill the gaps in regions where direct employment numbers were unavailable. Figures were calculated using production data and annual production per person ratios. Ratios represent the production (in t or kt) of a person annually. Hence, if annual production and the ratio is known, employment can be calculated via the following equation:

$$annual\ number\ of\ jobs = \frac{annual\ production\ (kt)}{ratio\ (kt/person/year)}$$

To illustrate the method, here is an example of calculated upstream jobs in China (2019):

	Number of jobs
Aluminium production: 35,795 kt	**71,590**
Alumina refining: 72,474 kt	**45,296**
Bauxite mining: 68,400 kt	**12,667**
	Total: 129,553

Primary Aluminium	Alumina	Bauxite
0.5	1.6	5.4

Ratios, kt/person/year

Data

The upstream sector of this study accounts for the aluminium industry's bauxite mining, refining and smelting processes.

The majority of upstream data was pulled directly from associations and sustainability reports. The few gaps that exist were calculated using production data from the IAI and annual production per person ratios, as outlined on page 14.

Ratios for primary aluminium and alumina were provided by Antaike, while the bauxite ratio was calculated as an average of multiple bauxite mine operations across different regions. In addition, the statistics also contain calculated figures from person hours worked in specific smelters and refineries (assuming a 40-hour working week).

Upstream ratios (in kt/person/year) used in the calculations are outlined below:

Primary Aluminium	Alumina	Bauxite
0.5	1.6	5.4

Based on the multiplier effects recorded in four previous studies (Australia, Brazil, India and UAE), we assume that for every direct job in the industry, 3.7 indirect jobs are created.

Limitations

The best available data has been used, however the quality of the data varies for different regions. The following limitations should be noted.

Firstly, the data used to acquire ratios is limited and calculations are affected by regional variability. Different geographical areas have different work efficiency depending on operations (e.g., more/less automation). Consequently, a range of average to advanced level ratios based on geographical location was implemented for employment calculations within the downstream sector.

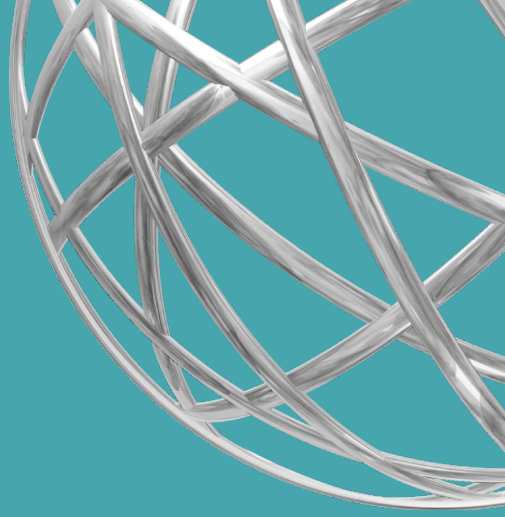
Due to the limited availability of country-level production data for the downstream sector, the study assessed downstream employment at a regional level only. Moreover, downstream employment in this study does not account for other downstream production - such as wire and forging, and upstream employment does not account for anode production.

The study does not include induced jobs, which are created by wage-funded expenditure on goods and services by employees (both direct and indirect) within the aluminium sector.

Sources

	Country	Source
	New Zealand	New Zealand Aluminium Smelters
Oceania	Australia	Australian Aluminium Council
	Brazil	Brazil Aluminium Association - Statistical Yearbook 2019
		Hydro
	Argentina	Personnel hours Puerto Madryn 2019
South America	Guyana	Rusal Sustainability Report 2019
		European Aluminium Sustainable Development Indicators
West Europe	EU28+EFTA	2015 Full Data Set
		2020 Economic Impact of the Aluminium Industry, John
	USA	Dunham & Associates
		Aluminium Association of Canada Sustainable Development
	Canada	Report 2019
North America	Jamaica	Personnel hours Clarendon refinery 2019
	Bahrain	Alba Smelter
	UAE	EGA Sustainability Report 2019
	Qatar	QATALUM Sustainability Report 2016
	Oman	SOHAR Aluminium Sustainability Report 2019
GULF	Saudi Arabia	Maaden annual report 2019
		Rusal Sustainability Report 2019
		Personnel hours: Novokuznetsk, Bratsk, Sayansk, Irkutsk,
		Kandalaksha, Krasnoyarsk, Volgogradsk, Boguchansk
East & Central	Russia	smelters; Achinsk, Bogoslovsk, Bauxitogorsk refineries 2019
Europe	Ukraine	Rusal Sustainability Report 2019

	Country	Source
	Mozambique	South32 Sustainability Performance Report 2019
	Ghana	Personnel hours Tema smelter 2019
	South Africa	Personnel hours Hillside smelter 2019
	Nigeria	Rusal Sustainability Report 2019
		Rusal Sustainability Report 2019
		Alcoa Guinea
Africa	Guinea	EGA Sustainability Report 2019
	Indonesia	PTINALUM annual report 2019
	Malaysia	Press Metal sustainability report 2020
		Sistem Aluminyum
	Turkey	Eti Aluminyum AS
	India	'Aluminium Industry contribution to Indian economy' report by Hindalco 2020
	Japan	Industrial Statistics 2019, Ministry of Economy Trade & Industry of Japan; Japan Aluminium Association
	Kazakhstan	Personnel hours Uralsk 2019
ASIA EX CHINA	Armenia	Rusal Sustainability Report 2019
OTHER		
Downstream production data		IAI Alucycle
Bauxite production data		WBMS Yearbook 2020
Alumina production data		IAI energy data 2019
Aluminium production data		IAI energy data 2019
Rolling and extrusions (downstream) ratios		Antaike
Aluminium and alumina (upstream) ratios		Antaike



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