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China's hold on the lithium-ion battery supply chain: Prospects for competitive growth and sovereign control

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ABSTRACT

Battery production for electric vehicles (EVs) necessitates a supply chain capable of supporting the exploitation of a variety of raw materials. Lithium, nickel, manganese, and cobalt are of particular significance for the dominant lithium-ion battery (LIB) technology, primarily relying on lithium iron phosphate (LFP) and lithium nickel manganese cobalt oxide (NMC) cathodes. Geographically, the global supply is heavily reliant on China with competition expected to intensify. In light of this, the questions of how global competition manifests at the company level and whether regions capture their share of the supply chain through domestic companies remain unanswered. These are addressed by analyzing the companies behind each supply chain sector and the respective raw materials. The results demonstrate that China, Europe, and the United States of America (USA) exhibit the most pronounced ownership across the supply chain, acquiring the largest foreign shares in the mining sector. Overall, China leads in a total of eleven out of the 12 investigated sectors, with its peak for LFP production at above 98 %. This preeminence, coupled with the substantial output of South Korea, Europe, and Japan in NMC production, the latter represents a viable target for mitigating supply chain vulnerabilities and attaining greater growth and sovereignty.

1. Introduction

The rapid upscaling of EV production requires a sustainable and resilient global supply chain covering the expansion of new production sectors [1]. The most significant sector, distinct from the conventional supply chain of internal combustion engines, stems from the production of LIBs and the associated procurement of raw materials [2]. The essential raw materials comprise graphite and silicon, which are typically utilised for the anode, and nickel, cobalt, manganese as well as iron, which are employed in the state-of-the-art cathode materials lithium nickel manganese cobalt oxide ($LiNi_xMn_yCo_{1-x-y}O_2$) and lithium iron phosphate ($LiFePO_4$) [3–5]. Irrespective of the selection of cathode material, lithium inherently occupies the pivotal role in the production of LIBs [5]. Despite the global distribution of these raw materials, their extraction and refinement pose a variety of significant supply risks [6,7]. The high centralisation of raw materials in regions characterised by potential political uncertainties exerts a detrimental influence on the consistent supply and price stability [8]. Moreover, it is conceivable that the material demand may exceed the annual production capacity, resulting in potential supply shortages in the future [9]. Until the adoption of substitute materials and recycling technologies at the required scale to realise the transition to a circular economy, the primary materials and their respective sources referenced will maintain their central role and substantial influence on the EV market [10,11]. This influence directly translates to the subsequent step of cathode active material (CAM) synthesis, rendering it critical in terms of capital allocation within the supply chain. Gutsch et al. calculated that this step alone accounts for over 45 % of the costs, CO_2 equivalents and combined environmental impacts of the remainder of the value chain, including recycling [12]. Besides the material costs, the LIB-cell production itself accounts for 17–28 % of the overall cell costs, depending on battery size and cell design (prismatic, cyclindrical and pouch) given the multitude of complex process steps, thereby placing a substantial capital burden on this stage of the value chain [12–15]. A considerable proportion of this

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equity is already capitalised by China, as it possesses 49 % of the intellectual property for the LIB-cell-production [16]. One of the primary domains in which LIBs are employed is the EV market, which is anticipated to generate revenue in excess of 800 billion US dollars on a global scale by the year 2025 [17]. At present, the market revenue is shared between China, Europe and the USA to the tune of 95 %, reflecting the substantial impact of these regions on the whole LIB supply chain [18].

Nevertheless, the significant profit potential is invariably accompanied by considerable risks. Risks of this nature may manifest in the form of monopolies, export restrictions and supply shortages, which have the potential to result in bottlenecks within the LIB supply chain [19]. Such bottlenecks have been the objective of several previous studies, approaching the identification and minimization of contemporary problems through the analysis of material flows [20], global warming potentials [21], including possible decarbonization [22], and supply risks [23–25]. A number of other studies have focused on the use of recycled materials by developing models and strategies to accomplish a circular economy [26–28]. In 2024, a comprehensive analysis regarding disruption vulnerabilities along the LIB supply chain was conducted by Cheng et al. [29]. The disruption vulnerabilities were first assessed by an index, which describes the influence of the choice of cathode material on the supply chain, and then mitigated by a network flow optimisation of distinct scenarios [29]. In addition, Cheng et al. thoroughly visualised the geographical distribution of the EV battery supply chain, with a particular focus on lithium, nickel, cobalt, and manganese. This visualisation demonstrated that China localised the majority of the supply chain, dominating from refining to EV production, with the mining of each raw material resembling the only exceptions [29]. The valuable insights concerning geographical localisation in this publication give rise to a question regarding the capital ownership shares of the respective regions through companies along the supply chain. In sight of the late-breaking news of China considering the imposition of restrictions on the export of production technologies [30], it is of particular interest to investigate whether China's ownership shares exceed its local production shares, thereby further increasing supply chain vulnerabilities. The objective of this work is to analyse the regional hold on capital and company ownership, in particular that of China, from a company perspective within the supply chain. Furthermore, the study identifies potential targets for decisionmakers to mitigate supply vulnerability and increase sovereignty from China.

2. Methods

This section describes the workflow to obtain accurate data that is comparable to the results obtained in the study by Cheng et al. [29]. Consistency and validity of the results with the reference study is achieved by aligning the workflow in terms of the sections of the supply chain and the scope of the elements and materials. The supply chain is defined as the process of mining, refining, CAM-, LIB-cell-, and EV-production, with the initial two sections focusing on lithium (Li), nickel (Ni), cobalt (Co), and manganese (Mn). The latter two sections encompass all chemistries employed in the production process, whilst the emphasis of the CAM production is solely on LFP and NMC chemistries. In accordance with the reference data, the following countries and regions are included in the analysis: Australia, Chile, China, Democratic Republic of the Congo (DRC), Europe (EUR), Indonesia, Japan, Russia, South Africa, South Korea, the USA and 'Other'. The region designated as EUR covers all countries located on the European continent besides Russia, whilst the region 'Other' comprises any country not encompassed by the previously enumerated regions. Russia is evaluated separately from Europe in order to align with the reference data and to demonstrate its substantial natural resource capacities.

2.1. Data generation

As the reference data provides a share of production and the comparison of absolute numbers is insufficient due to a lack of availability and consistency, the gathered data in this work is calculated as a share of production as well. The geographical distribution for mining in the year 2020 was obtained using the U.S. Geological Service's Mineral Commodity Survey, which is a comprehensive database of mineral deposits and their locations [31]. The reference data regarding the refinery is taken from Sun et al. and covers the production of lithium carbonates/hydroxides, refined cobalt, nickel chemicals and electrolytic manganese dioxides [25]. Based on the regions given in both sources, the largest mines and refineries were identified, thereby enabling an updated calculation of the geographical distribution based on the headquarters of the companies by the annual outputs. The ownership data is sourced from various websites and company reports, all of which are referenced in the supplementary materials (Table S1).

First, the regional production shares in a specific country based on each mine/refinery individually ($RPS_{country,mine/refinery,region}$) are calculated by multiplying the share of ownership of each region on the mine/refinery with the production share of the corresponding mine/refinery in the selected country. The latter is calculated by dividing the production output of one mine in a country ($Prod._{mine/refinery,country}$) by the total production output of the respective country ($Total\ Prod._{country}$).

$$RPS_{country,mine/refinery,region} = \frac{Prod._{mine/refinery,country}}{Total\ Prod._{country}} \bullet Share\ of\ ownership_{mine/refinery,region} \quad (1)$$

The results for the respective mines/refineries within a country are then aggregated to derive the regional production shares ($RPS_{country}$) for that specific country.

$$RPS_{country,region} = \sum_{mine} RPS_{country,mine/refinery,region} \quad (2)$$

In the following, the $RPS_{country,region}$ is multiplied with the reference production data ($RPD_{country}$) and divided by 100 to yield the updated regional production output of each country ($UP_{country,region}$).

$$UP_{country,region} = \frac{RPS_{country,region} \bullet RPD_{country}}{100} \quad (3)$$

The last step consists of accumulating the $UP_{country,region}$ with respect to each region to calculate the updated production of the regions (UP_{region}) based on the ownership.

$$UP_{region} = \sum_{country} UP_{country,region} \quad (4)$$

The updated share of production of each region (USP_{region}) is determined by dividing the UP_{region} by the total global reference production data (RPD).

$$USP_{region} = \frac{UP_{region}}{RPD} \bullet 100 \quad (4)$$

The values of USP_{region} range between 0 and 100 per cent and are calculated for each produced element and material separately. The data regarding the annual outputs of the mines/refineries was gathered from a diverse array of news reports, public statements, and annual reports of the respective companies, with the corresponding source given in detail in the supplementary materials (Table S1). In instances where the company was identifiable but no current production data was available, the reference value for the entire region was applied to the company in question. To illustrate this point, the *Managem Group* was identified as a company for the *Bou Azzer Cobalt Mine* in Morocco [32]; however, no current production data was available. As the company is headquartered in Morocco, the reference production output for Morocco of 2.3 kt was used for the updated results in this case. In addition to the data relevant to the refining, also the findings from Sun et al. concerning CAM- and LIB-production were used as reference [25]. The information regarding the global companies in CAM-production for both LFP and NMC chemistries, as well as their annual output, has been derived from a report by the *Yano Research Institute* [33]. For the LIB-production, the latest data from *EV-volumes* was used and included the top ten producers which account for 97 % of the total output [34]. The share of production is in both cases calculated by aggregating the annual production volume per region and dividing it by the total annual production output. The reference data concerning the geographical distribution of global EV production were derived from a report published by the *International Energy Agency* in 2022 [35]. In comparison, the updated production shares of EVs are based on the annual sales of each EV in 2023, as reported by *Marklines* [36]. The corresponding regions are assigned on the basis of the headquarter location of the respective original equipment manufacturers (OEMs). The sales figures for each region are then divided by the total sales for 2023 to calculate the sales share. Comprehensive data pertaining to the individual sectors of the supply chain are available in the supplementary material (Tables S2–S17).

3. Results and discussion

3.1. Regional ownership shares

The reference data concerning the **a)** geographical distribution is subjected to comparison with the results of this work, which consider the LIB supply chain from the **b)** ownership distribution (Fig. 1). Upon thorough examination of the supply chain in its entirety, it becomes evident that the proportion of Chinese overall stakes increases even further when the issue of ownership is given due consideration.

The CAM-production of LFP represents the point at which Chinese control is almost complete, with a production share of 98.45 %. The major companies in this field are, for instance, *Hunan Yuneng* and *Shenzhen Dynanonic*. In addition, Chinese companies possess the largest shares in the refining of each element as well, ranging between 59.50 % and 73.57 %, with only minor alterations compared to the geographical distribution. Additional information pertaining to the annual production outputs of the individual companies can be found in the supplementary material.

Interestingly, the actual ownership shares on the supply chain for the latter steps, including CAM-production of NMC, LIB- and EV-production are slightly below the geographical reference data, whilst still remaining above 45 %. Despite the absence of NMC production facilities in Europe, companies such as *BASF* and *Umicore* contribute approximately 20 % of the global supply, thereby augmenting the influence of Europe by owning factories or shares in companies and joint ventures in Asia. Considering LIB-cell-production, South Korea emerges as the runner-up with regards to China, accumulating ownership of 26.88 % of the global production, primarily driven by *LG Energy Solution*, *SK on* and *Samsung SDI* and their Chinese factories. While the proportion of US companies in LIB-production is less than 3 %, they were able to secure 28.56 % of EV-production, representing their large share in the worldwide automotive market. In addition to *Tesla*, which – besides *BYD* - has dominated global sales with over 2 million EVs sold in 2023, the *GM Group* and *Ford Group* have also significantly contributed to the impact of the USA.

However, besides LFP, the most significant disparity between production shares from geographical and ownership perspectives arises in the mining of raw materials. In this area of the supply chain, China exerts a significantly higher degree of control over production shares compared to the actual production located in the country.

The mining of Nickel and Cobalt seems to be of particular interest to Chinese companies, as Chinese stakeholders govern above 30 % of the global production of each element, despite the fact that less than 5 % are currently extracted within China (Table 1). This discrepancy can be attributed to the acquisition of foreign mining rights from Chinese companies, thereby securing the largest shares in the extraction of lithium, nickel, and cobalt. This acquisition strategy is also employed by Europe and the USA, with the latter primarily investing capital in the control of lithium through companies such as *Albemarle* and *Livent*, owning 26.8 % of the global production. Despite having limited natural resources and almost no stakes in the mining of lithium, Europe has succeeded in controlling a significant share of the global production of nickel, cobalt, and manganese, thereby securing a position among the top three producers of these raw materials. The major shareholding European companies include *Glencore*, which is headquartered in Switzerland, as well as the French company *Eramet*. In terms of manganese mining, Europe as well as China possess comparatively modest shares, ranking third and fourth respectively. By contrast, Australia, and South Africa account for the majority of mining rights, with each country holding a share above 20 %.

The updated results demonstrate that economically strong regions such as China, Europe and the USA leverage their capital power to significantly increase their influence across the supply chain, especially within the mining sector. China, in particular, expands its influence by holding the largest share in eleven out of twelve sectors from a company

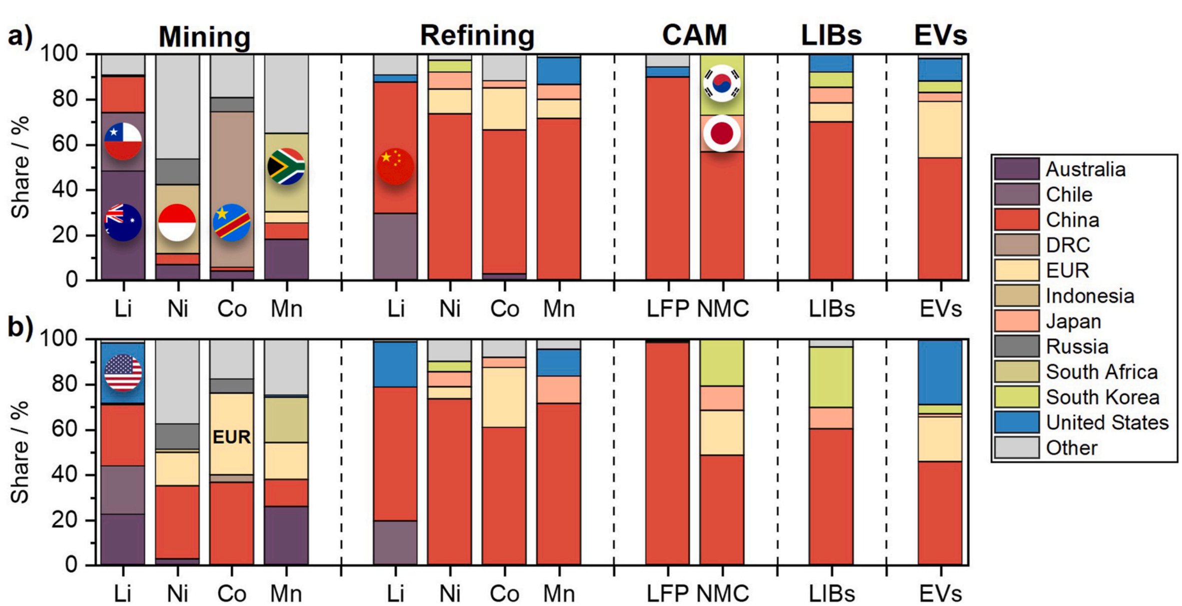

Fig. 1. a) Geographical distribution (revisualized from Cheng et al.) [29], and **b)** Ownership distribution of the LIB supply chain.

Table 1
Reference production shares (RPS), updated production shares (USP), and the respective factor for the mining of each raw material.

Country	Lithium			Nickel			Cobalt			Manganese		
	RPS	USP	x	RPS	USP	x	RPS	USP	x	RPS	USP	x
Australia	48.07 %	20.16 %	0.42	6.73 %	2.70 %	0.40	3.96 %	0.42 %	0.11	17.89 %	25.77 %	**1.44**
Chile	26.03 %	21.61 %	0.83	0 %	0 %	1	0 %	0 %	1	0 %	0 %	1
China	16.10 %	29.26 %	**1.82**	4.78 %	32.26 %	**6.75**	1.55 %	36.57 %	**23.59**	7.2 %	11.89 %	**1.65**
DRC	0 %	0 %	1	0 %	0 %	1	68.89 %	3.50 %	0.05	0 %	0 %	1
EUR	0.42 %	0.42 %	1	0 %	14.75 %	n/a	0 %	36.00 %	n/a	4.96 %	16.40 %	**3.31**
Indonesia	0 %	0 %	1	30.71 %	1.47 %	0.05	0 %	0 %	1	0 %	0 %	1
Japan	0 %	0 %	1	0 %	0 %	1	0 %	0.32 %	n/a	0 %	0 %	1
Russia	0 %	0 %	1	11.27 %	11.27 %	1	6.33 %	6.33 %	1	0 %	0 %	1
South Africa	0 %	0 %	1	0 %	0 %	1	0 %	0 %	1	34.93 %	20.18 %	0.58
South Korea	0 %	0 %	1	0 %	0 %	1	0 %	0.27 %	n/a	0 %	0 %	1
USA	0 %	26.83 %	n/a	0 %	0 %	1	0 %	0 %	1	0 %	1.00 %	n/a
Other	9.38 %	1.72 %	0.18	46.51 %	37.55 %	0.81	19.27 %	16.45 %	0.85	35.02 %	24.76 %	0.71

perspective (see Fig. 1), compared to its dominance in eight segments from a geographical perspective.

3.2. Flow of ownership shares

As the mining sector has emerged as the area with the greatest discrepancies between geographical location and actual company ownership, Fig. 2 depicts where the regions secure their respective shares for each element. An examination of the current situation pertaining to lithium mining reveals that both China and the USA have secured significant interests in Australian mining operations, for instance, the *Greenbushes lithium operations* [37]. Moreover, the US company *Albemarle* is the proprietor of the *Salar de Atacama mine* in El Loa, which accounts for approximately one-quarter of the total output located in Chile [37].

With regard to nickel mining, approximately 30 % of global

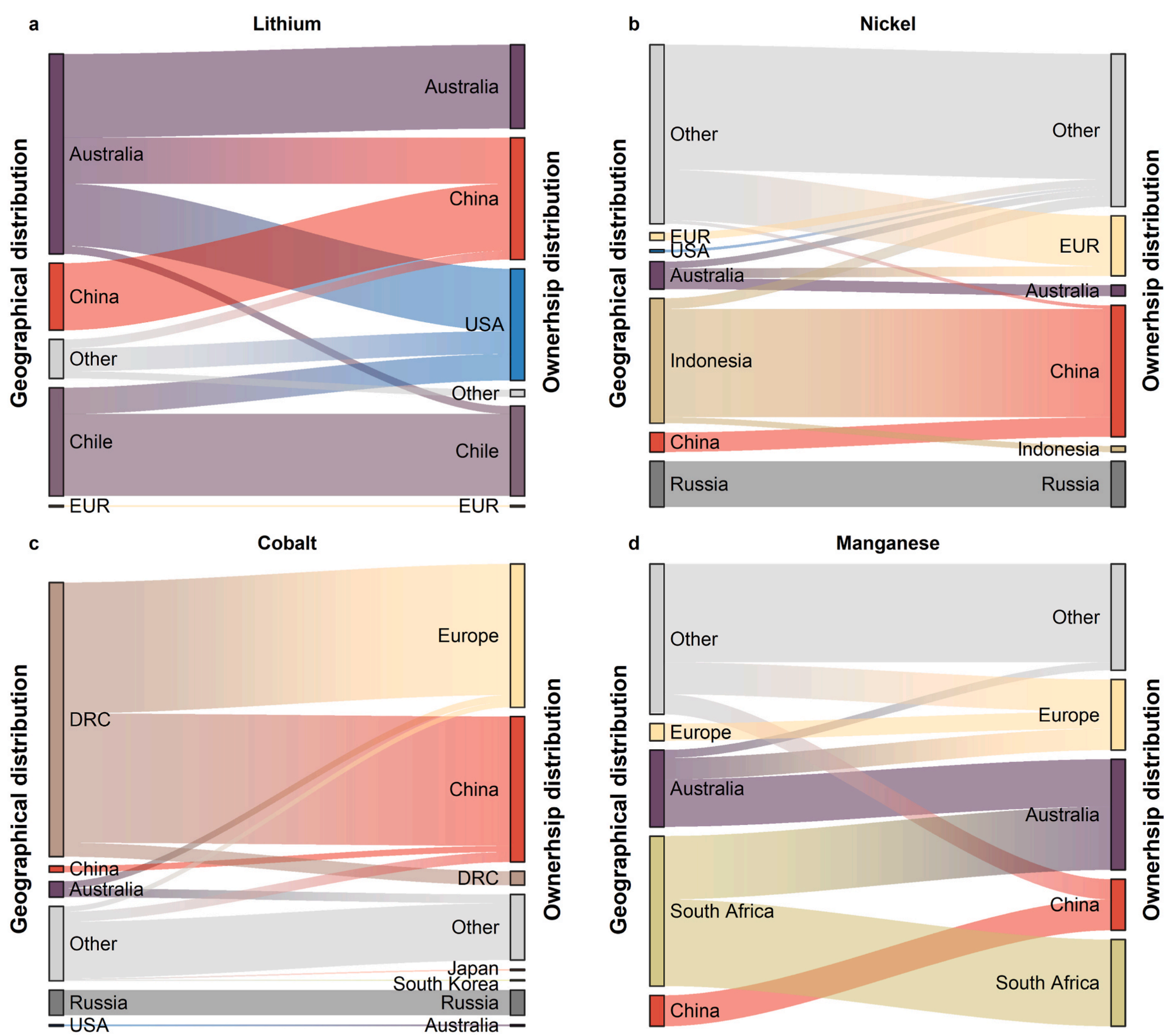

Fig. 2. Sankey diagrams illustrating the global flow of production shares between the location and actual ownership for the mining of **a)** Lithium, **b)** Nickel, **c)** Cobalt and **d)** Manganese.

production is located in Indonesia, establishing it as the leading region. Out of its own production share, a mere 4.77 % is currently owned by Indonesian companies. Meanwhile, China has a dominant presence there, holding an impressive 86.73 % of the Indonesian mining rights, thus ranking first in terms of ownership of global nickel production. In contrast to China's strategic emphasis on Indonesian nickel, Europe has a more diversified supplier base, with Brazil, Canada, and New Caledonia accounting for the bulk of production. Major European companies owning these mines encompass *Glencore*, *Anglo American* and *Eramet*. More than one third of the 'Other' regions share originates from the Philippines, ranking third in global nickel production with 13.30 %, and is controlled by the *Nickel Asia Corporation*. As for Russia, all major mines located in the country, irrespective of the extracted raw material, are owned by *MMC Norilsk Nickel* and, as a result, are under Russian control.

The in-depth analysis of Cobalt revealed a scenario for mining in DRC analogous to Nickel mining in Indonesia. While 68.89 % of the global production is located in the DRC, the local companies itself possess only slightly above 5 % of the mining facilities in the country. The majority of the stakes in the DRC are held by China and Europe, with 47.15 % and 47.77 % respectively. The primary actors responsible for this shift are the *CMOC Group* from China as well as the *Eurasian Resources Group* and *Glencore* with their headquarters located in Europe. In case of the other regions, the Philippines, Cuba, and Morocco appear to be the most significant contributors, accounting for a combined total of 45.30 % of the production in these other regions.

Considering the mining rights of manganese, Australia extends its impact through the companies *South 32* and *Jupiter Mines* by acquiring 51.12 % of the South African mines, thereby ascending to the preeminent position. Despite giving up more than half of its mining rights, South Africa remains in control over the second largest share of global production without the acquisition of foreign mines. As the third largest global stakeholder, Europe is responsible for the operation of mines primarily located in Australia, Gabon and the Ukraine with *Anglo American*, *Eramet* and the *Eurasian Resources Group* emerging as the most significant stakeholders respectively. The Chinese company *South Manganese Investment Ltd.* owns the majority of manganese mines located in China and is further involved in the *Bembélé mine* in Gabon. Gabon itself is the region that accounts for the third largest share of mines of 17.78 % worldwide, of which 40.41 % are currently owned by entities headquartered in Gabon, such as *Nouvelle Gabon Mining*. Consequently, it constitutes the majority of the stakes of the 'Other' nations, with Ghana, India and the Côte d'Ivoire also being significant producers. Comprehensive numerical data and detailed information regarding the respective mining projects can be found in the supplementary material.

3.3. China's cumulative power in mining

The preceding examination of the geographical and ownership distribution has successfully exposed China's pivotal position within the value chain, particularly in the domain of mining. In the context of potential trade restrictions, it is imperative to incorporate political control into the existing analysis. This extension of the analysis encompasses the hypothesis that, in addition to the oversight of its own corporate entities, China could wield authority over foreign production facilities situated within China's borders. In Fig. 3, China's domestic shares (RPS) as well as the updated shares of production (USP) on the total global mining output, both illustrated in Fig. 1 as well, are depicted with their respective foreign shares of production (FSP) on the global output in the rest of the world for each raw material.

Given the theoretical assumption that China would exercise full control over the mines located within the country, the domestically located shares could be assigned entirely to China's jurisdiction. This would result in a decrease in the freely available remaining global supply, corresponding to the size of the RPS. However, as previously

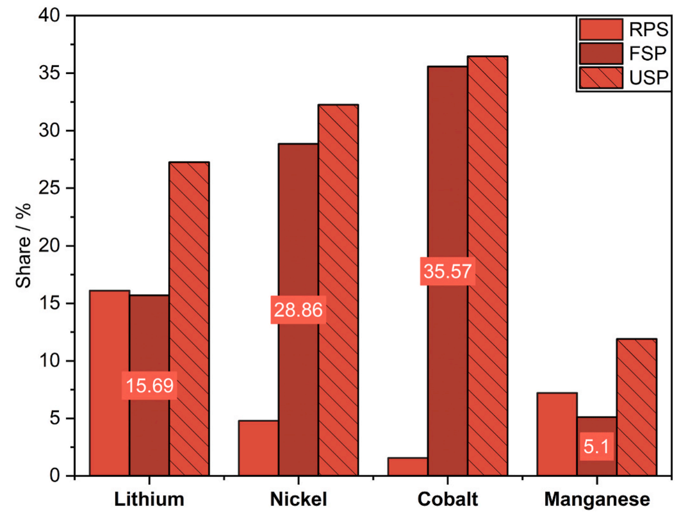

Fig. 3. China's domestic production (RPS) and updated ownership production (USP) shares on the total global output, alongside the share of China's foreign production (FSP) on the global output, outside of China, for the mining of each raw material.

noted on the basis of the USP, a significant proportion of global production outside China is controlled by Chinese companies. Consequently, the FSP is utilised as a metric to accurately quantify China's share of the remaining freely available global supply of raw materials, reducing it even further. China has an FSP of over 15 % for three of the four raw materials, illustrating its immense influence on the supposedly freely available value chain. The most significant cases are nickel and cobalt, where China's FSP stands at 28.86 % and 35.57 %, respectively. These figures underscore the observation that, despite its limited domestic resources, China is achieving a leading position in the USP through its strategic acquisition of FSP. With an FSP of only 5.1 %, China has a comparatively low influence on the depletion of manganese, which is in line with the moderate influence observed when looking at the USP. In general, it can be derived that a FSP lower than the RPS is indicative of a sufficient domestic supply. Conversely, a considerably higher FSP is suggestive of critical raw materials, which are particularly vulnerable to supply risks.

4. Conclusion

In a globalised world, where cooperation and trade are increasingly important, it is essential to not just consider the location but to examine the ownership stakes behind the respective mines, refineries, and production plants within a supply chain. Therefore, data on the regional production shares based on ownership is gathered and compared with the respective shares based on the geographical distribution to provide a holistic view about the current balance of power in the LIB supply chain. A particular focus was on the impact of China, given the potential repercussions of future export restrictions on specific battery production technologies, which could significantly affect the global supply chain [30].

The findings indicate that China's dominance within the supply chain is amplified in terms of ownership shares when compared to the geographical distribution, now holding the largest shares in eleven out of the 12 segments, up from eight when compared to Cheng et al. [29]. The majority of the LIB supply chain, from refining to EV production, is already localised in China, and the largest companies therefore originate from China. However, these companies are expanding their control over the supply chain even further through the acquisition of various mines and subsidiaries beyond their national borders. Currently, only the mining of manganese remains the sole sector of the LIB supply chain in which China does not possess the largest share of production, with

Australian, South African, and European companies leading the field. The primacy of China within the mining sector was further validated through the integration of a political dimension, as it has emerged that the nation additionally secures a significant proportion of the presumably freely available supply chain abroad.

Similar to China, Europe and the USA are pursuing a greater control over the LIB supply chain through the acquisition of mines and refineries. Whilst the USA ranks second in ownership stakes regarding the mining of Lithium and Europe's stakes are negligible (Fig. 2), the situation is the opposite for nickel and cobalt. The most substantial regions impacted by the corporate acquisitions are Australia, Indonesia, and the DRC with regard to lithium, nickel, and cobalt, respectively.

China's dominance in the latter segments of the supply chain is almost uncontested, reaching its peak of over 98 % for the LFP active material production and is only challenged by South Korea in the NMC- and LIB-production and the USA for the EV-production.

These results clearly emphasise the necessity to reduce supply chain dependencies on China and Chinese controlled companies, taking potential restrictions and trade conflicts into consideration. By establishing free-trade agreements and implementing legislation focused on critical materials, the USA aim to strengthen its supply chain resilience and reduce reliance on China. This proactive approach seeks to enhance domestic production capabilities and foster international partnerships, ultimately counterbalancing China's dominance in the market, but the effects will only be significant in the long term. Furthermore, the findings suggest that by basing the production of LIBs and subsequently EVs on NMC instead of LFP, the dependency on China can be slightly reduced. However, considering the price advantage of LFP based LIBs over their NMC counterparts, this will be a difficult choice to make for European and US companies and customers. Given the equitable distribution of shares in mining rights, the primary focus should be on the fast expansion of refining facilities outside of China to meet global demand for the ongoing NMC-production. If the USA and Europe were to join forces against China, they could significantly reduce their dependency on Chinese-controlled supply chains by expanding their own refining and production capabilities for LIBs. This collaboration could create a more balanced global supply chain, potentially challenging China's dominance and fostering greater economic independence for both regions. The findings of this study hereby provide a foundation upon which sophisticated strategies can be developed to counter China's dominance and secure a larger share of capital in the primary material-based supply chain.

Notwithstanding the comprehensive approach adopted, a minor proportion of smaller entities and production facilities remain which are not included in the scope. Given the negligible influence on the global output within the LIB supply chain, these entities can be disregarded for the purposes of this study. Further, it is important to note that the production data of the mines and refineries was invariably determined in relation to the reference data. Consequently, it would be worthwhile in future approaches to gather additional data with the most recent standardised outputs and compare it to these results. Furthermore, given that the majority of global natural graphite is derived from politically unstable regions [38], the anode side could face similar supply vulnerabilities in the future, thus rendering a follow-up study analysing the supply of natural and synthetic graphite, as well as silicon, highly relevant.

Additionally considering a transition to a circular economy in the 2050s and beyond, the build-up of refining capacities outside of China has to be well balanced with the development and build-up of recycling capacities to foster this necessary transition. Failure to do so may result in the emergence of comparable dependencies and vulnerabilities from China, thereby further amplifying their global dominance.

CRediT authorship contribution statement

Tim Greitemeier: Writing – original draft, Visualization, Software, Methodology, Formal analysis, Conceptualization. **Achim Kampker:** Writing – original draft. **Jens Tübke:** Writing – original draft. **Simon Lux:** Writing – original draft, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.powera.2025.100173.

Data availability

Data will be made available on request.

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