

POLICY PAPER

LEVERAGING THE PHOSPHATE VALUE CHAIN FOR JUST TRANSITIONS:

MOROCCO'S UPGRADING PATHWAY

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SOUTHERN
TRANSITIONS

THE
IMAL
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FOR CLIMATE AND DEVELOPMENT



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SUMMARY

With approximately 70% of global phosphate rock reserves and a long-standing national commitment to industrial development, Morocco occupies a central position in the global phosphate economy.

Phosphorus is indispensable to global food security and has no known substitute. As demand for phosphate-based fertilisers remains essential to agricultural production, and new demand emerges from lithium iron phosphate (LFP) batteries, control over phosphate resources is becoming increasingly strategic.

Morocco's development pathway demonstrates how resource endowments can be transformed into broader industrial capabilities. Over several decades, directed public investment and long-term planning have supported the emergence of a diversified phosphate-related ecosystem spanning mining, beneficiation, phosphoric acid production, fertiliser manufacturing, logistics, research and development, engineering services, and skills development. This integrated approach has enabled substantial local value creation and strengthened Morocco's role in global food systems.

At the same time, significant challenges persist. The sector remains exposed to volatile commodity and energy markets, dependence on imported ammonia, geopolitical disruptions, water scarcity, environmental pressures, and technological shifts that could reshape future demand.

Water stress is particularly acute given the industry's water intensity and Morocco's growing climate vulnerability. Social pressures, regional inequalities, and skills gaps highlight the need for more inclusive distribution of the benefits generated by phosphate-linked growth.

This paper argues that Morocco's next phase of development should advance a whole-of-economy, whole-of-society approach to economic, social, and environmental upgrading. Key economic opportunities include domestic green ammonia production to reduce import dependence and decarbonise fertiliser manufacturing, integration into rapidly expanding LFP battery value chains, and deeper regional engagement through agricultural service platforms and partnerships across Africa. These pathways can strengthen resilience, diversify revenue streams, and support Morocco's broader green-industrial ambitions.

Social and environmental upgrading must accompany these economic shifts. Priorities include expanding education and technical training, improving youth and women's employment outcomes, strengthening community benefit-sharing mechanisms, promoting circularity, and enhancing stewardship across the water–energy–food nexus. Continental collaboration and carefully structured South–South partnerships — particularly around technology transfer and capability-building — can further support inclusive development.

Morocco's experience shows that resource wealth can underpin wider industrial transformation when supported by coordinated policy and patient capital. The country's next challenge is ensuring that future upgrading delivers measurable social and environmental outcomes alongside economic gains, offering a model for just and sustainable mineral value-chain development across Africa and the wider Global South.

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1

INTRODUCTION



Phosphorus, a chemical element mined in phosphate rock, forms the backbone of the world's food security. Modern agriculture depends heavily on phosphate-based fertilisers to sustain global food production. Phosphorus is a primary nutrient for plant growth, stimulating roots and yield. The chemical element furthermore has a wide range of applications beyond agriculture, with lithium-ion batteries set to drive large volumes of demand in the near future.

Yet, phosphorus is finite, non-renewable, and geographically concentrated. Importantly, it is also, to date, biochemically irreplaceable. No substitutes exist, and alternatives cannot currently be engineered. This unique combination — absolute necessity, geological scarcity, and concentrated supply — places extraordinary significance on the countries that control phosphate reserves.

Morocco, which holds about 70% of the global reserves of phosphate rock, occupies an exceptional position in the global (phosphate) economy. Leveraging its position, the country has managed to effectively implement an integrated value chain, led by the state-owned OCP (Office Chérifien des Phosphates) Group, which spans extraction to beneficiation and fertiliser manufacturing to associated mining-related and manufacturing-related services. This integrated approach has delivered significant socio-economic value (notably, in terms of employment and investment), fast-tracked infrastructure development, and fostered a national ecosystem of skills development, research and development (R&D), and engineering services.

However, **water usage, energy consumption, food security, and environmental trade-offs must be actively managed** to deliver deep and sustainable social and environmental upgrading alongside economic gains.

This paper examines the phosphate value chain and Morocco's unique position to inform just transition pathways in Africa and the Global South more broadly. It establishes a baseline of Morocco's current position and upgrading strategies and then identifies additional opportunities for economic, social, and environmental advancement. The analysis outlines the structure and dynamics of the global value chain (GVC), reviews policy initiatives and state-led investments aimed at capturing local value, and presents forward-looking pathways. These include realistic, just, and investable pathways to decarbonise fertiliser production, develop Africa-centred agronomic solutions, pursue technological spillovers that result in social uplifting, and align the region's renewable energy and environmental goals.

This analysis applies a just transition framework, combining GVC mapping with locally grounded evidence from Morocco, with the aim of unpacking how the North African phosphate powerhouse and other resource-rich countries can leverage a critical mineral to pursue a more equitable, sustainable path. It applies a 'whole-of-economy, whole-of-society' filter to evaluate economic, social, and environmental upgrading opportunities, with a focus on regional cooperation and the impacts across the water–energy–food (WEF) nexus (Hermanus and Montmasson-Clair, 2025).¹

The paper is structured in four main sections.

The first section maps the phosphate value chain, tracing the journey from phosphorus as a biological and agricultural essential to the dynamics of the global market, trade flows, and geopolitical concentration. The second section situates Morocco within this global landscape, profiling the country's macroeconomic and social context before examining OCP Group's integrated value chain, its strategic configuration, and its forward-looking upgrading agenda. The third section turns to the principal risks facing

Morocco's phosphate sector, including market and price volatility, environmental pressures, and disruptions, and considers mitigation strategies. The fourth and final section identifies concrete opportunities for advancing a just pathway, encompassing economic, social and environmental upgrading, and the potential of continental collaboration and South–South cooperation. A brief conclusion draws together the key findings and their implications for Morocco's long-term development trajectory.



2

THE GLOBAL PHOSPHATE VALUE CHAIN



Understanding Morocco's position in the phosphate economy requires first establishing the foundations of the global system it operates within.

This section maps the phosphate value chain from its biological and agricultural roots to its complex commercial and geopolitical dynamics. It begins by examining the unique properties of phosphorus and the structural

drivers of global demand, before tracing the value chain itself — from mining and beneficiation through to chemical processing, fertiliser production, and end-market distribution — and analysing how value is created, captured, and distributed across its key actors and geographies.

THE ROLE AND DEMAND FOR PHOSPHORUS

Phosphorus is an element indispensable to life.

It is fundamental to cellular biology, forming the structural backbone of DNA and RNA, and serving as the primary currency of biological energy transfer. The viability of global food security rests upon this crucial and non-renewable resource, which is one of the main elements of the fertilisers that enable the large agricultural yields necessary to sustain the world's growing population. Not only do fertilisers provide essential nutrients for maintaining the quality and quantity of global crops, but the phosphorus in them also facilitates root development and improves yield and resistance to drought.

The three essential fertiliser nutrients are nitrogen, phosphorus, and potassium. However, unlike other inputs, phosphorus has no known agricultural substitute (OECD–FAO, 2024). While it is present in all living things, it cannot be synthesised, and its primary source is found in mined phosphate rock deposits. These rich deposits formed naturally over millions of years in specific marine environments, making geological concentrations of high-grade, economically exploitable ore exceedingly rare (Filippelli, 2011).

Mined phosphate rock is the raw material from which phosphoric acid is produced, the precursor to most commercial phosphate fertilisers, notably diammonium phosphate (DAP) and monoammonium phosphate (MAP). The United Nations' (UN's) Food and Agriculture Organisation (FAO) estimates that nearly 50 million nutrient tonnes are applied annually in the form of MAP, DAP, triple superphosphates (TSP), or other phosphate blends (FAO, 2024). As the application of these fertilisers is directly correlated with crop yields, a reduction in phosphorus availability would lead to a severe decline in agricultural productivity, threatening global food supply (Brownlie et al., 2024).

Global demand for phosphorus-based fertilisers (and fertilisers overall) has grown exponentially since the end of World War II. Largely inelastic, demand has increased with the imperative of feeding a growing global population. In 2022, global fertiliser use reached 178 million tonnes, compared to 30 million tonnes 50 years earlier (1962). Similarly, per capita use has expanded from 10 kg in 1962 to more than 23 kg in 2022. Nitrogen dominates as an input (58%), along with phosphorus (23%) and potassium (19%).²

Importantly, fertiliser use depends on gross domestic product (GDP), income levels, and climatic conditions. As such, the use of fertilisers is highly unequal globally. While China (24% in 2022), India (17%), Brazil (11%), the USA (9%), and the EU (6%) account for the lion's share of global consumption (comparatively, Africa accounted for 4% in the same year), the countries with the highest use of phosphate fertiliser per hectare of cropland, such as Bangladesh, Kuwait, Brazil, China, Japan, Egypt, South Korea, and Vietnam, form a largely disparate group of economies. At the other end of the spectrum, fertiliser use in most African countries is extremely low.

In addition to fertilisers (which overwhelmingly dominate demand), **phosphate products are also used in a range of applications, from biofuels, chemicals, and food and feed additives to semiconductor manufacturing.** Moreover, a new market driver for phosphate production has emerged over the past decades: lithium-ion batteries.

The use of lithium-ion batteries in stationary energy storage and electric mobility is on an exponential rise globally. Lithium iron phosphate (LFP) batteries are increasingly considered safer, cheaper, and longer-lived than their current, direct competition, namely nickel–cobalt–aluminium (NCA) and nickel–manganese–cobalt (NMC) lithium-ion batteries. As such, LFP batteries have emerged as key technologies for both stationary and mobile applications (IEA, 2023). While NMC chemistries still dominate the market, LFP batteries have rapidly increased their market share, driven primarily by a massive expansion of manufacturing capacity led by Chinese companies (Nsitem, 2024).

This new demand stream is still marginal – fertilisers account for about 85–90% of phosphate (GVR, 2026), and if all batteries made today were LFPs, they would consume just 1% of the phosphorus used in agriculture (IEA, 2023) – but it is set to rapidly expand in the years and decades to come, potentially signalling future market demand and supply tensions.

THE GLOBAL VALUE CHAIN

The global phosphate value chain begins with mining and extraction of phosphate rock from geological deposits, primarily sedimentary formations. This raw ore then undergoes beneficiation, a physical concentration process involving crushing, screening, and flotation to remove impurities and increase phosphate content, typically to 65–72% phosphate pentoxide (P_2O_5).

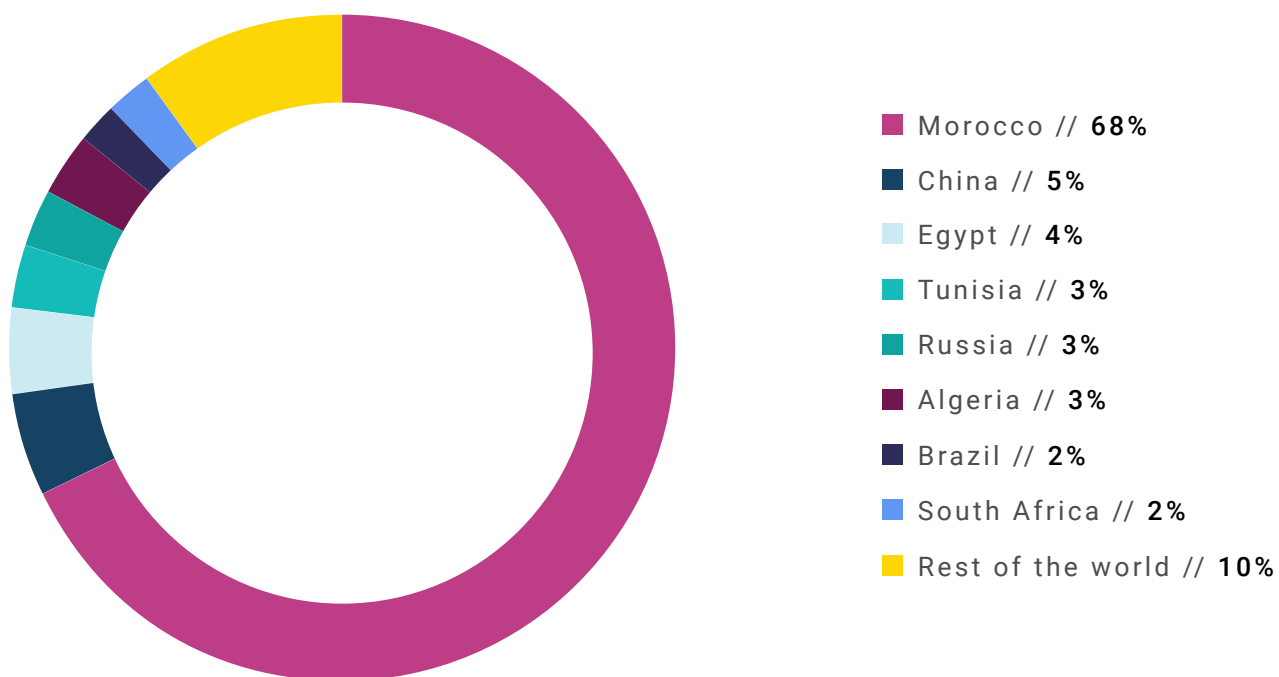
The beneficiated rock is then chemically processed through acidulation, where it reacts with sulfuric acid to produce phosphoric acid, the key intermediate product in the chain. This phosphoric acid is subsequently transformed into various fertiliser products, most commonly DAP, MAP, and NPK blends that combine nitrogen, phosphorus, and potassium.

Importantly, the production of high-concentration fertilisers, such as DAP and MAP, also requires ammonia as an input. Ammonia production is a capital- and energy-intensive process (the Haber-Bosch process) combining atmospheric nitrogen and hydrogen (historically from fossil gas feedstock) at high pressures and high temperatures.

These fertilisers move through distribution networks to reach end-users, primarily agricultural producers. While fertilisers account for most of the demand, food and feed additives, chemicals, pharmaceuticals, metal parts, and electronics account for the balance.

Global reserves of phosphate rock are incredibly concentrated. North Africa is the primary region where deposits are found. In 2025, Morocco held 68% of the world's deposits proven to be economically and technically feasible to mine. Egypt (4%), Tunisia (3%), and Algeria (3%) were also notable players. China (5%), Russia (3%), Brazil (2%), and South Africa (2%) completed the picture (USGS data).³

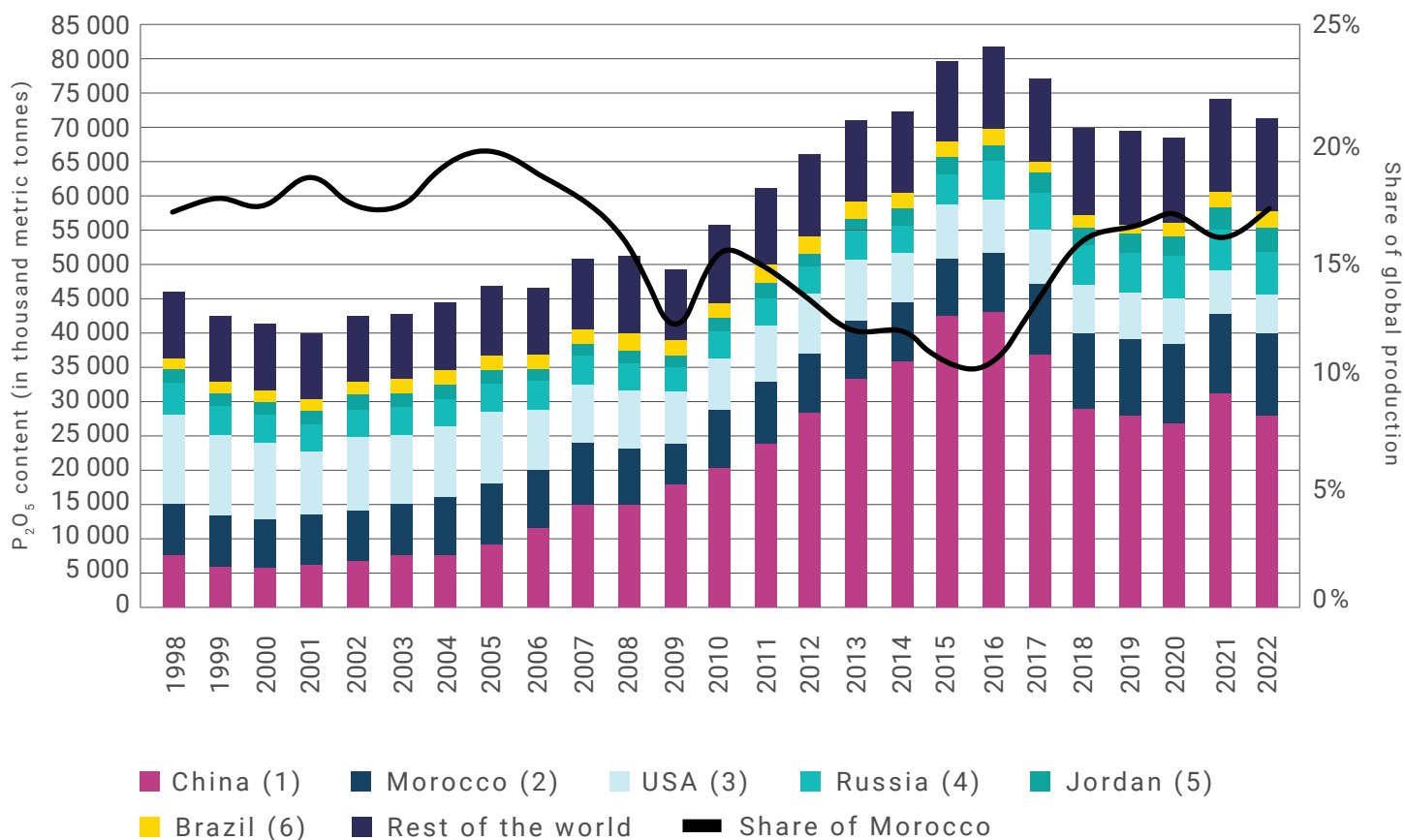
FIGURE 1: GLOBAL RESERVES OF PHOSPHATE ROCK



Source: Authors, based on data from the United States Geological Survey (USGS).

Global mining of phosphate rock, slowly growing from the middle of the 19th century, has exploded since the end of World War II, rising exponentially in line with population growth and the associated demand from food systems. Over the past two decades, phosphate rock production (in P_2O_5 content) has approximately doubled, reaching over 70 million tonnes in 2022. It is primarily dominated by a few countries. Despite only holding 5% of global reserves, China is the largest producer, accounting for 39% in 2022. Morocco follows, with a relatively small part of global production (17%) compared to its leading share of reserves. The United States of America (USA), Russia, Jordan, and Brazil were the other leading producers in the same year (USGS data).

FIGURE 2: GLOBAL MINING OF PHOSPHATE ROCK



Source: Authors, based on data from the USGS.

The composition of global market supply differs markedly from that of phosphate rock mining.

Indeed, leading producers keep a large share of their domestic production for downstream beneficiation. This is notably the case with regard to China and Morocco. As such, Jordan was the primary exporter of phosphate rock in 2023, ahead of Morocco, Peru, and Egypt. By contrast, Morocco is the world's largest exporter of phosphoric acid. Jordan, China, Senegal, and the USA completed the top five. The leading exporters of phosphate-based fertilisers are Russia, Morocco, China, Saudi Arabia, and the USA.

Value capture in the chain is more complex than simple price escalation, as illustrated in Figure 3.

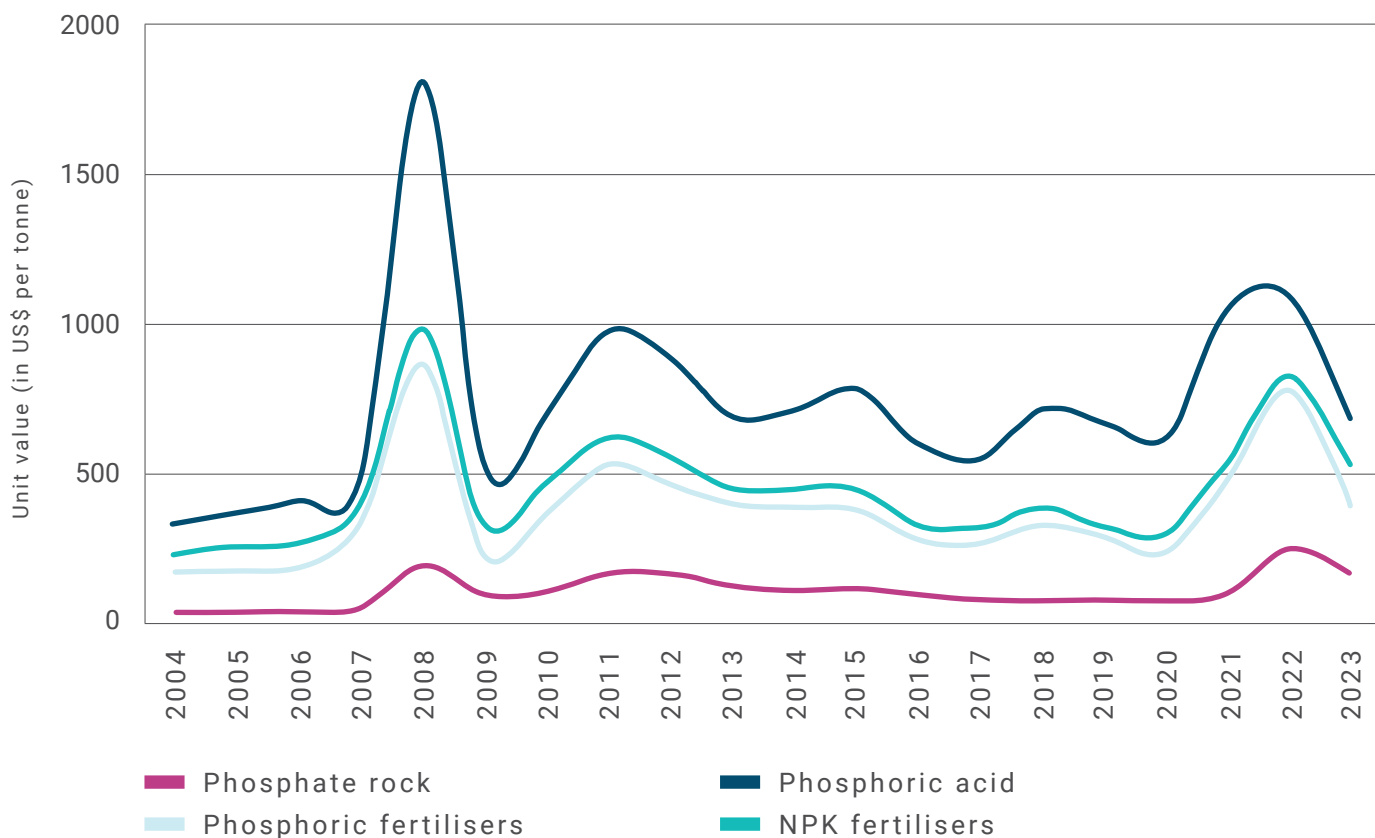
Using Moroccan exports as a basis, phosphate rock trades around US\$100–US\$250 per tonne, while phosphoric acid commands US\$650–US\$1100 per tonne, representing substantial value addition through chemical processing. Finished fertilisers, such as superphosphates and DAP, trade around US\$400–US\$800 per tonne, appearing lower in absolute price but capturing value through product differentiation, formulation expertise, and market access. The critical value shift occurs between raw rock and phosphoric acid production, where integrated producers capture margins through control of both mining and chemical processing.

Overall, the global market price of phosphate and associated products has historically been quite volatile. Large, rapid price shifts are common in the value chain. As described above, phosphate-based fertilisers are not simply blended materials but are controlled, chemically engineered products whose final value is derived from the successful integration of two globally significant

commodity chains. This critical interdependence means that phosphates are uniquely vulnerable to simultaneous supply shocks in both the mining and the energy sector. A fertiliser-producing country's competitive advantage and profitability, therefore, depends on its ability to manage the sourcing and price risk of two distinct and volatile inputs: phosphate rock and ammonia. This makes the entire system a complex interplay of geology, energy markets, and chemical engineering, with significant implications for agricultural economics and food security (Cordell and White, 2013).

The combination of supply-side concentration, high dependency of agricultural activities on fertilisers, and direct links between oil and gas prices and fertiliser production (for ammonia production, notably) ***make global pricing very sensitive to any material shift in demand or supply,*** whether from conflicts, trade policies, macroeconomic factors, or any external shock (IEA, n.d.). For instance, China has significantly restrained its supply of fertilisers to global markets since 2021, through export bans and additional inspection requirements, forcing many importers to increase their local production or find alternative suppliers. Sanctions against Belarus (from 2020) and Russia (from 2022), USA tariff escalations (since 2025), maritime disruptions in the Red Sea (since 2023), reduced navigability in the Panama Canal (in 2023–2024), and rising shipping insurance costs are other examples of factors that have added pressure to the fertiliser market in recent years (AMIS, 2025).

FIGURE 3: MOROCCO'S EXPORTED UNIT VALUE FOR PHOSPHATE-RELATED PRODUCTS



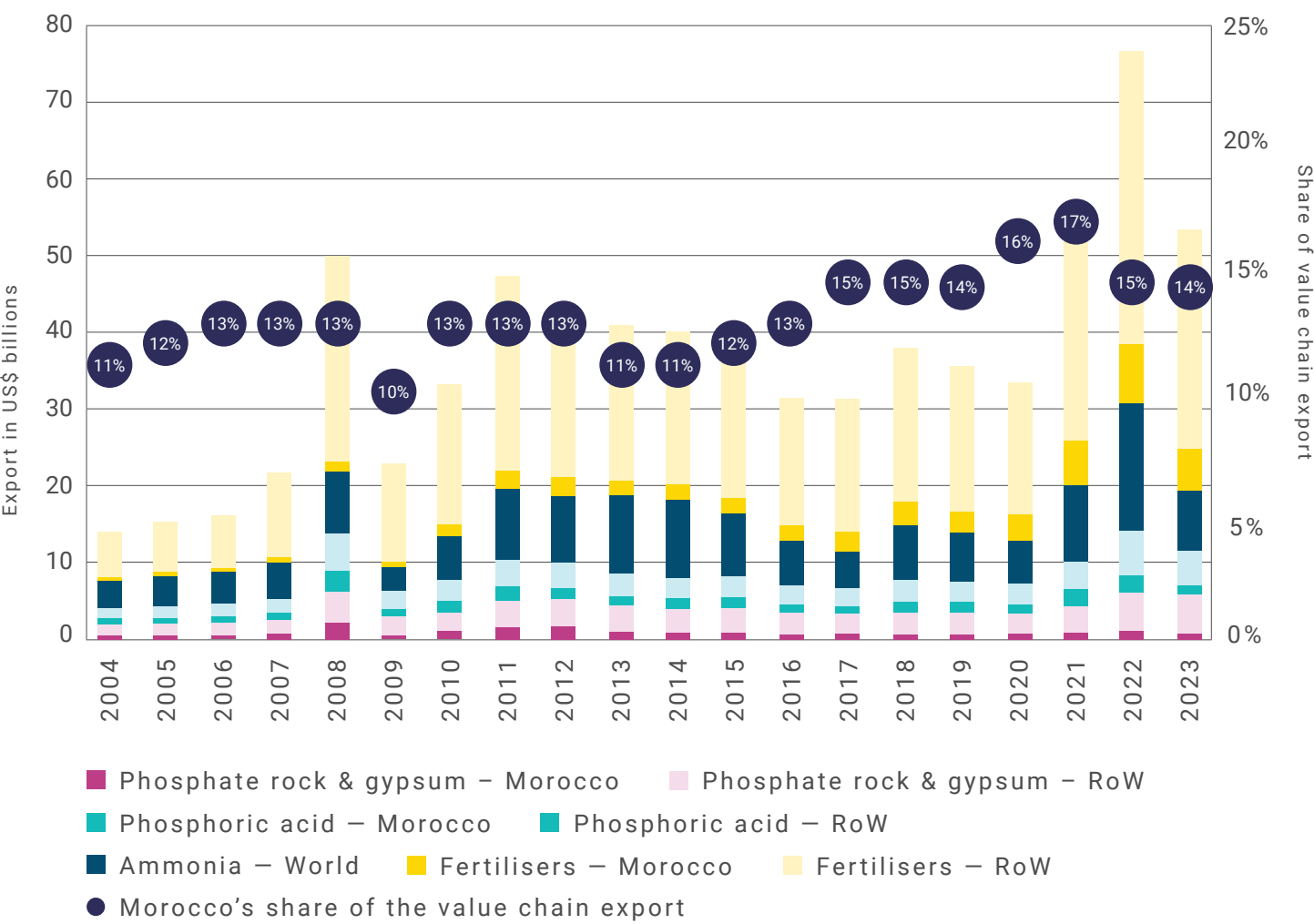
Source: Authors, based on data from TradeMap.

Beyond geology, power dynamics profoundly shape value distribution. Countries involved only in upstream extraction typically remain price-takers on global markets, while those integrating downstream into acid and fertiliser production capture processing margins and develop technical capabilities. Morocco's integrated model from mine to fertiliser factory represents an exceptional case of vertical integration in what is typically a fragmented global industry.

Overall, Morocco holds a unique position in the GVC. In addition to controlling over two-thirds of global reserves, it is a key exporter of

phosphate rock, phosphoric acids, and phosphate-based fertilisers. The only stage of the value chain in which Morocco is not directly involved is ammonia production, although this is set to change in the foreseeable future (see section 5). Overall, as shown in Figure 4, Morocco accounted for 14% of global export value across the phosphate value chain in 2023, reflecting a structurally strong positioning, particularly in higher value-added segments such as processed fertilisers.

FIGURE 4: MOROCCAN PHOSPHATE VALUE CHAIN EXPORT IN THE WORLD



Source: Authors, based on data from TradeMap.

3

MOROCCO'S PHOSPHATE VALUE CHAIN



Morocco is the world's largest exporter of phosphate products and second-largest producer of phosphate rock, making it a key global player.

Through its state-owned OCP Group, the country has developed an integrated value chain from mining to manufacturing. This section unpacks the role of the value chain in Morocco's economy, analysing its contributions to value added, investment, trade, and employment.

It also explores the opportunities for increased value addition domestically and in collaboration with partners across the African continent and beyond.

Morocco's phosphate value chain must be understood within the country's broader development trajectory, shaped by both

important progress and persistent structural challenges. Over the past decade, Morocco has advanced in areas such as industrial development, infrastructure expansion, renewable energy deployment, and strategic public investment. At the same time, significant constraints remain, including regional inequalities, pressures on employment, gaps in education and skills systems, and growing vulnerability to climate change⁴, particularly water stress. Situating the phosphate sector within this wider economic, social, and environmental context is therefore essential to understanding both its strategic potential and the conditions required for more inclusive and sustainable value creation.

MACROECONOMIC AND GEOPOLITICAL CONTEXT

The Moroccan economy has displayed strong levels of resilience over the past few decades.

Morocco's economic growth has recovered after sharp deceleration in 2020 and 2022, due to the shocks of the COVID-19 pandemic and overlapping commodity and climatic shocks, respectively. The country's modest but positive GDP growth in 2023 and 2024 shows the resilience of the Moroccan economy, despite disruptions caused by a devastating earthquake, trade headwinds, and persistent droughts. This resilience has been partly supported by the country's tourism and industrial sectors, including phosphates, which remain a key pillar of exports, helping to offset drought-related slowdowns in agriculture (World Bank, 2023).

Morocco has also benefited from a stable macroeconomic framework, with the fiscal deficit narrowing and government debt stabilising at around 70% of GDP in 2023. Morocco has

embarked on ambitious reforms to boost investment and expand social development, as outlined in the New Development Model 2021–2035, which sets as a key objective the doubling of per capita income by 2035 (World Bank, 2023). However, significant structural challenges, coupled with a widespread informal sector and high levels of emigration, continue to weigh down job creation and long-term inclusive growth. Domestic private investment is low, the labour productivity gap with high-income economies is large, and the labour market is characterised by high youth unemployment and one of the lowest female participation rates in the world (OECD, 2024).

Morocco's geopolitical identity is shaped by its colonial past under French and Spanish rule, its strategic location at the crossroads of Europe and Africa, and its distinctive political structure as a constitutional monarchy. Historically anchored in

close political, economic, and trade relations with Europe, particularly France and Spain, Morocco has in recent years broadened its international partnerships and increased its openness to a more diverse set of actors, including India, China, Brazil, the USA, and countries across the Gulf and Africa. This diversification reflects a pragmatic foreign economic strategy aimed at expanding markets, attracting investment, and strengthening the country's strategic autonomy

in a shifting global landscape. Regionally, the country positions itself as a South–South leader and key partner for the African continent, with its phosphate sector playing an important role in this wider engagement. Through OCP Group in particular, Morocco has supported investment, industrial cooperation, and agricultural partnerships across parts of Africa, helping to build both commercial ties and political goodwill.

SOCIO-ECONOMIC CONDITIONS

Contrasts exist between the country's modern, capital-intensive manufacturing and industrial sector and the broader Moroccan economy.

This reflects a dual economic system where a highly productive, export-oriented sector coexists with a large, low-productivity traditional sector. Agriculture, for example, remains the country's main employer, concentrating over 30% of the labour force, yet it is highly vulnerable to the severe and escalating droughts linked to climate change (World Bank, 2022). The dependence on rain-fed agriculture creates a fragile situation for rural livelihoods and national food security. This situation highlights a national paradox: Morocco advances a pan-African vision of industrial leadership, exporting fertiliser expertise to boost agricultural yields across the continent, while simultaneously managing its own domestic food and water-security pressures.

Morocco is home to nearly 38 million people, with population density concentrated in the northern and western coastal plains, in contrast to the sparsely populated Sahara and mountain regions (UNDESA, 2024).

The country has a dynamic and young population that faces deep-seated structural challenges. In 2023, women's labour force participation stood at only 19.8%, while youth unemployment reached a staggering 32.7%, underscoring the severity of the country's jobs crisis (World Bank data).⁵ This situation appears to be partly associated with constraints within the national education system. Despite policy reforms, poor learning outcomes leave a vast share of the country's youth ill-equipped for the modern economy (OECD, 2023). Widespread frustration in the face of limited prospects has fuelled large-scale youth emigration, often through dangerous, irregular channels, alongside more recent youth-led protests. These dynamics signal a growing rejection of a socio-economic model perceived as failing to deliver inclusive opportunities for all Moroccans (OECD, 2022).

THE PHOSPHATE INDUSTRY AND ITS INTEGRATED MODEL

Morocco's dominance in the phosphate value chain is rooted in its unparalleled geological endowment, as discussed in Section 2. This establishes Morocco not merely as a major producer but as a central player in the global phosphate economy.

What is important to highlight is not the country's mineral reserves, but how Morocco has successfully leveraged this raw material advantage to create a sophisticated industrial ecosystem. This represents a case of successful resource-based industrialisation, driven by a decades-long strategy of integration and expansion. In a relatively short period, the country has moved from just exporting raw phosphate rock to becoming a global leader in finished fertiliser products. This transformation from a simple extractive operation to a knowledge-based industry was powered by strategic, patient, and state-led investment in capabilities and technology, which was focused and materialised into the state-owned enterprise (SOE) known today as the OCP Group.

Through the OCP Group, aided by a combination of good management and an aligned long-term vision, *Morocco's phosphate industry trajectory features deep local value creation and value capture*. In practice, the development of the sector and the evolution of OCP are one and the same, as the company has been the primary vehicle through which downstream integration, sidestream expansion, and capability building have been pursued. The ramp-up of the local value chain is therefore inextricably linked to OCP's own transformation. Moreover, while the sector's direct GDP contribution is estimated at between 3% and 4% consistently over the past two decades (OCP, n.d.-e; OECD, 2025), its true economic footprint is far larger. The industry anchors a vast industrial ecosystem, generating significant indirect economic spillovers through extensive supply chains, major infrastructure projects, and targeted regional development initiatives. The next subsection explores the history and evolution of this phosphate-based SOE and, by extension, Morocco's phosphate sector.

OCP: THE MOROCCAN PHOSPHATE POWERHOUSE

An analysis of the Moroccan phosphate industry is inseparable from an examination of the OCP Group, the SOE that has developed the Moroccan phosphate industry for over a century. Established in 1920 as the Office Chérifien des Phosphates, OCP has evolved from a state bureau focused on the extraction and export of raw phosphate rock into a globally integrated industrial giant. This transformation, particularly over the past two decades, has been instrumental

in shaping Morocco's economic trajectory — and its strategic positioning within the global phosphate market and the food security landscape. The group's corporate structure, strategy, and operational footprint offer a notable model of state-led value chain integration, while also revealing the inherent challenges and future opportunities facing the Moroccan phosphate sector.

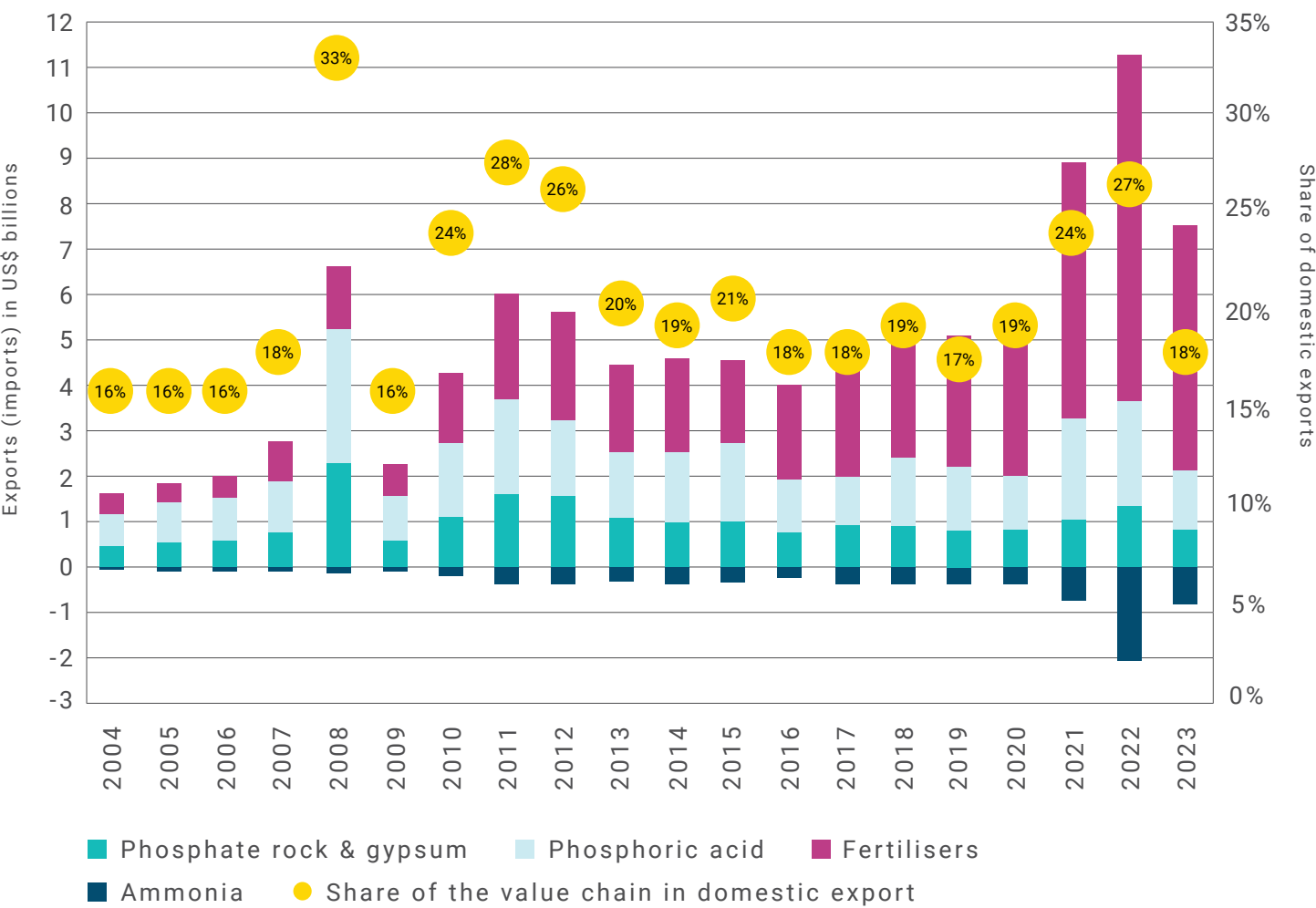
OCP'S STRUCTURE, STRATEGY, AND IMPACT

The Government of Morocco holds 94% of OCP Group, and the company operates as a pivotal engine of the Moroccan economy. With annual revenue of US\$11.3 billion, it represents nearly 20% of Morocco's total export earnings, making it the country's largest industrial exporter (OCP, 2022b; OECD, 2024). The group directly employs over 20 000 workers across mining, processing, and logistics operations, while supporting tens of thousands of additional indirect jobs in related services, transportation, and socio-economic development (OCP, 2023c). This significant economic footprint is the result of a deliberate, long-term strategy to move beyond the simple extraction of mineral resources and capture greater value downstream. OCP's industrial shift has positioned the group and the country as one of the world's top producers and exporters of phosphate derivatives, with a 17–19% global market share in phosphate rock, 35% in phosphoric acid, and 26% of phosphate fertilisers exports in 2022 (OECD, 2024).

In 2023, OCP's operational capacity was substantial, with the ability to produce 47.5 million tonnes of phosphate rock, 8 million tonnes of phosphoric acid, and 14 million tonnes of finished fertilisers (OCP, 2023a). The group's revenue structure reflects its success in downstream integration, with fertilisers constituting 66% of its consolidated revenue in 2023. The next top revenue streams were phosphate rock (17%) and phosphoric acid (8%), underscoring the shift from commodity exporter to manufacturer of value-added products. Geographically, OCP's market presence is largely diversified, with Africa (28%), Latin America (26%), and Europe (17%) representing its largest markets (OCP, 2023b).



FIGURE 5: MOROCCO'S PHOSPHATE VALUE CHAIN EXPORTS



Source: Authors, based on data from TradeMap.

Despite its global share, OCP's operational and asset base remains highly concentrated within Morocco, with 95% of its consolidated assets located domestically (OCP, 2023b). While this concentration has anchored significant industrial development at home, it also highlights a

OCP'S VALUE CHAIN CONFIGURATION

The group's competitive advantage is built upon a vertically integrated value chain that spans from extraction to market. The process begins at its primary mining sites in the regions of Khouribga, Gantour Basin and Boucraa, which collectively hold most of Morocco's reserves. The mined rock is then transported to the major processing hubs at Jorf Lasfar, Mzinda, and Safi. This logistical connection is a cornerstone of OCP's operational efficiency, exemplified by the 187-kilometre (km) slurry pipeline connecting the Khouribga mines to the Jorf Lasfar processing platform and the 102 km conveyor belt linking the Boucraa mine to Laâyoune. Operational since 2014, this pipeline doubled transport capacity to 38 million tonnes annually, while reducing transport costs by 90% and water consumption by 3 million cubic metres per year (OCP, n.d.-a).

At OCP processing sites, the phosphate rock is converted into phosphoric acid, the essential precursor for high-concentration fertilisers like DAP and MAP. These facilities also integrate the production of sulfuric acid and leverage cogeneration to capture waste heat to generate

strategic imperative to expand its international production footprint, particularly in Africa, to enhance market proximity and supply chain resilience.

electricity, which, according to company reports, has made the Jorf Lasfar complex largely energy self-sufficient, significantly reducing its reliance on the national grid and avoiding greenhouse gas (GHG) emissions (OCP, 2024).

The final products are then distributed to a network of over 350 clients across more than 160 countries through dedicated port infrastructure in Casablanca, Jorf Lasfar, Safi, and Laâyoune (OCP, n.d.-b). This integrated model of extraction, logistics, processing, and global distribution has allowed OCP to optimise costs, ensure quality control, and adapt to shifting market demands with a higher degree of agility.

OCP'S STRATEGIC PATHWAYS

While the integrated fertiliser model has been a well-studied success, *OCP's long-term strategy has increasingly focused on diversification, sustainability, and aligning its corporate objectives with Morocco's national development priorities.* The group's ambitious US\$13 billion green investment programme (over the 2023–2027 period) aims to achieve carbon neutrality by 2040 and further expand its value-added product portfolio (OCP, n.d.-c).

A central pillar of OCP's strategy is the decarbonisation of its industrial inputs, mentioned in Section 2 (see also Figure 5).

The group is particularly reliant on imported ammonia, exposing it to significant price volatility and an increased carbon footprint on its supply chain. In response, OCP has announced substantial investments to produce green ammonia domestically, using hydrogen generated from renewable energy sources. The company

aims to produce 1 million tonnes of green ammonia by 2027, and 3 million tonnes by 2032, supported by the development of 13 GW of solar and wind energy capacity (OCP, n.d.-c, 2022c). This upstream integration into renewable energy and green ammonia production could represent a transformative opportunity to secure its supply chain, control costs, and establish Morocco as a global example of sustainable production. However, timeline updates remain limited beyond the initial announcements (Eljehtimi, 2023, 2024; Reuters, 2024a).

Furthermore, the company has announced plans to enter the LFP battery materials market, with a target of producing 30 000 tonnes of intermediate products by 2027 (OCP, 2022c).

This move signals an intent to link Morocco's phosphate endowment to the rapidly growing low-carbon energy transition, creating synergies with the country's large automotive industry.

THE OCP INDUSTRIAL ECOSYSTEM

OCP's operating model extends beyond mining and fertiliser production into a wider ecosystem that supports project delivery, product development, and skills formation across the phosphate value chain. This ecosystem

is structured around dedicated subsidiaries, joint ventures, and partnerships spanning R&D, industrial engineering, agronomic services, and workforce development, and is presented by OCP as reinforcing both operational performance and broader national development objectives (OCP, n.d.-b, n.d.-f).

A central pillar of this ecosystem is the Mohammed VI Polytechnic University (UM6P), established as part of OCP's broader development

programme and positioned as a driver of innovation, talent development, and technology uptake. Within the UM6P ecosystem, OCP highlights INNOVX as a venture and deployment platform that helps translate research and emerging technologies into new industrial and sustainability-focused initiatives (OCP, 2017b).

Operationally, OCP Nutricrops is a dedicated subsidiary for soil health and plant nutrition solutions, reflecting a shift towards higher-value agronomic products and services. In parallel, OCP has built internal project delivery capacity through JESA, the joint venture with American firm Jacobs Engineering, which provides engineering and project management services supporting large-

scale industrial and infrastructure programmes (OCP, n.d.-g, n.d.-h). OCP also links workforce development to its industrial footprint through Industrial Competence Centres (CCIs), training platforms serving OCP and the wider ecosystem.⁶

OCP also uses targeted partnerships and joint ventures to extend capabilities along the value chain, including collaboration with Germany's Fraunhofer Institute on green hydrogen and green ammonia applications, a 50/50 joint venture with Chinese firm Hubei Forbon focused on new fertiliser technologies and digital agriculture solutions, and a joint company between OCP and

Spanish Fertinagro Biotech for enriched fertilisers and related products (OCP, 2018, 2019, 2021a).

Alongside industrial and innovation entities, OCP also positions philanthropic and community programming as part of its footprint through the OCP Foundation, which is focused on improving living conditions for communities in Morocco and across the African continent (OCP, n.d.-d).



4 RISKS AND MITIGATION



Morocco's pivotal position within the global phosphate value chain presents both significant opportunities and inherent vulnerabilities. Effective risk management is crucial to safeguard against internal and external shocks. This section unpacks the common risks faced by Morocco's phosphate industry, explores its unique challenges, and proposes potential mitigation solutions for the country's phosphate ecosystem.

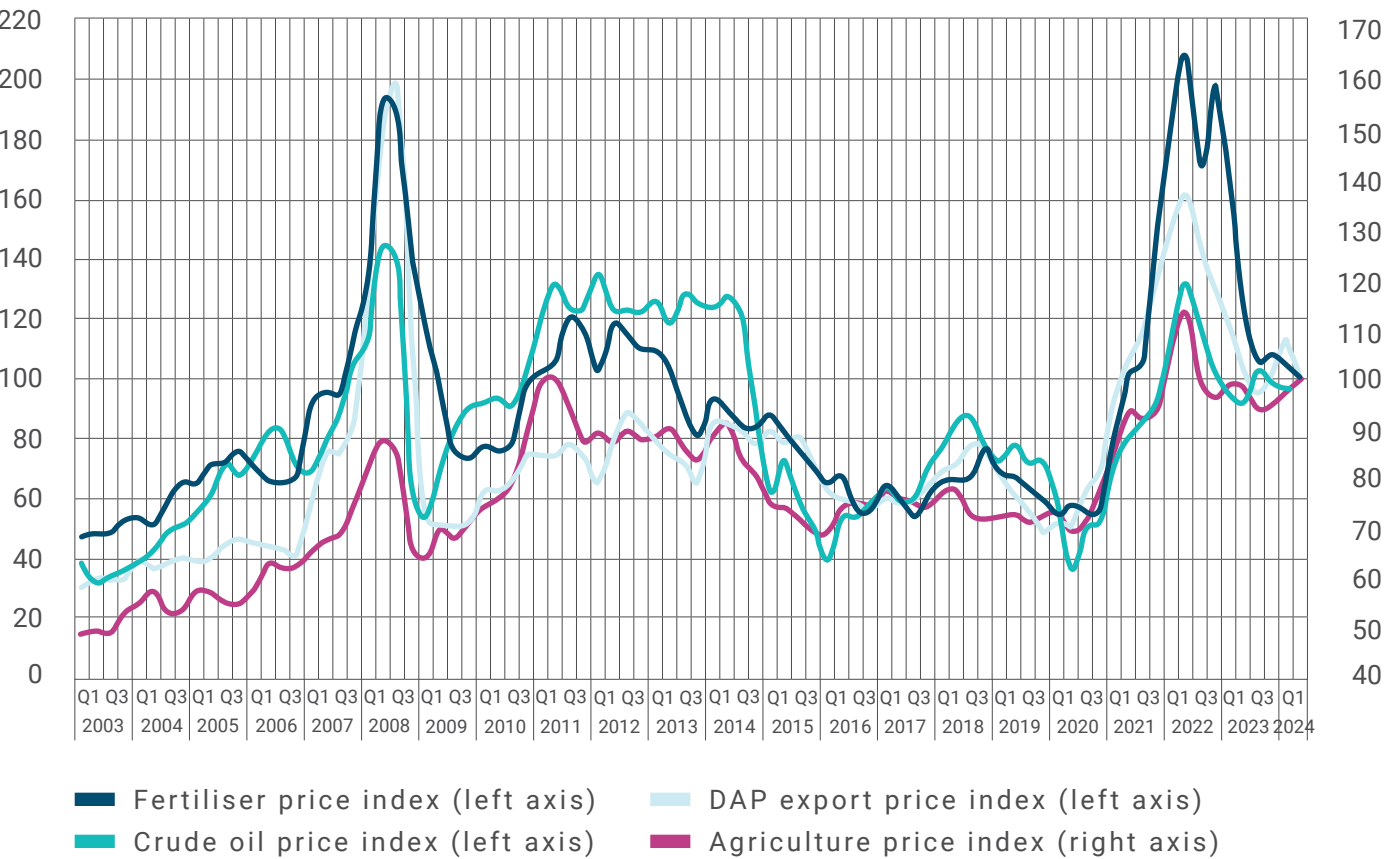
MARKET AND PRICE VOLATILITY

Phosphate markets exhibit significant price volatility, driven by multiple factors including weather-related demand fluctuations, geopolitical events, and macroeconomic conditions. As shown in Figure 6, the 2008 phosphate price surge demonstrated the potential for extreme market disruptions. The spike emerged from the convergence of policy-driven demand and supply shocks: China's imposition of export duties to discourage fertiliser exports, India's ad hoc subsidy scheme that kept farm-gate prices flat and

drove a dramatic surge in DAP import demand, and OCP's decision, driven by years of eroding margins from rising oil prices and a weakening US dollar, to announce significant phosphate rock price increases for 2008 shipments within an already tight global market (Mew et al., 2023). More recently, the 2022 Russia–Ukraine conflict and associated energy price increases created substantial input cost pressures, particularly for ammonia and sulfuric acid production.



FIGURE 6: PRICE INDEXES OF PHOSPHATE-LINKED PRODUCTS (2024 Q2 = 100)



Source: Authors, based on data from IMF.

Input price volatility, particularly for gas, represents the most immediate operational risk.

As noted in Section 2, ammonia production costs are 70–80% dependent on fossil gas prices. Since ammonia is a primary fertiliser component, gas price fluctuations directly affect finished fertiliser production costs. This deep integration with energy markets means geopolitical events that disrupt fossil gas supplies can rapidly translate into severe price shocks for phosphate fertilisers (Levi and Molnar, 2022).

One promising strategy to mitigate the phosphate industry's vulnerability to energy price volatility is the gradual integration of locally produced green ammonia into fertiliser production and distribution. Green ammonia, produced from renewable energy sources, offers a pathway to decouple fertiliser costs from fossil fuel markets. Morocco has plans to develop domestic green ammonia production capacity to reduce import dependency, further discussed in Section 5. If successful, this upstream strategy into energy inputs would provide cost stability and carbon footprint reduction, while positioning Morocco as a potential green ammonia exporter to other fertiliser producers.

Market and price volatility in phosphate-based fertilisers can be worsened by reliance on centralised, distribution-heavy production systems.

A potential mitigation is to localise downstream conversion by producing small-scale ammonia using low-cost stranded energy and blending it with locally available (often low-grade) phosphate rock to press nitrogen–phosphorus fertiliser tablets closer to rural demand, reducing exposure to wider supply-chain disruptions and distribution burdens. Risks such as the current low efficiency and production rates of green ammonia and the safety requirements associated with ammonia handling can be mitigated through phased deployment where trained contractors operate ammonia systems under strict safety protocols, while farmers handle only the finished tablet product (Koestoer et al., 2024).

Furthermore, the diversification of input suppliers and strategic stockpiling has provided additional risk mitigation. Morocco has expanded ammonia import sources beyond traditional suppliers in Russia and Ukraine to include companies from Saudi Arabia, Trinidad and Tobago, the USA, and a range of other countries (Qatar, Libya, Oman, Indonesia, Egypt). Strategic storage facilities can also buffer short-term supply disruptions, though the capital requirements and storage constraints limit the feasibility of maintaining large inventories (van den Brink et al., 2020).

WATER STRESS AND ENVIRONMENTAL PRESSURES

The phosphate industry is highly water-intensive, utilised primarily for ore washing, phosphoric acid production, and cooling systems. This reality is particularly relevant for Morocco, where balancing industrial demands with extreme water scarcity represents one of the nation's most pressing long-term sustainability challenges (World Bank, 2022).

These pressures create complex trade-offs, as phosphate operations in regions like Khouribga compete with agriculture and urban populations for scarce water resources. Expanding processing capacity without improving water efficiency and water-supply risks would exacerbate these tensions (Lee et al., 2020). Mitigation strategies focus on efficiency improvements and alternative sources. OCP reports implementing closed-loop systems that reduce consumption by approximately 30%, while planned seawater desalination projects aim to supply 100 million cubic metres annually by 2027 (OCP, n.d.-c). However, desalination efforts also carry a separate set of environmental impacts, and their substantial energy requirements reinforce the critical need for renewable energy integration.

Phosphogypsum waste management presents additional environmental challenges. Morocco generates approximately 30 million tonnes of phosphogypsum annually (Meskini et al., 2024) as a by-product of phosphoric acid production. While some phosphogypsum can be used in cement production and land reclamation, the majority remains stored in waste piles that present groundwater contamination risks. Looking ahead, circularity approaches including phosphogypsum recycling for construction materials (such as cement) and rare earth element (REE) recovery could transform this waste stream into an economic asset (Geissler et al., 2018; Lee et al., 2020). However, phosphogypsum recycling is currently not cost-competitive, as it must compete with abundant, low-cost natural gypsum and overcome the technological challenge of implementing complex, energy-intensive purification processes (IEA, 2023; Tayibi et al., 2009).

GEOPOLITICAL RISK AND TRADE EXPOSURE

Morocco's phosphate industry is exposed to ammonia price and supply volatility, given its reliance on imported inputs and the energy-intensive production chains required to produce it. Morocco currently depends heavily on imported grey ammonia,⁷ which increases its sensitivity to external shocks (Dahani et al., 2024). This exposure is compounded by regional tensions and

conflict dynamics. Following the breakdown in Morocco–Algeria relations in August 2021, Algeria decided not to renew gas flows through the Maghreb–Europe pipeline, increasing pressure on Morocco's energy security and triggering higher costs for upstream industrial inputs at that time (Reuters, 2021). In parallel, the Russia–Ukraine war disrupted global ammonia markets and

prices. As a result, OCP reported sharply higher import costs and broader supply disruptions, including interruptions to Russian ammonia exports (Eljechtimi, 2022, 2023; Ewing, n.d.).

Also, political sensitivities surrounding phosphate operations in Morocco's southern mining area add a layer of geopolitical complexity to the sector's risk profile. The Bou Craa mine produces approximately 10% of Morocco's phosphate output (OCP, 2022a), meaning that any deterioration in the longstanding conflict with the Polisario Front (Nichols, 2025) could potentially affect production and cause logistics constraints. At the same time, a 2025 UN Security Council resolution,⁸ which renewed MINURSO's⁹ mandate until October 2026, reaffirmed the importance of respecting the ceasefire in the region and avoiding any act that

jeopardises the political process. In this context, the main risk associated with Bou Craa-origin phosphate is therefore less one of formal trade bans than of higher transaction, compliance, insurance, and investment risk.

Further risks include politically motivated trade policies, including potential sanctions, tariffs, or export restrictions, like the duties imposed by the USA on Moroccan phosphate imports in 2021 due to allegations of countervailing subsidies (AMIS, 2022; Li et al., 2023; Reuters, 2020). These tariffs had a direct impact on market access and pricing, and were heavily disputed by the OCP Group (OCP, 2023d). While for now the most recent wave of USA tariffs do not directly target Morocco, the situation remains highly volatile.

TECHNOLOGICAL AND COMPETITIVE DISRUPTION

Emerging technologies could disrupt traditional phosphate markets. Precision agriculture and biotechnology innovations, including nitrogen-fixing crops and enhanced phosphorus-uptake varieties, could reduce fertiliser demand, while recycled phosphorus from wastewater and organic waste could capture market share from mined phosphates (Roy et al., 2019).

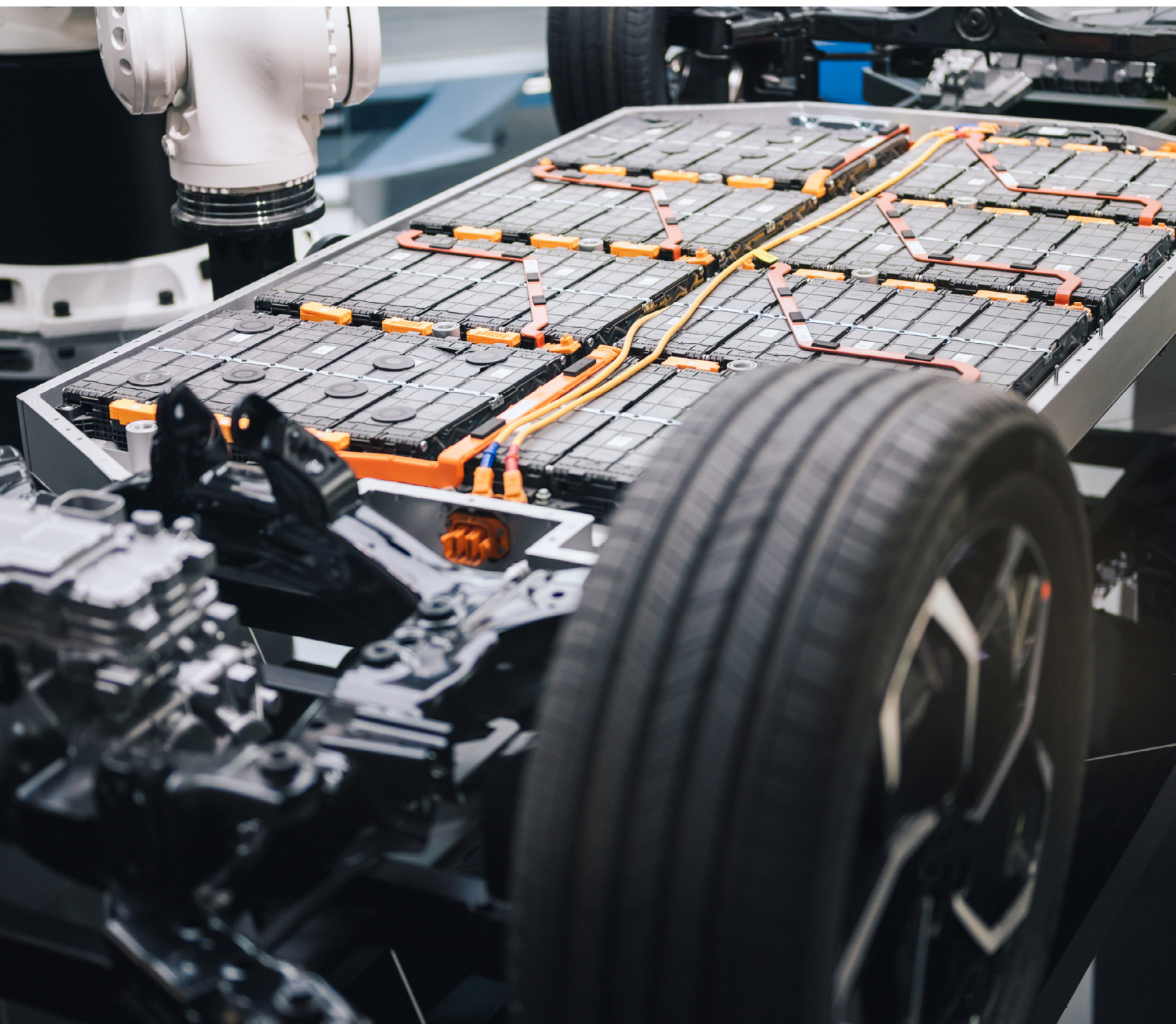
Battery technology evolution presents both opportunities and risks. While LFP batteries create new demand for phosphate-based materials, alternative battery chemistries, including sodium-ion and solid-state technologies, could reduce phosphate requirements. The rapid

pace of battery technology development requires flexible positioning to capture opportunities while avoiding stranded assets (IEA, 2024a).

Competitive threats from other phosphate producers could erode Morocco's market position. Potential development of phosphate resources in other regions, including offshore phosphate-nodule mining and enhanced recovery from lower-grade deposits, could increase global supply. However, Morocco's cost advantages and established infrastructure provide defensive positioning against most competitive threats.

5

ADVANCING JUST TRANSITION PATHWAYS



As described in previous sections, Morocco has leveraged its exceptional phosphate endowment to retain and expand value creation within its national borders. Rather than remaining primarily a raw-material exporter, which is often associated with the so-called “resource curse”,¹⁰ the country has developed domestic industrial capabilities, generated sustained national revenues, and built an integrated ecosystem of companies operating across the phosphate value chain. Looking ahead, Morocco can build on its established industrial base and emerging opportunities to generate new forms of value aligned with a ‘whole-of-

economy, whole-of-society’ approach, while maintaining competitiveness and strengthening regional and global cooperation. To ensure future development is both equitable and sustainable, additional directed and strategic actions are necessary. Key priorities must include mitigating water scarcity and regional disparities while fostering social inclusion, job creation, and local skill development. This section examines local, regional, and global opportunities to deepen integration and outlines instruments to enable economic, social, and environmental upgrading.

ECONOMIC UPGRADING PATHWAYS

GREEN AMMONIA INTEGRATION AND FERTILISER DECARBONISATION

The move towards green ammonia production offers Morocco a potentially transformative economic upgrading opportunity that could advance multiple strategic objectives simultaneously.

In 2024, Morocco’s ammonia imports exceeded 1.8 million tonnes (TradeMap data), representing both a cost burden and a carbon liability that green domestic production could eliminate. Green ammonia integration presents a compelling strategic opportunity that improves input-cost stability, opens new export options, and supports the country’s GHG emission-reduction ambitions.

Morocco’s renewable energy resources provide an important competitive advantage for local green ammonia production. Solar irradiation levels exceeding 2 000 kWh/m² annually in southern regions, combined with consistent Atlantic wind resources, enable low-cost renewable energy generation (El Hafdaoui et al., 2025). The country’s planned additional capacity

of 10 GW from renewables (solar, wind, and hydro) by 2030 should support Morocco’s 2030 target of achieving a 52% renewable energy capacity, which could provide the electricity needed for green ammonia production while helping to accelerate decarbonisation across its wider economy (IEA, 2019; OECD, 2024).

OCP’s planned investment of US\$7 billion in green hydrogen and ammonia production by 2027 aims to produce 1 million tonnes annually.

If successful, this could cover most domestic requirements (OCP, n.d.-c). In the meantime, securing off-take for a portion of green ammonia supply could further reduce exposure to gas-driven ammonia price shocks, while progressively decarbonising the fertiliser value chain and strengthening the investment case for new renewable energy and green ammonia capacity (Tanchum, 2022). While green ammonia remains more costly than fossil fuel-based production, its feasibility could improve over time if renewable

energy costs continue to decline and carbon pricing mechanisms reshape relative costs. In the short term, while this transition cannot yet be viewed as a commercially certain solution, it can be understood as a longer-term strategic opportunity for Morocco to strengthen domestic industrial capacity and reduce exposure to external supply and price vulnerabilities.

Prioritising green ammonia production could not only strengthen domestic industrial resilience but, over time, position Morocco as a key regional exporter. This would help shift the national energy sector into a strategic engine for growth, further improving the trade balance and supporting a stronger long-term GDP trajectory. Converting the country into a regional exporter of green hydrogen and derivatives could enable exports of approximately 4.41 million tonnes of hydrogen equivalent annually by 2040 (World Bank, 2025). In addition, green ammonia exports to European and African markets could generate important additional earnings (Kleissl, 2018; Lee et al., 2020).

BATTERY VALUE CHAIN INTEGRATION

Morocco's positioning in LFP battery materials represents another strategic diversification opportunity that builds on its existing capabilities to capture the exponential growth in clean-energy markets. By 2024, LFP batteries already accounted for nearly half of the global electric-vehicle (EV) battery market, and their share is expected to continue growing (IEA, 2025). Market estimates vary widely, valuing the global LFP battery market at between approximately US\$18 billion and US\$65 billion in 2024–25 and projecting it to reach around US\$47 billion to US\$160 billion by 2030.¹¹

However, this pathway requires coordinated investments across multiple sectors. Renewable energy development must be synchronised with electrolyser capacity expansion and ammonia synthesis facilities. Storage and distribution infrastructure for ammonia requires substantial capital investment but could create opportunities for domestic engineering and construction services (World Bank, 2022). The successful implementation of this complex new integration will require significant national and foreign investment and will once more depend on careful state coordination and patient capital deployment, which Morocco has previously achieved in phosphate industry developments.

An LFP integration pathway would span multiple stages, with varying technical and commercial requirements. Integrating into this value chain requires implementing distinct technical stages: upgrading phosphate purification to meet strict battery-grade specifications, deploying specialised chemical engineering for iron phosphate precursor synthesis, and applying advanced materials science for precision cathode fabrication (Dorri et al., 2025). Given these high technical barriers and China's dominance in battery supply chains, Morocco has targeted and attracted significant Chinese investment to bridge the technology gap and create synergies.

Morocco has seen a surge in foreign capital, mostly Chinese, aimed at building a domestic EV battery ecosystem. China's Gotion High-Tech has signed an agreement to develop a large battery factory, with production expected to start in 2026. At the same time, the Sino-Moroccan joint venture COBCO (Al Mada and CNGR) has transitioned from planning to operations, launching battery material production at Jorf Lasfar in 2025, with further expansion underway. Furthermore, South Korea's LG Chem, in partnership with Youshan (a subsidiary of China's Huayou Group), has announced a joint cathode materials plant, also scheduled for 2026. Additionally, Chinese battery materials maker BTR New Material Group is planning to produce key cathode components near Tangier, reflecting expectations of growing demand for LFP supply chains (Curran, 2023; Eljehtimi, 2025; Reuters, 2024b; Yang, 2023).

This investment influx is a result of Morocco's strong geographical and value proposition for actors seeking access to European markets on more favourable terms.

In 2024, the country was already the African continent's premier automotive export hub, hosting major car manufacturers including Renault, Stellantis, and Ford. This mature ecosystem offers critical synergies for EV battery integration (Hermanus and Montmasson-Clair, 2025). By positioning itself to meet rising EV demand, Morocco can use local battery assembly facilities as a domestic demand anchor for LFP materials, thereby accelerating the electrification of its wider automotive industry.

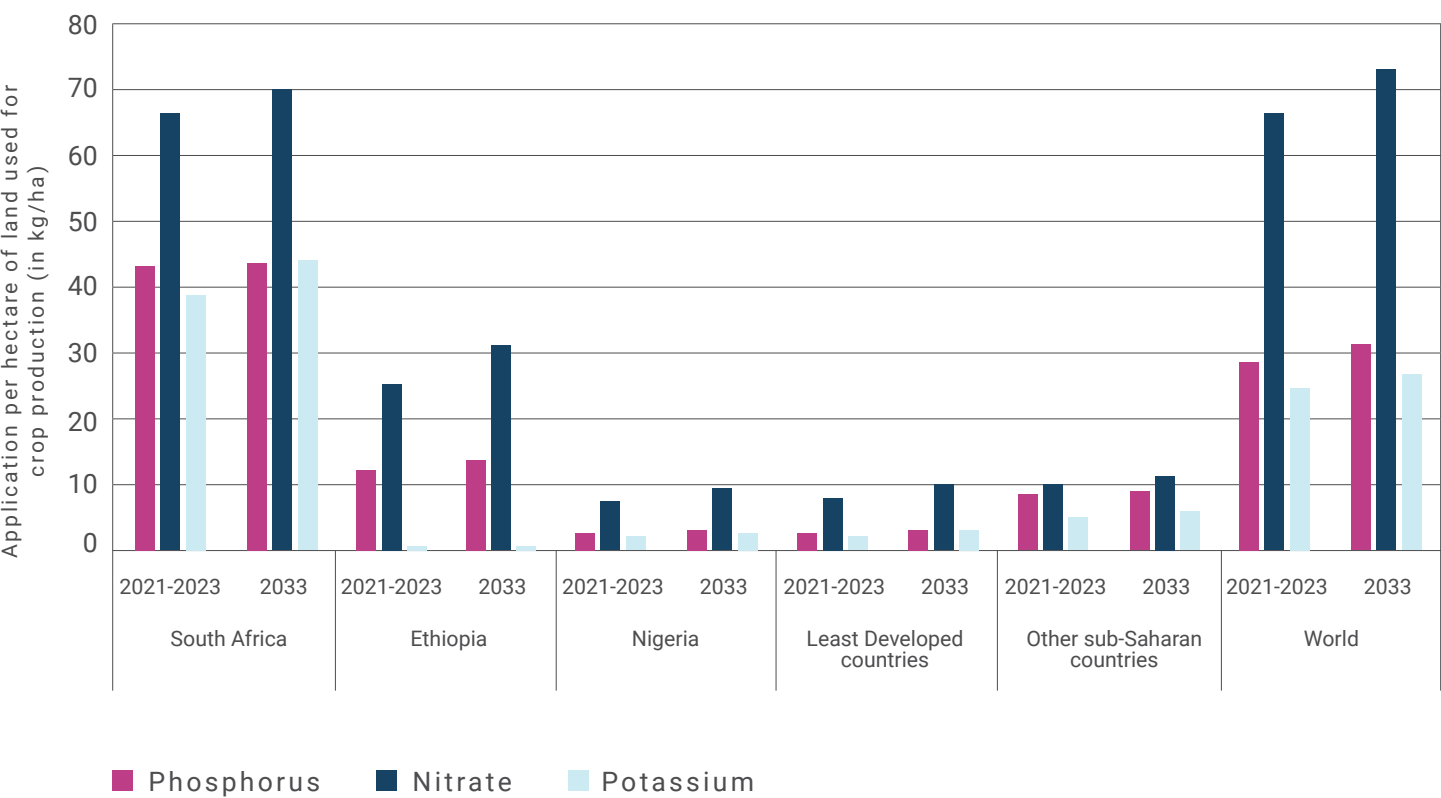
GEOGRAPHICAL DIVERSIFICATION: REGIONAL HUBS AND GLOBAL MARKETS

Regional and global diversification represents yet another pathway for Morocco's economic upgrading, allowing the country to use its established phosphate expertise as a lever to unlock deeper industrial and service-based partnerships both within the African continent and across the Global South.

Regionally, Morocco's deep expertise in the phosphate industry, coupled with Africa's significant agricultural potential, **presents a powerful opportunity to drive shared prosperity and cement the Kingdom's aspirations as a regional technological leader.** Sub-Saharan Africa currently has the lowest fertiliser consumption

rate in the world, with an average application of around 25 kilogrammes per hectare, a fraction of the global average of 146 kilogrammes per hectare (FAO, 2024). This vast gap signifies that there is an immense opportunity to boost crop yields and improve food security on the African continent. By leveraging its technical know-how, Morocco, through OCP and its ecosystem, is moving to provide integrated agricultural services that address these agronomic gaps, transforming its resources into a catalyst for continent-wide development.

FIGURE 7: FERTILISER APPLICATION PER HECTARE OF LAND USED FOR CROP PRODUCTION IN SUB-SAHARAN AFRICA



Source: Authors, based on data from the OECD and the FAO.

OCP Africa's regional strategy, described in Section 3, relies on deploying comprehensive agricultural service platforms that offer more than just fertilisers. Regional hubs and platforms integrate value-adding components, such as soil mapping, customised fertiliser blending (tailored to specific soil and crop needs), advisory services, and farmer training programmes. This service-oriented model captures greater economic value and builds lasting customer relationships that are resilient to volatile commodity prices.

OCP has operationalised this vision through large investments across Africa. In Nigeria, the

group has committed US\$1.3 billion to build an industrial platform in Akwa Ibom to produce ammonia and fertilisers, complementing three operational blending plants in different Nigerian states (Reuters, 2018). In Ethiopia, the group signed a pact to develop a fertiliser complex in Dire Dawa, with an estimated investment of up to US\$3.7 billion, aimed at securing the country's fertiliser self-sufficiency (Ministry of Finance, 2021; OCP, 2022a). Underscoring a strategic shift towards localised production hubs across the Global South (North Africa Post, 2024), these investments, supported by frameworks like the African Continental Free Trade Area (AfCFTA),

not only create platforms for scalable service delivery but also build local industrial capabilities and employment (OCP, 2021b), positioning Morocco as a pivotal partner for the continent's much-needed agricultural transformation.

Globally, OCP has also strengthened South–South cooperation through strategic assets in key markets. In India, a joint venture with Krishak Bharati Cooperative Limited (KRIBHCO) was established to construct a 1.2 MT/year NPK fertiliser plant in Andhra Pradesh, securing supply

for a major agricultural economy ((OCP, 2017a). Simultaneously, OCP expanded its downstream presence in Brazil via its subsidiary OCP Fertilizantes, enhancing distribution and storage infrastructure in a critical region. By integrating into the supply chains of agricultural economies in the Global South, these external ventures and international partnerships further advance Morocco's journey as a regional leader and provider of integrated agribusiness services.

SOCIAL AND ENVIRONMENTAL UPGRADING

Morocco's phosphate-led economic upgrading, described in the previous section **will only translate into a just transition if it is matched by deliberate social and environmental upgrading mechanisms that strengthen livelihoods, reduce inequality, and manage impacts across the WEF nexus.** The long-term viability of the sector depends on fostering social improvements and environmental resilience. While OCP Group's initiatives to localise the benefits of the mining value chain through skills development and local entrepreneurship remain an important effort, they

have not been sufficient on their own. As unemployment grows, environmental stress deepens, and education lags, the challenge lies in ensuring social and environmental mechanisms are systemic rather than sporadic and localised. Successful upgrading pathways require that industrial gains translate into broad-based societal benefits, effectively mitigating the negative externalities associated with resource-intensive extraction.

EDUCATION, SKILLS DEVELOPMENT, AND YOUTH EMPLOYMENT

Morocco's phosphate industry provides a strong platform for specialised technical training, but converting industrialisation into social opportunity requires a skills and employment pipeline that extends far beyond the immediate needs of the sector. This is particularly urgent given the country's demographic profile. In 2024, close to 40% of its youth faced unemployment (HCP, 2025). OCP's educational initiatives provide a good model, but scaling successful pilots into a national engine for employment requires broader

collaboration and deeper penetration into rural communities.

UM6P, its subsidiaries, business units, and related ecosystem, sit at the centre of OCP's R&D and educational strategy and provides an important national asset for advanced training and applied research. UM6P's high-level R&D partnerships with institutions like MIT and the University of Sheffield facilitate important knowledge transfer, but fail to tackle the root

cause: scale. The magnitude of Morocco's youth unemployment challenge means that this flagship university cannot address labour market gaps on its own. Priority should be not only to increase enrolment at UM6P, but also to expand access throughout the network of public universities, strengthening technical and vocational education – especially for rural and mining regions – through satellite programmes, blended learning, and regional training hubs. Digital literacy and entrepreneurship programmes targeted at rural mining communities could address broader developmental needs while creating economic opportunities. Mobile technology platforms for agricultural extension, financial services, and e-commerce require technical skills that can be developed through industry-supported training programmes, creating pathways for young people to participate in the digital economy while remaining in their home communities (World Bank, 2022).

Robust technical programmes and formalised, structured apprenticeship and placement pathways are needed to further address high youth unemployment and scale skills development (OECD, 2024). To connect training to jobs, Morocco can formalise these pathways that link industrial operators, contractors, and foreign organisations to measurable employment outcomes as well as support to micro, small, and medium-sized enterprises (MSMEs) that can absorb trained youth.

Skills development, internships, learnerships, and entry-level hiring should align with practical competencies required by Morocco's evolving industrial strategy. These could include process operations and maintenance, chemical and industrial safety, logistics and port operations, renewable energy installation and

operations, water efficiency and reuse systems, environmental monitoring, and mine rehabilitation and ecological restoration. While highly relevant for the phosphate value chain, these skills are portable and applicable across sectors, reducing the risk that job creation remains confined to a single value chain. Partnership programmes with the national vocational education system could scale these opportunities to reach thousands of additional students annually (OECD, 2024) and become a replicable model for other African nations.

Recent episodes of social discontent and growing frustration among young people underscore the urgency of strengthening the education and skills ecosystem as part of a broader strategy for social cohesion and inclusive development. Addressing these challenges is essential not only for improving employment outcomes, but also for reducing the risk of deepening social fragmentation. Critically, such interventions cannot be driven by OCP alone; they require coordinated action across national and local government, education and training institutions, the private sector, and development partners. Financing mechanisms beyond OCP's direct investments are essential, such as public-private partnerships with international development agencies, scholarship programmes funded through industry export revenues, and results-based financing tied to employment outcomes. The education agenda should centre on capability at scale across regions and sectors.

REGIONAL DEVELOPMENT AND COMMUNITY BENEFIT-SHARING

Beyond skills and jobs, social upgrading requires that rural and mining regions capture lasting development gains and diversified livelihoods, rather than remaining remote extractive enclaves.

Phosphate mining regions, including Khouribga, Gantour Basin, and Boucraa, face significant development challenges despite proximity to major industrial operations. Unemployment rates in rural areas exceed national averages (HCP, 2025), infrastructure development lags coastal urban areas, and economic diversification remains limited. Systematic regional development initiatives that embed phosphate-led investment within local development and align public and private spending in transport, digital connectivity, housing, health, and education facilities could help address these challenges while strengthening the industry's social licence to operate.

MSME development is an important lever for localisation and community resilience. Targeted supplier development programmes paired with MSME development programmes can leverage phosphate industry supply chains to create local economic opportunities. Technical assistance, preferential procurement policies, improved access to finance, and early invoicing initiatives can help develop local firms participating in maintenance, fabrication, logistics, catering, professional services, and environmental services. Well-designed MSME programmes can reduce opportunity leakage (loss of economic benefits that could stay in local communities), grow local capabilities, and create employment pathways that are not limited to OCP's direct

workforce.

Women's economic inclusion represents an especially relevant pathway for social upgrading, given Morocco's relatively low female labour force participation rates (OECD, 2024). Female inclusion in the workforce should be treated as a structural priority rather than an add-on. In the phosphate industry, occupational entry points include laboratory and quality control functions, environmental monitoring, administrative and professional services, and managerial roles. However, these must be accompanied by childcare facilities, flexible work arrangements, and skills development programmes targeted at women to increase participation rates while addressing broader social development objectives.

Community benefit-sharing and accountability mechanisms also matter for long-term

legitimacy, especially in remote communities. OCP and its suppliers could include revenue-sharing mechanisms, local shareholding trusts, and environmental remediation programmes to ensure that mining communities directly benefit from phosphate-related development. Local policy reforms, coupled with community participation in planning processes, credible grievance mechanisms, and transparent reporting on local investment and rehabilitation commitments strengthen trust and reduce conflict risk, particularly where water and land pressures heighten perceptions of unfairness or exclusion.

CIRCULARITY AND WASTE VALORISATION

Circularity measures can convert phosphate-linked externalities into economic opportunities

while reducing the long-term environmental burden of industrial scale-up.

The valorisation of phosphogypsum and REEs represents opportunities to transform industrial by-products into economic assets

while addressing environmental liabilities.

Phosphogypsum is generated in very large quantities as a by-product of phosphate fertiliser production, with global production estimated between 200 and 300 million tonnes per year, making it one of the world's largest industrial waste streams. Despite its scale, global recycling remains limited (estimated at about 15%), leaving significant unrealised potential for circularity applications, particularly in construction materials (Bilal et al., 2023; Geissler et al., 2018; Yang et al., 2024). In Morocco, the scale of phosphogypsum generation is closely linked to OCP Group's downstream phosphoric acid and fertiliser operations. OCP notes that it is actively assessing reuse pathways, such as road and construction applications (OCP, 2020a, 2020b).

The potential applications are twofold: 1) high-volume applications (cement and construction materials), and 2) high-value extraction of REEs and other potentially recoverable components.

However, both pathways demand major capital investment in new processing facilities and

technical expertise. Developing such circular models is critical for industrial sustainability but requires supportive policies, technological innovation, and market development to overcome the initial investment barriers (Damania et al., 2023).

While the prospect of recycling phosphogypsum and recovering REEs is an important area to explore for circularity gains, the commercial viability of these technologies remains constrained by high costs and significant energy requirements.

The processes required to extract them, such as acid leaching and solvent extraction, are not yet economically competitive at scale (Walawalkar et al., 2016). Similarly, converting phosphogypsum into construction materials requires extensive processing to remove impurities, often making it more costly than using natural gypsum (Tayibi, 2009). Therefore, despite the clear environmental benefits, the economic and energetic hurdles remain substantial barriers to widespread adoption, especially in an emerging economy like Morocco. Until the technology matures and becomes more cost-effective, these promising recycling opportunities will struggle to move from pilot projects to a scale that can meaningfully impact the phosphate industry's environmental footprint.

ENVIRONMENTAL STEWARDSHIP AND THE WATER-ENERGY-FOOD NEXUS

Many of the economic pathways outlined in the previous subsections have implied environmental advantages, but these co-benefits must be made explicit and elevated as core objectives, especially where water and land are involved.

To realise these objectives, decarbonisation should not be viewed only as an industrial ESG agenda, but as an upgrading pathway by itself. Also, integrating green ammonia and scaling renewable energy can lower life-cycle emissions

in fertiliser production while advancing Morocco's broader energy transition. Finally, renewable energy capacity build-out, grid planning, and industrial electrification need to be aligned, with clear metrics and monitoring so that decarbonisation outcomes are demonstrated rather than assumed.

Moreover, water regulation and priorities must move from an operational constraint to a strategic pillar of the upgrading pathway.

As highlighted in Section 4, phosphate operations are water intensive and operate in a context of worsening scarcity, with direct trade-offs against agriculture and rural demand. Environmental strategy should therefore prioritise water demand management and efficiency (closed-loop systems, leak reduction, process optimisation), expanded reuse (exploring treated wastewater where feasible), and transparent water accounting and pricing for industry. Where desalination is pursued, it should be treated as one component of a wider water security portfolio, as this option comes with high energy cost and additional environmental constraints. Morocco should avoid substituting one constraint

(water) with another (power and cost), while ensuring that water-related decisions support food security, environmental sustainability, and local stability.

Finally, land and ecosystem impacts need clearer visibility in the upgrading narrative. Mine rehabilitation and ecological restoration should be planned as progressive, funded commitments supported by monitoring, enforceable closure provisions, and community-informed land-use planning. This includes dust and air quality management, safe handling of residues and by-products, and biodiversity-sensitive restoration where relevant, particularly as the industrial footprint expands.

Bringing these environmental priorities to the front of the strategy would strengthen Morocco's ability to align phosphate-led upgrading with national climate and resource goals, while reducing water and land risks that can otherwise undermine sustained operations, social legitimacy, and investment certainty.

CONTINENTAL COLLABORATION AND SOUTH-SOUTH COOPERATION

Morocco's phosphate-led upgrading pathway can deliver deeper and more durable outcomes when linked with international cooperation frameworks. This position can help the country foster broader collaboration across the Global South. Through the phosphate value chain,

Morocco can move beyond simple trade relationships and build vital partnerships that advance resilience and shared growth.

AFRICAN AGRICULTURAL TRANSFORMATION PARTNERSHIP

Building on the strategy of establishing regional agricultural service hubs, Morocco can reach its regional leadership aspirations by fostering deep, collaborative partnerships focused on knowledge transfer and capacity building.

While service platforms can expand access to inputs and agronomic support, collaboration between African and other Global South partners is increasingly important for developing locally relevant solutions in a context of climate stress and food insecurity. Morocco's own experience can be complemented by African expertise to advance drought-resilient cropping systems and improved water management practices that are relevant across the continent (FAO et al., 2023). Structured collaboration with African universities, non-governmental organisations, and agricultural institutions can also deepen trust and strengthen regional problem-solving capacity beyond bilateral alliances.

REGIONAL VALUE CHAIN INTEGRATION

Regional value chain integration is a practical mechanism for strengthening industrial resilience, boosting intra-African commerce, and supporting sustainability and decarbonisation goals through existing continental and regional cooperation arrangements.

The AfCFTA provides a strong framework for developing integrated regional phosphate value chains that distribute activities across multiple countries, reduce exposure to external shocks, and diversify Morocco's national concentrated asset risk. As described in the "Economic upgrading pathways" section, by establishing final-stage fertiliser blending or customisation facilities in key markets, OCP and its regional

These partnerships matter as agricultural productivity remains central to inclusive growth and poverty reduction across Africa, given the scale of employment in the sector (World Bank, 2023). Coupling technical expertise with financial inclusion programmes, including micro-finance and crop insurance, can help smallholder farmers manage risk and adopt improved practices (OECD-FAO, 2024). This requires patient, long-term capital that can be mobilised through existing regional development organisations. This approach of combining commercial service delivery with collaborative knowledge-sharing can be an important lever for shared resilience and sustainable mutual prosperity.

partners can create local employment and technical capabilities with relatively low capital investment. A model where Moroccan phosphoric acid is the input for locally finished products would foster commercial cooperation that can ensure mutual benefit and address specific local agronomic needs. Developing such regional value chains would support green industrialisation and strengthen the competitiveness of African industries (AfDB, 2023).

A regional integration strategy should extend to include logistics and innovation systems that increase reliability and reduce costs across borders. Developing shared transport corridors, storage capacity, and trade facilitation can

improve fertiliser availability while strengthening regional economic linkages that support stability and growth for other industries. Furthermore, by linking research institutions and universities into a cohesive innovation network, Morocco can help accelerate the development of agricultural technologies tailored to common African challenges like soil health and climate adaptation. This aligns with the African Union's long-term goals that position collaborative science and technology as drivers of development (African Union Commission, 2020). The successful implementation of this

model would require careful public and private multilateral coordination to ensure benefits are distributed equitably, transforming a Morocco-centric industry into a truly pan-African engine for economic development.

Anchored in existing continental frameworks and delivered through balanced partnerships, **regional value chain integration can build resilience, create distributed economic opportunity across African markets, and enable low-carbon development.**

SOUTH–SOUTH INTEGRATION: A CASE FOR SINO–MOROCCAN COOPERATION

Targeted South–South cooperation can accelerate upgrading where it strengthens domestic capability and supports shared global objectives. As global supply chains reconfigure, Morocco has an opportunity to position itself as a stable industrial node that links investment and production capabilities to multiple end-markets, while retaining strategic agency (Hermanus and Montmasson-Clair, 2025). The Sino–Moroccan relationship is particularly relevant in this context because it aligns China's green technology strengths and interest in mineral supply chains with Morocco's ambition to upgrade its value chains.

While the bilateral relationship between China and Morocco is well-established, it has built further momentum over the past decade. Chinese investments in Morocco have picked up since 2017 under the Belt and Road Initiative, and the presence of Chinese actors has diversified across sectors ranging from banking to infrastructure. Key projects have included a high-speed rail line, solar power plants, and a technology hub in Tangier. By 2021, this

cooperation extended to agriculture, notably through a joint venture between OCP and China's Hubei Forbon to develop fertiliser technologies (OCP, 2021a; Hermanus and Montmasson-Clair, 2025). Most recently, Chinese investment has become pivotal in accelerating Morocco's entry into the LFP battery value chain. The recent surge in LFP chemistries has sparked major capital inflows into the country, reaching US\$15.3 billion in 2022 alone. This figure matches the total from the previous five years combined, and was largely driven by Chinese battery players (IEA, 2024b).

While capital inflows are important, Morocco's approach should prioritise capability-building and standards alignment to ensure this cooperation supports long-term upgrading. The country's call for more local manufacturing and refining capacity, during the 2025 OECD High-Level Dialogue on Africa, points in this direction. The Origin, Transit, and Certification (OTC) Corridor concept offers a practical mechanism leveraging Morocco's geography to link markets while verifying sustainability credentials such as carbon intensity and human rights (Bore, 2025;

Hermanus and Montmasson-Clair, 2025). At the same time, further infrastructure finance linked to the Belt and Road Initiative can be a useful source of financing for critical infrastructure. However, Morocco should aim for blended models that combine Chinese funds with multilateral and domestic capital – to avoid over-reliance on a single partner and protect fiscal and strategic autonomy (World Bank, 2019).

Morocco's engagement with China should be a core component of a broader strategy of regional and global diversification. While cooperation with China offers advantages in scale and technology, Morocco must further cultivate other South–South relationships, while maintaining its historic partnerships with Europe

and the US. This strategy allows Morocco to mobilise foreign capital and technical know-how to upgrade its industrial base, while retaining strategic agency and remaining aligned with national just transition priorities. In this framing, South–South cooperation delivers the greatest value when it builds domestic skills, strengthens local capabilities, and supports quality job creation. Anchored within a diverse ecosystem of international partners, Morocco can convert its natural reserves into sustained economic and social gains, rather than short-term extractive benefits. If pursued with clear safeguards and measurable domestic outcomes, this approach can strengthen Morocco's competitiveness and reinforce its position as a credible green value chain hub for Africa.



6 CONCLUSION



Global phosphorus security as it relates to food security is set to emerge as one of the defining sustainability challenges of the 21st century.

Accelerated extraction and mobilisation of phosphate rock have intensified environmental pressures, including pollution of freshwater systems, while also deepening global dependence on a finite, non-renewable resource. Phosphate price volatility has brought these risks into sharper focus, showing how quickly supply shocks can translate into fertiliser disruptions with disproportionate impacts on smallholder farmers. As accessible resources become scarcer, more costly to extract, and increasingly concentrated in a small number of countries, affordability constraints are likely to widen. While phosphorus-based fertilisers are essential to maintain productivity, approximately one-sixth of the world's farming population remains too poor to access formal fertiliser markets, including across much of the African continent. Addressing this challenge requires transformation across the full system, from extraction and processing to more efficient agricultural use and nutrient recovery from waste streams.

Morocco is at the centre of this dynamic, with an immense phosphate endowment that places it as a key player in the global food security nexus. Its significant reserve base gives it both responsibility and opportunity to ensure reliable, affordable phosphate products for agricultural systems worldwide, while minimising environmental harm. The country's strategic management of this non-renewable and irreplaceable resource through the state-controlled OCP Group affords it significant economic and geopolitical influence. The OCP Group stands as an example of how a resource-rich nation can leverage its natural endowments to build an integrated industrial champion. The group's journey from a raw material exporter to a diversified manufacturer of high-value products

offers valuable lessons in long-term strategic planning and state-led industrial policy.

Looking ahead, OCP's ability to make good on its ambitious growth, diversification, and decarbonisation goals — while it continues to navigate the challenges of water scarcity, market volatility, and trade shocks — ***will be critical not only for its own commercial success but for a just and sustainable transition in Morocco.*** As global population continues to grow and the demand for food intensifies, Morocco's role as the gatekeeper of the world's phosphorus will only become more critical, with profound implications for international relations and global stability. Morocco's phosphate complex value chain demonstrates successful economic upgrading through downstream integration and ecosystem building. Overall, a cooperation strategy that links Morocco's phosphate upgrading pathway to continental frameworks and selective South–South partnerships can reinforce resilience, strengthen legitimacy, and expand the development gains from phosphates beyond national borders.

The next frontier is delivering social and environmental upgrading at scale locally and exporting services-led value across Africa. This phase requires a shift from narrow economic metrics to a just transition framing that makes social outcomes — such as jobs, skills, inclusion, and regional development — explicit objectives alongside environmental outcomes related to water, emissions, and waste. In a context of water scarcity and persistent youth unemployment, the phosphate-based platform can contribute to a renewed social contract if upgrading initiatives are backed by clear conditionalities, safeguards, and measurable indicators. Table 1 summarises the propositions that emerge from this analysis for resource-rich countries pursuing just and sustainable value chain upgrading.

TABLE 1: KEY PROPOSITIONS FOR JUST, SUSTAINABLE VALUE CHAIN UPGRADING IN AFRICA

UPGRADING DIMENSION	OPTION	PROPOSITIONS
Value chain	Develop more value-added activities	- Activate the ‘supply advantage’ by defining and enforcing state–state and state–firm conditionalities (mostly for globally leading producers) - Position mineral beneficiation as a stepping stone towards broader industrialisation, not the end goal
	Integrated planning between mining, energy, and industrial policy	- Establish a broad industrial strategy, with a focus on employment-rich parts of the value chain - Align mining, energy, water, and infrastructure planning so that new capacity is built as an integrated industrial platform
Industrial	International cooperation between centres of production and demand	- Cooperate – rather than compete – with China, leveraging complementary capabilities and interests - Build strategic partnerships along corridors of cooperation, including countries at various stages of the value chain
Economic	Green ammonia integration and fertiliser decarbonisation	- Prioritise green ammonia integration to reduce exposure to imported inputs and decarbonise fertiliser production - Build domestic engineering, operations, and maintenance capabilities
	Battery value chain integration (LFP)	- Treat battery-grade integration as a targeted diversification pathway, anchored in quality standards, capacity, and reliable inputs - Structure partnerships to secure technology transfer, workforce development, and local supplier participation - Phase investments to manage technology and market risk, and align incentives with domestic and regional demand anchors
	Regional supplier and geographical diversification	- Diversify suppliers for critical imported inputs and expand strategic storage and logistics to buffer short-term disruptions - Develop corridor-based infrastructure and regional trade arrangements that reduce costs and improve supply chain resilience

Social	• Education and skills development	• Build in localisation, employment creation, and community development along with a clear capability building road map, especially for youth employment and women
	• Work, inclusion, and social protection	• Strengthen labour standards and occupational safety, and support formalisation where mineral-linked employment remains informal • Adopt targeted measures that expand access for women and improve the quality of entry-level opportunities for youth
	• Community participation and benefit-sharing	• Strengthen participatory decision-making and Free, Prior and Informed Consent (FPIC) processes
Environmental	• Explore recycling and circularity technologies	• Utilise R&D and international cooperation to bolster continuous exploration of valorisation and REEs to reach a competitive cost solution
	• Position as a supplier into low-carbon value chains	• Invest in renewable energy infrastructure and pursue sustainability certifications to access premium green ammonia markets • Synchronise renewable energy build-up, grid planning, water supply, and industrial off-take so that emissions reductions are measurable and financeable
	• Environmental safeguards and sustainability standards	• Strengthen the design and implementation of environmental policies, including water allocation, waste management, monitoring, and transparent reporting against sustainability standards

Morocco's trajectory shows that geological advantage can be translated into industrial value when paired with patient capital, coordinated planning, and sustained capability building. It also underlines the constraints that define the next phase of upgrading, including water stress, exposure to energy and input volatility, and the need to broaden the distribution of benefits. If Morocco can align decarbonisation investments, circularity pathways, and social upgrading with clear safeguards and measurable outcomes, it can reinforce its role in food systems while building credible linkages to emerging low-carbon and battery value chains. For other resource-rich countries, the lesson is to adapt the emphasis on integration, ecosystem development, and conditional partnerships to local contexts and to the WEF nexus, rather than to replicate any single model.

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ENDNOTES

¹ This policy paper is part of a series. A ground-clearing report, Navigating the African opportunity landscape for value chain upgrading in the global scramble for critical minerals: Delineating the opportunity landscape, provides an overview of the window of opportunity for Global South countries (Montmasson-Clair et al., 2024). Two case studies – on the bauxite value chain in Guinea (Montmasson-Clair et al., 2025; Montmasson-Clair and Hermanus, 2025) and the copper-cobalt value chain in the Democratic Republic of the Congo and Zambia (forthcoming) – complement this policy paper. A final paper investigates Sino-African relations and the opportunity for mutually beneficial just transition pathways (Hermanus and Montmasson-Clair, 2025).

² Authors, based on 1960–2022 data from the Food and Agriculture Organization of the United Nations. See data here: <https://www.fao.org>

³ Authors, based on 2025 data from the United States Geological Survey (USGS). See data here: <https://www.usgs.gov/>

⁴ The effects of climate change are increasing in Morocco, which the Intergovernmental Panel on Climate Change (IPCC) has identified as a highly vulnerable country. The economy depends on sectors (agriculture, fisheries, and tourism) that are highly sensitive to climate change. Morocco is a water-scarce country, with agriculture consuming around 80% of its water resources, as most land is in arid and semi-arid areas (AfDB, 2022).

⁵ <https://data.worldbank.org/country/morocco>

⁶ Deployment of operator and subcontractor capabilities development through a certification programme in Mechanical and Electrical Maintenance as a pilot project at the Jorf site, as described in the OCP 2021 Annual Report.

⁷ Grey ammonia refers to ammonia produced using fossil fuels (typically gas).

⁸ United Nations' Resolution 2797 (2025). S/RES/2797(2025). Adopted by the Security Council at its 10030th meeting, 31 October. Available at: [https://docs.un.org/en/s/res/2797\(2025\)](https://docs.un.org/en/s/res/2797(2025))

⁹ MINURSO is the United Nations mission established in 1991 to support the settlement proposals and ceasefire reached by Morocco and Frente POLISARIO

¹⁰ Refers to the paradox where nations rich in non-renewable resources often face slower economic growth, authoritarianism, and instability when compared to peer countries without mineral endowments.

¹¹ Figures calculated based on LFP market reports from Markets and Markets, Global Market Insights and Grand View Research. Reports available at <https://www.marketsandmarkets.com/PressReleases/lithium-iron-phosphate-batteries.asp> <https://www.gminsights.com/industry-analysis/lithium-iron-phosphate-lfp-battery-market> <https://www.grandviewresearch.com/industry-analysis/lithium-iron-phosphate-lifepo4-material-battery-market>.

ABOUT SOUTHERN TRANSITIONS

Southern Transitions is a climate and transition ‘think-and-do-tank’ working to advance just transitions in the Global South. ***We are focused on fostering transformative economic opportunities in systems that are changing, emerging and scaling up in the transition.*** Embedded in the Global South, we are experienced in bridging public and private actors and operationalising an entrepreneurial, innovative and implementation spirit in our work. We draw on our growing network to collaboratively generate ideas, evidence and experiments for just transitions.

To achieve our vision and mission, we have established a programme of work including four initial areas: ***providing technical support towards just transitions*** in multilateral processes and Global South countries; formulating viable business cases and associated future-oriented ***pathways for Global South countries to harness value chain upgrading*** opportunities; ***mapping and interrogating real transition-driven economic risks and opportunities*** for transformation in and for the Global South; and supporting public policy and private-sector ***implementation through experimentation***, collaboration and learning to unlock just transition projects in the Global South.

ABOUT THE IMAL INITIATIVE FOR CLIMATE AND DEVELOPMENT

The IMAL Initiative for Climate and Development is an independent, non-profit and non-governmental climate think tank ***working to advance climate action and sustainable development in Morocco, Africa, the Arab region and the Mediterranean.*** IMAL works at the intersection of policy research, strategic dialogue and advisory support to inform climate and development pathways that are ambitious, equitable and grounded in regional realities.

Through its programmes on Green Economy, Resilience, Diplomacy and Cooperation, and Finance and Investment, ***IMAL supports evidence-based policy and implementation on issues including green industrialisation, energy transition, climate resilience, sustainable finance and international climate diplomacy.*** Its work aims to connect local and regional priorities with global climate debates, helping shape practical pathways towards green, resilient and just futures.

Ayala, A., Benchekroun, S., Ait-Hssaine, Z., Montmasson-Clair, G., and Hermanus, L. (2026). *Leveraging the Phosphate Value Chain for Just Transitions: Morocco's Upgrading Pathway*, Southern Transitions, Cape Town.



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