1. Global Overview
   * 1.1 Introduction
     + 1.1.1. Global Market Size & Growth

(Example: Market Worth: USD 2,550 bn,

CAGR: 1.07% Global auto products,

Global production forecast: +4% (98Mn units by 2027)

* + - 1.1.2. History and Milestones

(Example:

Year Milestone Owner

1886 First Automobile Benz Patent-Motorwagen

1908 Mass Production Ford Model T

1934 Streamlined Design Chrysler Airflow

1950 Compact Car Revolution Volkswagen Beetle

1973 Oil Crisis & Fuel Efficiency Toyota Corolla

1991 Electronic Fuel Injection Bosch EFR System

1997 Hybrid Technology Toyota Prius

2003 Hydrogen Technology Honda FCX

2008 Electric Vehicles Reborn Tesla Roadster

2021 Autonomous Driving Milestone Waymo Driverless

)

* + - 1.1.3. Sector Segments

(Example:

Passenger: Cars, SUVs. Minivans

Commercial: Buses, Trucks

Two Wheelers: Motorcycles, Scooters, Mopeds, Electric Bikes

Specialty/Industrial: Tractors, Forklifts, Bulldozers, Harvesters)

* + - 1.1.3. Segments Market Share

(Example:

Passenger Vehicles: 63%

Commercial Vehicles: 22%

Two Wheelers: 12%

Specialty/Industrial Vehicles: 3%)

* + - 1.1.4. Emerging trends and industry insights

(Example:

|  |  |
| --- | --- |
| Category | Key Points |
| ESG Disruption |  |
|  | \* Rising EV market share driven by sustainability goals and stricter emissions regulations |
|  | \* Increasing demand for sustainable mining practices for metals like copper and lithium |
|  | \* Growing importance of ESG reporting and data analysis |
| Consumer Behavior |  |
|  | \* Shift towards electric vehicles, especially plug-in hybrids and EVs |
|  | \* Growing importance of price, quality, and performance in purchasing decisions |
|  | \* Increased demand for connected vehicle services, particularly in emerging markets |
| Supply Chain Overhaul |  |
|  | \* Significant reduction in the number of components required for EVs compared to ICE vehicles |
|  | \* Rising demand for raw materials like copper, leading to supply chain challenges |
|  | \* Need for traditional Tier 1 suppliers to adapt to the shift from ICE to EV production |
| Manufacturer Response |  |
|  | \* Focus on fewer, high-volume EV platforms to meet increasing demand |
|  | \* Collaboration with suppliers to optimize supply chains and ensure just-in-time production |
|  | \* Vertical integration and strategic partnerships to secure critical components and technologies |

)

* + 1.2. Global Trade
    - 1.2.1. Leading Countries

(Example:

|  |  |  |  |
| --- | --- | --- | --- |
| Country | Imports (USD) | Exports (USD) | Production (Tonnes pa) |
| China | 10 | 30 | 20 |
| Germany | 20 | 20 | 10 |
| USA | 50 | 30 | 20 |
| Japan | 10 | 40 | 20 |
| ) |  |  |  |

* + - 1.2.2. Major country insights

(Example:

China:

* Global leader in EV vehicle production based on national policies and initiatives
* BYD owns the end-to-end value chain for battery production used in their vehicles
* Focus on penetrating the European and Asian markets by reducing the cost of production enabling them to sell cars at a lower price to the customer

Germany:

-High export value is driven by its focus on high-margin luxury vehicles.

-Efficient logistics and production capacity solidify its role as a global hub for luxury vehicle exports.

-Trade relationships with Europe, North America, and Asia further boost its export potential.

Japan:

-Focus on cost-effective, reliable vehicles over luxury models explains its lower export value despite higher production when compared to Germany.

-Japanese automakers have extensive manufacturing facilities outside Japan, indicating that many vehicles are produced and sold locally in foreign markets and not reflected in Japan's export figures.

USA:

-Lower export value is due to American brands competing in lower-margin segments and their focus on meeting local demand.

-Relies on importing cars from Mexico and Canada due to the integrated North American supply chain, supported by United States-Mexico-Canada Agreement (USMCA).

)

* 1.2.3. Major global suppliers

(Example:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Manufacturer | Segment Type | Estimated Global Market Share (2023) | Production Capacity (Units per year) | Strategic Advantage |
| Toyota | Passenger Vehicles | 10% | 10 million | Strong brand reputation, extensive global presence, diverse product lineup. |
| BMW | Passenger Vehicles | 7% | 4 million | Wide range of brands, significant market share in Europe and China. |
| Audi | Passenger Vehicles | 6% | 6 million | Diverse brand portfolio, strong presence in Europe and North America. |
| Volkswagen | Commercial Vehicles | 8% | 3 million | Luxury brand recognition, innovation in automotive technology. |
| Ferrai | Commercial Vehicles | 9% | 4 million | Strong presence in North America, leadership in truck and SUV segments. |
| MAN | Commercial Vehicles | 12% | 2 million | Strong position in the Chinese market, partnerships with international brands. |
| Ashok Leyland | Commercial Vehicles | 11% | 4 million | Leading producer of trucks and buses, strong global distribution network. |

)

* + - 1.2.4. Country analysis case study, 2 countries **[Decision Required]**. Country selection process based on whether said industry is a major export / production in the economy
      * 1.2.4.1. Country GDP and industry contribution

(Example:

* + Country: China
  + GDP (2023): $17,794 bn (11% Automotive))
    - * 1.2.4.2. Workforce in industry

(Example: Employees in Automotive: 4.54 M (1.13% of Labor))

* + - * 1.2.4.3. Market size of industry in country

(Example:

Vehicle Production (2023): 30.16 M

Vehicle Export Turnover: $45.8 bn

Major OEMs: -13

Component Manufacturers:10,000)

* + - * 1.2.4.4. Top Suppliers and Manufacturers in the country

(Example:

OEMS: Changan, SAIC, Dongfeng, BYD, Chery, BAIC, Great Wall, Geely, FAW, GAC Motor, NIO, Xpeng, Li Auto.

Components Manufacturer: Minth Group, HASCO, CATL, Baosteel, Fuyao, JOYSUNG, Weichai, Dicastal, Nexteer)

* + - * 1.2.4.5. Milestone Journey
        + Establishment years of suppliers

(Example:

|  |  |
| --- | --- |
| Year | Milestone |
| 1956 | First Automobile Works (FAW) founded, assembling mainly trucks, at a capacity of 1,600 units. |
| 1992 | Annual automobile production capacity exceeds one million vehicles. |
| 2000 | China's entry into the World Trade Organization (WTO). |
| 1979 | CHINA ADOPTED ITS FIRST LAW ON JOINT VENTURES, ATTRACTING FOREIGN TECHNOLOGY AND CAPITAL. |
| 1994 | China's entry into the World Trade Organization (WTO). |
| 2001 | China produced 13.79 million automobiles, becoming the world's largest auto producer. |
| 2019 | Tesla opens Shanghai Gigafactory (first foreign-owned plant) |
| 2021 | China becomes the leading exporter of EV’s to Europe and USA |

)

1. KSA Landscape overview
   * 2.1. KSA Market overview
     + 2.1.1. Local Market Segmentation

(Example:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Vehicle Type | Manufacturers | Manufacturers Count | Vehicles Sold 2023 (Units) | Imports 2023 (mSAR) |
| Cars | Lucid, Ceer, SNAM, Hyundai | 4 | 746,297 | 70,930 |
| Trucks | National Automobile Industries, ISUZU, SAMCO, AVI, Arabian Auto Agency | 5 | 55,785 | 10,570 |
| Buses |  | 0 | 6,203 | 2,657 |
| ) |  |  |  |  |

* + - 2.1.2. Major players: Major players (local or global) with a Saudi presence across segments in KSA

(Example:  
Passenger Cars: Lucid, Ceer, Hyundai

Commercial Vehicles: FUSO, Mercedes-Benz, IMALAT, Renault, UD Trucks, SNAM, ISUZU, IVECO)

* + - 2.1.3. Market share

(Example:

**KSA Market Share 2023 (Passenger Cars):**

* Toyota: 32%
* Hyundai: 14%
* Changan: 5%
* MG: 5%
* Kia: 5%
* Isuzu: 5%
* Nissan: 4%
* Ford: 4%
* Mazda: 4%
* Geely: 3%

**KSA Market Share 2023 (Busses):**

* King Long (18%)
* Yutong (12%)
* Zhongtong (12%)
* Toyota (11%)
* Ankai (10%)
* Mitsubishi (8%)
* Mercedes-Benz (6%)
* Tata Motors (5%)
* MAN SE (5%)
* Blue Bird (4%)

**KSA Market Share 2023 (Trucks):**

* Toyota: 13%
* MAN SE: 12%
* Mitsubishi: 10%
* Isuzu: 11%
* Sinotruk: 9%
* FAW: 8%
* Scania: 7%
* Freightliner: 5%
* Kenworth: 5%
* Volvo: 5%

)

* + - 2.1.4. Current and projected demand

(Example:

**Passenger Cars Sold and Forecast (thousands of units)**

* **2023:** 733 (Actual)
* **2024:** 744 (Actual)
* **2035:** 920 (Forecast)

**Forecast Increase:** +24% from 2024 to 2035

)

* + 2.2. Segments Overview
    - 2.2.1. Import dependency of various segments

(Example:

**Automotive Vehicles Import 2023 (mSAR)**

|  |  |  |
| --- | --- | --- |
| Segment | Import Value (mSAR) | % of Total Import |
| **Passenger Vehicles:** | 70,930 | (81%) |
| **Trucks:** | 10,570 | (12%) |
| **Buses:** | 2,657 | (3%) |
| **Others:** | 3,236 | (4%) |

* + - 2.2.2. Market size – Different segments and market size

(Example:

* + - * Spark-Ignition ICE: 746,297 units (99%)
      * Compression-Ignition ICE: 5,475 units (1%)
      * HEV: 49,831 units (6%)
      * BEV: 1,550 units (0%)

)

* + - 2.2.3. Market trends

(Example:

**Vehicles Import Trend (Units):**

* **2018:** 366,050
* **2019:** 486,101
* **2020:** 472,524
* **2021:** 501,133
* **2022:** 613,069
* **2023:** 808,285

**Insights:**

**•** Passenger Vehicles: Components

make up 5%\* of imports, showing

reliance on fully assembled vehicles

and a less mature local supply chain

• Trucks: With components at 18%\*

of imports, the local truck assembly

market is more developed.

• Buses: Components account for

23%\* of imports, reflecting a strong

aftermarket and repair industry,

given the lack of local bus assembly.

)

* + 2.3. Trade Analysis
    - 2.3.1. Top Exporting countries per segment

(Example:

**Automotive Categories Top Exporting Countries to KSA**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Category | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
| Vehicles |  |  |  |  |  |  |
| Passenger Cars | Japan | Japan | Japan | Japan | Japan | Japan |
| Buses | China | China | China | China | Japan | China |
| Trucks | Thailand | Thailand | Thailand | Japan | Japan | Japan |
| Components |  |  |  |  |  |  |
| Components | United States | China | China | China | China | China |
| Powertrain (Electric) |  |  |  |  |  |  |
| Electric | China | United States | China | China | United States | United States |

* + - 2.3.2. Top Exporting countries rank

(Example:

**Automotive Top Exporting Countries to KSA**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Rank | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
| 1 | Japan | Japan | Japan | Japan | China | Japan |
| 2 | United States | United States | China | China | Japan | China |
| 3 | South Korea | South Korea | United States | United States | United States | United States |
| 4 | Thailand | China | South Korea | South Korea | South Korea | South Korea |
| 5 | China | Germany | Germany | Germany | Germany | Thailand |

)

* + - 2.3.3. Trends and insights

(Example: Over 80% of total automotive imports originate from 7 countries: Japan, China,

USA, South Korea, Thailand, Germany and India)

* + 2.4. Local Capabilities
    - 2.4.1. Current Local Capabilities

(Example:

**Pirelli**

* JV with PIF to build a tire manufacturing facility
* Expected production start: 2026
* Capacity: 3.5 million units/year

**Electric Vehicle Infrastructure Company (EVIO)**

* Establish 1,000+ locations with 5,000+ fast chargers by 2030
* Collaborate with EV companies
* Support R&D and manufacturing of advanced materials

**Automotive Manufacturers Association & National Automotive and Vehicles Academy**

* Develop automotive ecosystem
* Train and employ qualified students for Lucid and Ceer

)

* + - 2.4.2. Upcoming supplier categories

(Example:

Local suppliers for various automotive parts will begin operations in the future, further enhancing the robustness of the supply chain for the sector in the kingdom which also indicates a growing maturity and self-sufficiency within the industry.

**Supplier Categories**

* **Automotive Body**
* **Automotive Chassis**
* **Passenger Vehicle Seats** (Lear Corporation)
* **Plastic Components**
* **Battery Cell**

)

1. Associated Industry and Value Chain Analysis
   * 3.1. Associated Industry Analysis
     + 3.1.1. Associated Industry list

(Example:

|  |  |
| --- | --- |
| Industry Number | Associated Industry |
| Associated Industry 1 | Engine and Powertrain |
| Associated Industry 2 | Seats |
| Associated Industry 3 | Fuel Cell and Hydrogen Storage |
| Associated Industry 4 | Tires and Wheels |

)

* + - 3.1.2. Industry Role

(Example:

|  |  |  |
| --- | --- | --- |
| Associated Industry | Value Chain Role | Contribution to Final Product |
| Engine and Powertrain | Midstream industry used for power generation and transmission systems, primarily utilizing steel | **Provide propulsion, support vehicle versatility, optimize efficiency** |
| Seats | Midstream industry focused on vehicle seating systems, prioritizing comfort and safety, primarily utilizing steel frames and foam materials | **Ensure occupant comfort, provide safety during travel, and enhance ergonomic support for an optimal driving experience** |
| Fuel Cell and Hydrogen Storage | midstream industry enabling energy generation and storage, primarily utilizing composite materials, steel, and advanced alloys | **Enable zero-emission energy generation, provide efficient energy storage** |
| Tires and Wheels | midstream industry producing vehicle mobility components, primarily utilizing rubber, steel, and aluminium | **Ensure traction, enable mobility, provide load support, and contribute to safety and handling performance** |

)

* + - 3.1.3. Supplier Tiers

(Example:

|  |  |  |  |
| --- | --- | --- | --- |
| Associated Industry | Tier 1 suppliers | Tier 2 suppliers | Tier 3 suppliers |
| Engine and Powertrain | * Cummins * FAW Sihuan * Toyota * Volkswagen * Magna International | * Cummins * Bosch * NAIEC * Borgwarner * Schaeffler Group | * Rio Tinto * Baosteel * Evonik * Hydro * Arcelormittal |
| Seats | * Faurecia * Lear Corporation * Adient * Geely * Grammer AG | * Faurecia * Brose * Antolin * Yanfeng * Sage Automotive Interiors | * ArcelorMittal * BASF SE * Dow * Toray * Covestro AG |
| Fuel Cell and Hydrogen Storage | * Faurecia * Hexagon Purus * Toyota Industries Corporation * Voith * Ballard Power Systems | * Toray * Solvay * Mitsubishi Chemical * Johnson Matthey * Chart Industries | * 3m * Toray * Sgl carbon * Umicore * Solvay |
| Tires and Wheels | * Michelin * Bridgestone * Voith * Pirelli * Linglong Tire | * Linglong Tire * Cabot * Xingda * Jinneng * Bekaert | * Exxon Mobil * Linglong Tire * Sabic * Solvay * China national Petroleum Corporation |

)

* 3.1.4. Cost Contribution

(Example:

|  |  |  |
| --- | --- | --- |
| Associated Industry | % Cost Contribution | * Insights |
| Engine and Powertrain | 20%–30% | * **Advanced Features Increase Costs**: Technologies like turbocharging, direct fuel injection, variable valve timing, and multi-speed automatic or dual-clutch transmissions significantly increase the cost contribution of powertrain systems * **Regulatory Impact**: Stricter emissions and fuel efficiency standards drive the adoption of advanced engine and transmission designs, adding to the overall cost of powertrain systems * **Material Influence**: The use of lightweight materials like aluminum alloys for engine blocks and high-performance components in transmissions contributes to higher costs, particularly in vehicles focused on fuel efficiency and performance |
| Seats | 5%–10% | * **Notable Cost Component**: Seats contribute approximately **5%–10%** of a vehicle's total cost, varying based on the vehicle's segment, materials, and features (basic in economy models vs. advanced in luxury vehicles) * **Electrification Effects**: The rise of electric vehicles (EVs) is driving demand for lightweight seating systems to offset battery weight, increasing reliance on advanced materials like carbon composites, which can elevate costs * **Mass Production Advantage**: High production volumes for standard seating designs in mass-market vehicles help lower per-unit costs, while limited production or bespoke designs for niche or luxury models drive costs higher |
| Fuel Cell and Hydrogen Storage | 45%–70% | * **Fuel Cell Dominance**: The fuel cell system alone contributes **30%–50%** of the vehicle's cost due to the use of precious metals like platinum and the intricate design of the fuel cell stack and supporting components * **Storage Challenges**: Hydrogen storage accounts for **15%–25%** of the total cost, with high-pressure tanks made from carbon fiber composites contributing significantly due to stringent safety and durability requirements * **Economies of Scale Impact**: Low production volumes of FCVs exacerbate costs, with high per-unit prices for components compared to mass-market ICE or BEV vehicles; scaling production is critical for cost reduction |
| Tires and Wheels | 3%–7% | * **Material Impact**: Steel wheels, common in economy vehicles, are cost-effective, while alloy and forged wheels in mid-range and luxury vehicles significantly increase costs due to their lightweight and performance advantages * **Performance Tires Add Cost**: High-performance tires, run-flat tires, or specialized designs for luxury or performance vehicles can significantly elevate the overall cost compared to standard all-season tires * **Size Drives Expense**: Larger wheel and tire sizes, increasingly common in SUVs and luxury vehicles, increase costs due to higher material usage and manufacturing complexity |

* + 3.2. Value Chain Analysis
    - 3.2.1. 4-step value chain analysis

(Example:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Associated Industry | Insight Topic | Raw Material Insight | Material Processing Insight | Component Production Insight | Assembly Insight |
| Engine and Powertrain | Technology Requirements | * **Advanced Mining Equipment**: Use of automated and AI-enabled machinery for efficient extraction of raw materials like iron ore, aluminum, and rare earth metals. * **Sustainable Mining Practices**: Technologies for waste reduction, water recycling, and land restoration to meet environmental standards. * **Material-Specific Processes**: Specialized techniques for extracting high-purity materials like lithium and nickel critical for hybrid and electric powertrains | * **Precision Manufacturing**: Advanced casting, forging, and machining processes are essential for shaping raw materials like **aluminium**, **steel**, and **titanium** into complex engine and powertrain components. These processes ensure high dimensional accuracy, durability, and efficiency * **Thermal and Surface Treatment**: Technologies like **heat treatment**, **plasma spraying**, and **thermal barrier coatings** are required to enhance the temperature resistance, wear resistance, and longevity of materials used in high-stress components like turbochargers and transmission gears * **Recycling and Sustainability**: Innovations in material recovery and recycling technologies are critical to processing rare and high-value raw materials (e.g., **platinum**, **palladium**, and **nickel**) sustainably, reducing environmental impact and reliance on virgin materials | * **Precision Casting and Forging**: Critical for components like engine blocks, crankshafts, and connecting rods, requiring **high-pressure die casting** for lightweight materials (e.g., aluminum) and **forging** for high-strength parts to withstand operational stresses * **Advanced Machining**: **CNC machining** is essential for producing components with tight tolerances, such as pistons, camshafts, and cylinder heads, ensuring proper fit and function within the engine and powertrain system * **Material-Specific Manufacturing**: Components made from advanced materials like **ceramics** (e.g., turbocharger rotors) and **composites** (e.g., lightweight housings) require specialized processes such as **powder metallurgy** and **additive manufacturing** to achieve desired properties | * **Advanced Automation**: The assembly of engine and powertrain systems relies heavily on **robotics** and **AI-powered automation** to ensure precision, consistency, and efficiency, especially in high-volume manufacturing environments * **Flexibility in Assembly Lines**: Modular and reconfigurable assembly lines, supported by **cobots (collaborative robots)** and **adaptive tooling**, allow for the efficient production of diverse engine and powertrain configurations to meet varying customer demands * **Testing and Diagnostics Integration**: Inline and end-of-line testing technologies, including **vibration analysis**, **pressure testing**, and **functional testing rigs**, are required to validate the performance and durability of assembled systems before shipping |
| Engine and Powertrain | Industry Trends | * **Shift Toward Sustainability**: Increasing focus on eco-friendly extraction methods to minimize environmental impact. * **Rise in Critical Material Demand**: Growing demand for rare earth metals and lithium for EVs and hybrid powertrains. * **Vertical Integration**: Companies securing raw material sources to ensure supply chain stability | * **Lightweight Material Adoption**: The industry is increasingly utilizing lightweight materials such as **aluminum**, **magnesium**, and **carbon fiber composites** to reduce vehicle weight, thereby enhancing fuel efficiency and performance. This shift necessitates the development of specialized processing techniques, including advanced casting, forging, and joining methods, to effectively handle these materials * **High-Performance Surface Treatments**: Widespread adoption of **thermal barrier coatings**, **diamond-like carbon coatings**, and **plasma nitriding** for improving wear resistance, reducing friction, and enhancing the thermal properties of high-stress components * **Sustainable Processing Practices**: There is a growing emphasis on environmentally friendly material processing, including the recycling of rare and precious metals and the reduction of energy consumption during manufacturing. Implementing sustainable practices not only aligns with regulatory requirements but also addresses consumer demand for greener products | * **Advanced Manufacturing Techniques**: The integration of **additive manufacturing (3D printing)** is enabling the production of complex, high-performance components with reduced material waste and shorter development cycles. This technology allows for innovative designs and material combinations that were previously unattainable with traditional manufacturing methods * **Automation and Smart Manufacturing**: Increased reliance on **robotics**, **AI-driven quality control**, and **real-time monitoring systems** to enhance production efficiency, minimize defects, and maintain high precision in complex assemblies * **Customization and Modular Manufacturing**: Increasing demand for modular production systems that can accommodate various powertrain configurations, including internal combustion engines, hybrid systems, and electric drivetrains, on the same assembly line | * **Increased Automation**: The adoption of **robotics** and **cobots (collaborative robots)** in assembly lines is transforming the industry by improving precision, speed, and consistency in assembling complex engine and powertrain systems * **Real-Time Quality Control**: Integration of **sensor-based monitoring** and **AI-driven diagnostics** allows for real-time detection of assembly errors, ensuring high-quality production while reducing rework and waste * **Sustainability in Assembly**: Growing focus on reducing energy consumption and waste during assembly processes through the use of **energy-efficient robotics** and **recyclable assembly materials** |
| Engine and Powertrain | KSA local landscape | * **Abundant Resources**: Significant reserves of bauxite (for aluminum), phosphate, and other minerals essential for powertrain components. * **Government-Led Initiatives**: Vision 2030 prioritizes mining sector development with substantial investment in exploration and extraction. * **Ma'aden’s Role**: Saudi Arabian Mining Company (Ma'aden) leads in extracting key resources and developing integrated supply chains | * **Significant Investments in Metals and Mining**: In November 2024, Saudi Arabia announced nine investment deals worth over $9 billion in the metals and mining sector. These agreements aim to boost domestic self-sufficiency and contribute significantly to the kingdom's economic growth * **Focus on Sustainable Material Processing**: Aligning with Vision 2030, Saudi Arabia emphasizes sustainable practices in material processing. This includes adopting environmentally friendly technologies and processes to minimize the carbon footprint of manufacturing activities, thereby supporting the global shift towards greener automotive solutions * **International Collaborations for Resource Acquisition**: Saudi Arabia is engaging in international partnerships to secure essential minerals. For instance, the Saudi mining minister planned visits to Brazil and Chile to discuss investments in lithium, a critical component for electric vehicle batteries | * **Emerging Manufacturing Facilities**: The Ministry of Industry and Mineral Resources has reported the establishment of 160 vehicle-related factories, including 33 dedicated to parts, accessories, and engines, and 21 focused on vehicles and structures. This development signifies a growing domestic manufacturing base for automotive components * **Investment in Engine Technologies**: Saudi Aramco has acquired a 10% stake in Horse Powertrain, a joint venture between Renault and Geely, focusing on gasoline engines, hybrid systems, and gearboxes. This investment underscores Aramco's commitment to advancing internal combustion engine technologies and hybrid systems within the Kingdom * **Strategic Partnerships**: The Public Investment Fund (PIF) has signed a joint venture agreement with Hyundai Motor Company to establish a highly automated vehicle manufacturing plant in Saudi Arabia. PIF holds a 70% stake, while Hyundai holds 30%, providing strategic technology support. The plant aims to manufacture 50,000 vehicles annually, including internal combustion engine (ICE) and electric vehicles (EV) | * **Establishment of Local Assembly Plants**: Lucid Motors has inaugurated its first international assembly plant, Advanced Manufacturing Plant (AMP-2), in King Abdullah Economic City. The facility has commenced semi knocked-down (SKD) assembly, with an initial annual capacity of 5,000 vehicles, and plans to scale up to 150,000 units with complete build unit (CBU) production * **Strategic Partnerships for Vehicle Manufacturing**: The Public Investment Fund (PIF) has signed a joint venture agreement with Hyundai Motor Company to establish a highly automated vehicle manufacturing plant in Saudi Arabia. The facility aims to produce 50,000 vehicles annually, including internal combustion engine (ICE) and electric vehicles (EVs), utilizing the completely knocked down (CKD) assembly system * **Focus on Electric Vehicle Assembly**: Ceer Motors, a joint venture between PIF and Foxconn, represents Saudi Arabia's first electric vehicle brand. The company plans to design and manufacture a range of EVs for Middle Eastern markets by 2025, contributing over $150 million in foreign investment and creating up to 30,000 direct and indirect jobs |
| Engine and Powertrain | KSA Barriers expansion | * **High Initial Costs**: Substantial investment required for exploration, extraction, and mining technology implementation. * **Skilled Labor Shortage**: Limited availability of expertise in advanced mining and material processing technologies. * **Environmental Regulations**: Strict compliance requirements increase operational complexity and costs | * **Lack of Advanced Processing Technology**: Saudi Arabia currently lacks the necessary infrastructure and advanced technologies (e.g., high-pressure die casting, plasma spraying) required for processing specialized materials such as aluminum alloys, magnesium, and nickel-based superalloys critical for engine and powertrain components * **Dependence on Imported Raw Materials**: Despite having abundant natural resources, the lack of local processing capabilities leads to dependence on imported processed materials, increasing costs and extending supply chains * **Limited R&D Infrastructure**: The absence of strong local research and development (R&D) facilities dedicated to innovative material processing techniques impedes the development of competitive and sustainable processes tailored to the industry’s needs | * **Limited Local Supply Chain**: Saudi Arabia's automotive component manufacturing ecosystem is underdeveloped, leading to reliance on imported parts and raw materials, increasing production costs and supply chain inefficiencies * **Technological Gaps**: The Kingdom lacks access to cutting-edge manufacturing technologies, intellectual property (IP), and proprietary processes that are critical for producing high-performance engine and powertrain components * **Market Competition**: The global dominance of established manufacturers in regions like Europe, North America, and Asia creates intense competition, making it challenging for local players to secure contracts and achieve economies of scale | * **Limited Skilled Workforce**: The Kingdom faces a shortage of professionals with expertise in advanced automotive assembly techniques, particularly in areas like robotics and automation. This gap necessitates substantial investment in education and training programs to build a competent labor force * **Nascent Supply Chain Infrastructure**: The local supply chain for automotive components is underdeveloped, leading to reliance on imported parts. This dependency can result in increased production costs and potential delays, affecting the efficiency of assembly operations * **High Capital Investment Requirements**: Establishing state-of-the-art assembly plants demands significant financial resources. Securing the necessary capital, along with advanced technologies and equipment, poses a challenge, especially for new entrants in the market |
| Engine and Powertrain | KSA Strategic Advantage | * **Resource Availability**: Rich deposits of critical minerals like bauxite, phosphate, and rare earth metals provide a foundation for powertrain material production. * **Government Support**: Financial incentives, infrastructure development, and regulatory support under Vision 2030 drive growth in the mining sector. * **Proximity to Markets**: Strategic location allows easy access to European, Asian, and African markets for raw material exports | * **Abundant Natural Resources**: Saudi Arabia has vast reserves of raw materials such as **aluminum** (via Ma’aden), **magnesium**, and other minerals essential for producing lightweight and high-strength engine and powertrain components * **Proximity to Emerging Markets**: Saudi Arabia’s strategic location allows efficient access to major global automotive markets in Europe, Asia, and Africa, reducing transportation costs and time for processed raw materials * **Sustainability Initiatives**: Saudi Arabia is investing in green technologies and renewable energy for mining and material processing, ensuring compliance with global sustainability standards and reducing the environmental impact of these operations | * **Partnerships with Global Manufacturers**: Collaborations with companies like Foxconn and Hyundai enable technology transfer, access to intellectual property, and skill development, boosting local capabilities in advanced component manufacturing * **Access to Capital and Investment**: The Public Investment Fund (PIF) actively supports large-scale projects and ventures in the automotive sector, providing ample financial resources for component manufacturing initiatives * **Industrial Clusters and Ecosystems**: The development of dedicated industrial zones, such as the **King Abdullah Economic City (KAEC)**, provides world-class infrastructure and integrated supply chain solutions tailored for automotive manufacturing | * **Strategic Location**: The Kingdom’s central location allows for cost-effective distribution to major global markets in **Europe**, **Africa**, and **Asia**, positioning Saudi Arabia as a regional assembly hub for engine and powertrain systems * **Growing Domestic Automotive Market**: The establishment of local automotive brands (e.g., Ceer Motors) and partnerships with global players like Hyundai creates consistent demand for assembly services, fostering local expertise and supply chains * **Low-Cost Energy and Logistics**: Access to abundant and cost-effective energy resources provides a competitive advantage for powering assembly plants and reducing operational costs, while modernized logistics networks ensure smooth supply chain operations |
| Fuel Cell and Hydrogen Storage | Technology Requirements | * **Advanced Mining Techniques**: Use of precision drilling and automated machinery for efficient extraction of rare earth metals, platinum group metals (PGMs), and lithium. * **Hydrogen Production Materials**: Technologies to extract natural gas for blue hydrogen or water electrolysis for green hydrogen production. * **Sustainability Solutions**: Implementation of environmentally friendly extraction processes to minimize waste and emissions | * **Platinum Refinement and Nanoparticle Synthesis**: Advanced processes like **chemical vapor deposition (CVD)** and **colloidal synthesis** are essential to create high-surface-area platinum nanoparticles for efficient catalytic reactions in fuel cells * **Composite Layering**: Multi-layer fabrication processes for high-pressure tanks, involving carbon fiber winding over polymer liners to ensure structural integrity * **Proton Exchange Membranes (PEMs)**: Precision extrusion and casting processes to produce thin, durable PEMs from fluoropolymers like Nafion or emerging non-fluorinated alternatives. | * **Catalyst Layer Deposition**: Precision coating technologies, such as **plasma spraying** or **electrodeposition**, are required to apply thin, uniform catalyst layers on the fuel cell’s electrodes for optimal performance * **Membrane Electrode Assembly (MEA) Production**: Advanced automation is needed for assembling proton exchange membranes (PEMs) with electrodes, requiring precise alignment and bonding techniques * **Filament Winding Technology**: Automated systems for winding high-strength carbon fiber around a liner to create lightweight, high-pressure tanks capable of storing hydrogen at up to 700 bar | * **Advanced robotic systems:** are essential for assembling fuel cell stacks and hydrogen storage tanks with precision, ensuring alignment, sealing, and integration of complex components such as bipolar plates, membranes, and sensors * **Automated Fuel Cell Stack Assembly:** Technologies for **layer-by-layer assembly** of membrane electrode assemblies (MEAs) and bipolar plates are critical, utilizing **vision-guided robotics** for high-speed, error-free operation and   **Compression systems** are needed to apply precise pressure during stack assembly to ensure proper bonding and avoid performance degradation   * **Precision assembly of hydrogen storage systems**: requires advanced **thermal management systems** to handle material expansion and stress during integration |
| Fuel Cell and Hydrogen Storage | Industry Trends | * **Focus on Green Hydrogen**: Increasing investment in extracting resources for green hydrogen production through renewable-powered electrolysis. * **Demand Surge for Rare Materials**: Growing need for PGMs and lithium to meet the rising demand for fuel cells and hydrogen storage solutions. * **Circular Economy Practices**: Emphasis on recycling and recovering materials from used components to reduce reliance on primary extraction | * **Demand for Platinum Group Metals (PGMs)**: Platinum and palladium remain critical for fuel cell catalysts, with ongoing efforts to reduce PGM content through alternative catalyst development and nanotechnology * **Advancements in Lightweight Materials:** Carbon fiber composites are widely used for high-pressure hydrogen storage tanks, with innovations aimed at reducing production costs and improving material efficiency * **Emerging Hydrogen Production Material:** Membranes and electrodes for electrolyzers require advanced materials like ionomers and durable coatings to improve hydrogen production efficiency | * **Material Innovations**: The development of **high-performance polymers** and **lightweight composites** improves the durability and efficiency of fuel cells and storage systems. For instance, advancements in **polymer electrolyte fuel cells (PEFCs)** have led to better performance and scalability * **Advanced Manufacturing Techniques**: The adoption of **3D printing** and **automated assembly lines** enhances precision and scalability in producing complex components, such as fuel cell stacks and hydrogen storage tanks. These methods reduce production costs and time-to-market * **Integration of Digital Technologies**: Utilizing **digital twins** and **IoT-enabled monitoring** allows for real-time quality control and predictive maintenance, enhancing reliability and performance of manufactured components | * **Advanced Materials Integration**: Incorporating lightweight and durable materials, like carbon fiber composites for hydrogen storage tanks, improves energy density and system longevity, necessitating specialized assembly techniques to handle these advanced materials * **Modular Design Approaches**: Developing standardized, modular components facilitates easier assembly and maintenance, allowing for flexible configurations and quicker adaptation to various applications, from vehicles to stationary power systems * **Advanced Materials Integration**: Incorporating lightweight and durable materials, like carbon fiber composites for hydrogen storage tanks, improves energy density and system longevity, necessitating specialized assembly techniques to handle these advanced materials |
| Fuel Cell and Hydrogen Storage | KSA local landscape | * **Abundant Natural Resources**: Saudi Arabia possesses significant reserves of key minerals such as **lithium**, **platinum group metals (PGMs)**, and **rare earth elements**, essential for fuel cell catalysts and hydrogen storage systems, offering a competitive edge in global energy markets * **Innovative Lithium Extraction**: The Saudi Arabian Mining Company (Ma’aden) has successfully piloted **lithium extraction from seawater**, aiming to support the EV and hydrogen storage sectors, though commercial scalability remains a challenge * **Strategic Investments**: The Kingdom has signed multiple international agreements, such as partnerships with China's Zijin Group, to develop mining and smelting capabilities, ensuring a reliable supply of critical raw materials | * **Hydrogen Production Infrastructure**: Projects like the **NEOM Green Hydrogen Project** position Saudi Arabia as a leader in renewable hydrogen production, leveraging wind and solar energy to produce **green hydrogen**. * **Development of Processing Facilities**: Strategic collaborations, such as the partnership with Hastings Technology Metals for **rare earth processing**, aim to build advanced material processing capabilities locally. * **Focus on Sustainability**: Saudi Arabia is emphasizing **low-emission material processing technologies** to align with global sustainability goals and reduce the environmental impact of hydrogen and fuel cell production | * **Emerging Domestic Manufacturing**: Saudi Arabia is gradually establishing its manufacturing sector for critical components like **fuel cell stacks**, **proton exchange membranes (PEMs)**, and **hydrogen storage tanks**, supported by investments and technology transfer. * **International Partnerships**: Collaborations with global firms like Sungrow Power Supply enable knowledge sharing and the development of local manufacturing expertise for energy storage systems and related components. * **Rising Investment in Advanced Technologies**: Efforts are underway to incorporate **robotics**, **additive manufacturing**, and **automation** in component production to improve efficiency and scalability | * **Integration with Renewable Energy Initiatives**: Assembly operations for hydrogen storage systems and fuel cells are expected to be closely tied to renewable energy projects, such as **NEOM**, to support the Kingdom’s energy transition goals. * **Workforce Development Needs**: The lack of skilled labor for assembling advanced systems highlights the need for training programs and partnerships with international firms to upskill the local workforce. * **Potential for Local Assembly Hubs**: The development of **industrial zones** and proximity to renewable hydrogen production sites offers Saudi Arabia a strategic advantage in setting up localized assembly hubs for global distribution |
| Fuel Cell and Hydrogen Storage | KSA Barriers expansion | * **Limited Exploration of Critical Resources**: Despite significant potential, the exploration and mapping of key materials like lithium, platinum, and rare earth elements are still in the early stages, limiting immediate scalability. * **High Capital Requirements**: The extraction of rare and valuable materials, such as lithium and PGMs, requires substantial initial investments in equipment, infrastructure, and expertise, posing financial challenges. * **Environmental Concerns and Regulations**: Strict environmental regulations and the need for sustainable mining practices increase operational complexity and costs, potentially delaying projects | * **Technology Gaps**: The Kingdom lacks advanced material processing technologies, such as high-precision refining for PGMs and carbon fiber production for hydrogen storage tanks, which are critical for scaling production. * **Dependence on Imports**: Limited local production of intermediate materials necessitates reliance on imported inputs, increasing costs and exposing the supply chain to global market volatility. * **Energy-Intensive Processes**: Material processing for hydrogen and fuel cell applications often requires significant energy inputs, which, despite KSA’s low energy costs, may pose sustainability challenges if not aligned with green energy initiatives | * **Underdeveloped Supply Chain**: The absence of a robust local supply chain for critical components, such as bipolar plates, PEMs, and high-pressure storage tanks, hampers domestic manufacturing capabilities. * **Lack of Skilled Workforce**: Advanced manufacturing processes require a specialized workforce, which is currently limited in Saudi Arabia, creating a dependency on international expertise. * **High Cost of Technology Transfer**: Acquiring intellectual property and advanced manufacturing equipment from global leaders can be prohibitively expensive, slowing down local production development | * **Lack of Automation Expertise**: The Kingdom’s assembly operations for hydrogen and fuel cell systems lack advanced robotics and automation, which are essential for ensuring precision and scalability. * **Limited Workforce Readiness**: The assembly of fuel cell stacks and hydrogen storage systems requires highly skilled technicians, which necessitates significant investment in training and education. * **Underdeveloped Ecosystem**: The absence of a fully integrated ecosystem, including localized suppliers and supporting industries, increases assembly costs and delays timelines |
| Fuel Cell and Hydrogen Storage | KSA Strategic Advantage | * **Abundant Natural Resources**: Saudi Arabia possesses vast reserves of essential minerals like **platinum group metals (PGMs)**, **rare earth elements**, and **aluminum**, which are critical for fuel cells and hydrogen storage systems. * **Government Backing for Mining Projects**: The Saudi Arabian Mining Company (Ma’aden) and other government-supported initiatives provide robust financial and infrastructural support to expand mining and resource extraction capabilities. * **Strategic Investments in Lithium Extraction**: Pioneering efforts, such as lithium extraction from seawater, position Saudi Arabia as a future supplier of critical raw materials for hydrogen storage and fuel cell technologies | * **Advanced Industrial Infrastructure**: Facilities in industrial zones like **Ras Al Khair** and projects like the **NEOM Green Hydrogen Project** offer integrated processing capabilities and proximity to renewable energy sources for sustainable operations. * **Low-Cost Energy Availability**: Abundant and cost-effective energy resources, including renewables, enable Saudi Arabia to process materials like carbon fiber composites and PGMs competitively. * **Strategic Global Partnerships**: Collaborations with international players, such as the partnership with Hastings Technology Metals for rare earth processing, enhance local expertise and technology access | * **Growing Domestic Demand**: The rise of local hydrogen initiatives, such as the **NEOM Green Hydrogen Project**, and the establishment of automotive ventures like **Ceer Motors**, ensure steady demand for fuel cell and hydrogen storage components. * **Investment Incentives under Vision 2030**: Government-led programs provide financial incentives, infrastructure support, and regulatory reforms to attract investments in manufacturing advanced components like PEMs and storage tanks. * **Proximity to Global Markets**: Saudi Arabia’s location provides logistical advantages for exporting components to Europe, Asia, and Africa, leveraging its position as a regional manufacturing hub | * **Integration with Renewable Energy Projects**: Assembly operations benefit from alignment with large-scale renewable energy initiatives, such as the NEOM hydrogen project, to support sustainable production and deployment. * **Industrial Zones and Export Opportunities**: Dedicated zones like **KAEC (King Abdullah Economic City)** offer world-class facilities for assembling fuel cell and hydrogen storage systems with access to key export routes. * **Support from the Public Investment Fund (PIF)**: PIF’s involvement in projects like Lucid Motors and green energy initiatives ensures funding and technology transfer for establishing advanced assembly lines |

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* + - 3.2.2. Value chain supplier landscape

(Example:

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| --- | --- | --- | --- | --- | --- |
| Industry | Global vs Local Suppliers | Raw Material Suppliers | Material Processing Suppliers | Component Production Suppliers | Assembly Suppliers |
| Engine and Powertrain | Global Suppliers | * Rio Tinto * Vale * BHP | * ArcelorMittal * Norsk Hydro * Sumitomo Electric Industries | * Robert Bosch GmbH * Denso Corporation * Magna International | * Cummins * Toyota * Magna Steyr |
| Engine and Powertrain | Local Suppliers | * Ma'aden * Saudi Aramco * Alara Resources | * SABIC * Alcoa Saudi Arabia * AMI Saudi Arabia | * NA | * NAI * SNAM * Lucid |
| Fuel Cell and Hydrogen Storage | Global Suppliers | * Johnson Matthey * Solvay * Toray | * Umicore * Solvay * Toray | * Ballard * 3m * Sgl carbon | * Plug power * Ballard * HTWO |
| Fuel Cell and Hydrogen Storage | Local Suppliers | * NA | * NA | * NA | * NA |

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* + - 3.2.3. Supplier Case Study

(Example:

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| --- | --- |
| Supplier Name | Bosch |
| Headquarter Location | * Baden-Württemberg, Germany |
| Founding Year | * 1886 |
| 2023 Revenue (USD) | * 98.9 Bn |
| Top global operating location | * **Europe**: Major operations in **Germany**, **France**, **UK**, and **Spain**; UK sites include **Denham**, **Coventry**, **York**, and others. * **North America**: U.S. headquarters in **Farmington Hills, Michigan**; facilities in **California**, **Massachusetts**, **South Carolina**, and more. * **Asia-Pacific**: Strong presence in **China**, **India**, **Japan**, and **Australia**; India hosts one of the largest R&D centers outside Germany. |
| Number of Employees | * ~429,000 |
| Product Portfolio | * Powertrain solutions (ICE, hybrid, electric) * Advanced driver-assistance systems (ADAS) * Braking systems and ABS |
| Service Offering | * **Automotive Aftermarket Services**: Through the **Bosch Car Service** network, Bosch provides comprehensive vehicle maintenance and repair services, leveraging its expertise as a leading automotive supplier. * **Home Appliance Repair and Support**: Bosch offers professional repair services for its home appliances, ensuring customer satisfaction through trained technicians and the use of original Bosch parts. * **Industrial Technology Solutions**: Bosch delivers innovative solutions for industry and trades, including drive and control technology for factory automation and process plant engineering, enhancing operational efficiency across various sectors |
| Global Value Chain Contribution | * Bosch is instrumental in the transition to electric and hybrid vehicles, producing components such as electric motors, battery management systems, and inverters * Bosch supports vehicle safety and automation through its advanced ADAS technologies, with products like radar, camera systems, and adaptive cruise control * Bosch's aftermarket division provides replacement parts, diagnostic tools, and maintenance services through a global network of more than 16,500 workshops in 150 countries |

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* + - 3.2.4. Value chain localization opportunities

(Example:

Opportunity 1: Fuel cell assembly and integration facilities could be established within Saudi Arabia, leveraging the country’s upcoming investments and projects in Green Hydrogen production

Opportunity 2: Jo**int ventures** with companies like **Hyundai**, **Toyota,** **Ballard Power Systems or Plug Power** to bring **fuel cell production** technologies to Saudi Arabia would enhance the Kingdom's role in the global clean energy transition

Opportunity 3: Hydrogen Tank Manufacturing: Given the availability of the raw materials within the Kingdom combined with the giga-projects supporting Hydrogen Economy, a hydrogen tank production line for domestic as well as export potential is an opportunity to explore

Opportunity 4: Raw Material Export: KSA can act as a major export hub for hydrogen tank raw materials such as Aluminium (Maa’aden), HDPE (Saudi Polymers), Epoxy Resin (Jubail Industies), Metallic end boss and mounts (Saudi National Steel company)

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* + 3.3. Raw Material Analysis
    - 3.3.1. 4-step value chain analysis

(Example:

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| --- | --- | --- | --- | --- | --- |
| Associated Industry | Insight Topic | Raw Material Extraction insight | Material Processing Insight | Manufacturing Insight | Industry specific grades |
| Steel | Raw material overview | * **Iron Ore**: The primary raw material for steelmaking, sourced from mining operations in regions like Australia, Brazil, and India. * **Coal and Coke**: Essential for blast furnace operations, with metallurgical coal used to produce coke for reducing iron ore. * **Limestone**: Used as a flux in steel production to remove impurities during smelting | * **Sintering and Pelletizing**: Prepares iron ore for efficient use in blast furnaces by creating uniform pellets or sinter. * **Coking**: Processes coal into coke, which is used in blast furnaces for smelting. * **Basic Oxygen Furnace (BOF) and Electric Arc Furnace (EAF)**: Primary methods for converting raw materials into molten stee | * **Casting**: Converts molten steel into semi-finished forms such as slabs, billets, and blooms. * **Rolling**: Hot or cold rolling processes shape steel into final products like sheets, plates, and bars. * **Coating and Finishing**: Adds protective layers (e.g., galvanizing) and aesthetic finishes for specific applications | * **High-Strength Low-Alloy Steel (HSLA)**: Lightweight with high strength, used for structural components. * **Advanced High-Strength Steel (AHSS)**: Combines strength and ductility for safety-critical automotive parts. * **Dual-Phase (DP) and Martensitic Steel**: Provides a balance of toughness and formability for crash-resistant applications |
| Steel | Industry Trends | * **Sustainability Focus**: Increasing demand for sustainable mining practices and reduced environmental impact in iron ore and coal extraction. * **Localization of Supply Chains**: Efforts to reduce dependency on global raw material suppliers by developing local reserves and partnerships. * **Shift Toward Scrap Recycling**: Growing emphasis on using scrap metal as an alternative raw material to reduce reliance on virgin resource | * **Decarbonization Initiatives**: Adoption of green technologies like hydrogen-based direct reduction (H-DRI) to lower carbon emissions in steelmaking. * **Electrification**: Expanded use of Electric Arc Furnaces (EAFs), driven by the shift toward renewable energy and scrap-based production. * **Digitalization**: Integration of AI and IoT for real-time monitoring, optimizing efficiency, and reducing energy consumption | * **Lightweight Steel Innovations**: Increased R&D in producing lightweight steel components to meet the needs of electric and hybrid vehicles. * **Automation and Smart Factories**: Adoption of Industry 4.0 technologies for automated rolling, finishing, and quality control processes. * **Sustainable Coatings**: Development of eco-friendly coatings and finishes, such as chromium-free galvanization, for corrosion resistance and recyclability | * **Advancements in AHSS**: Continuous innovation in Advanced High-Strength Steel (AHSS) to improve crash performance while reducing vehicle weight. * **Custom Grades for EVs**: Development of electrical steels optimized for high-efficiency motors and battery housings in electric vehicles. * **Multi-Material Integration**: Collaboration with automakers to combine steel with other materials (e.g., aluminum, composites) for lightweight and high-strength designs |
| Steel | KSA manufacturing capabilities | * **Iron Ore Reserves**: The Wadi Sawawin mine in Al Madinah Province holds significant iron ore deposits, estimated at 383 million tonnes with a 40% iron grade. * **Strategic Partnerships**: Companies like Essar have secured raw material supplies, such as iron ore feed, to support upcoming steel plants in the Kingdom. * **Local Mining Initiatives**: Saudi Iron & Steel Co. (HADEED) is exploring investments in countries like Mauritania to ensure sustainable iron ore supply chains | * **Integrated Steel Plants**: The Kingdom hosts state-of-the-art facilities, such as ArcelorMittal's seamless tube mill in Jubail, designed to serve energy markets domestically and internationally. * **Capacity Expansion**: Investments are underway to boost production capacities, aligning with rising domestic and regional steel demand. * **Technological Advancements**: Companies like AIC Steel are enhancing manufacturing capabilities, contributing to sectors including defense and construction | * **Diverse Product Range**: Saudi steel manufacturers produce various products, from long and flat steel to specialized steel for construction and industrial applications. * **International Collaborations**: Partnerships with global steelmakers, such as Baosteel's joint venture with Saudi Aramco and PIF, aim to establish steel plate manufacturing facilities in the Kingdom. * **Export Potential**: The Saudi steel industry not only meets domestic demand but also serves a growing international market, enhancing the Kingdom's export profile | * **High-Quality Steel Production**: Facilities like SABIC's Metals (Hadeed) have developed grades such as ASTM A570 Grade 45 hot-rolled steel, suitable for automotive applications. * **Automotive Industry Support**: The development of an automotive city aims to provide materials like aluminum sheets and steel at competitive prices, fostering local automotive manufacturing. * **Specialized Manufacturing**: Investments in facilities capable of producing automotive structural steel are expected to support the Kingdom's growing automotive sector |
| Steel | KSA Barriers expansion | * **Limited Domestic Iron Ore Reserves**: The Kingdom has modest iron ore deposits, such as the Wadi Sawawin mine, which may not suffice for large-scale steel production. * **Dependence on Imports**: To meet raw material needs, Saudi Arabia relies on imports, exposing the industry to global market fluctuations and supply chain disruptions. * **Geographical Challenges**: Existing mineral deposits are often located far from industrial hubs, complicating logistics and increasing transportation costs | * **Energy-Intensive Operations**: Steel production processes consume significant energy, posing challenges in balancing industrial growth with environmental sustainability goals. * **Technological Gaps**: Adopting advanced processing technologies requires substantial investment and expertise, which may be limited domestically. * **Environmental Regulations**: Stringent environmental standards necessitate upgrades in processing facilities, leading to increased operational costs | * **Skilled Labor Shortage**: The industry faces a deficit of trained professionals, impacting productivity and innovation. * **Infrastructure Limitations**: Inadequate manufacturing infrastructure hampers efficient production and scalability. * **Market Competition**: Local manufacturers contend with established international players, making market penetration challenging | * **Specialized Production Requirements**: Manufacturing automotive-grade steel demands advanced technology and stringent quality control, areas where local capabilities may be underdeveloped. * **Supply Chain Constraints**: The just-in-time nature of automotive manufacturing requires a reliable supply of high-quality steel, which current local production may not consistently provide. * **Investment Needs**: Developing facilities for automotive-grade steel production entails significant capital investment, posing financial challenges |
| Steel | KSA Strategic Advantage | * **Government Investments**: Vision 2030 initiatives actively support mining sector growth, with incentives for exploration and extraction. * **Strategic Location**: Close proximity to Europe, Asia, and Africa allows cost-effective raw material export to global markets. * **International Partnerships**: Collaboration with global mining firms ensures access to advanced extraction technologies and expertise | * Xx **Export Capability**: Processed steel products can be exported efficiently, leveraging KSA’s strategic location near key trade routes * **Green Hydrogen Potential**: Investment in hydrogen-based steelmaking aligns with global decarbonization goals * **Industrial Zones**: Facilities like Ras Al Khair provide integrated infrastructure for large-scale steel processing | * **Growing Domestic Market**: Large-scale projects like NEOM and The Line ensure robust demand for locally manufactured steel products. * **Supportive Policies**: Tax breaks, financing, and government incentives attract investment in advanced manufacturing facilities. * **Skilled Workforce Development**: Ongoing investments in training programs improve the manufacturing sector’s capabilities | * **Automotive Industry Growth**: Local automotive initiatives like Ceer Motors and Lucid Motors drive demand for high-quality steel grades. * **High-Strength Steel Production**: Investments in Advanced High-Strength Steel (AHSS) and lightweight grades cater to EV and safety-critical applications. * **Collaboration with Global Leaders**: Partnerships with companies like Baosteel ensure access to advanced automotive-grade technologies |
| Aluminum | Raw material overview | * **Major Bauxite Producers**: Countries like **Australia**, **China**, **Guinea**, and **Brazil** dominate global bauxite mining, the primary ore for aluminum production * **Vertical Integration**: Many global aluminum producers (e.g., Rio Tinto, Alcoa) own bauxite mines to ensure supply chain control * **Energy and Environmental Considerations**: Sustainable mining practices and reduced energy use are key challenges in bauxite extraction | * **Alumina Refining Leaders**: China, Australia, and Brazil are leading global players in refining bauxite into alumina. * **Energy-Intensive Smelting**: The aluminum smelting process requires substantial energy, often supported by hydropower in countries like Canada and Norway * **Global Trade of Alumina**: Alumina is a globally traded commodity, with Australia as a top exporter to markets like China and India | * **Diverse Applications**: Aluminum manufacturing supports industries like construction, aerospace, packaging, and automotive, requiring varied product forms (sheets, extrusions, foils). * **Major Players**: Companies like **Arconic**, **Constellium**, and **Novelis** dominate manufacturing and innovation in aluminum products * **Regional Specialization**: Asia dominates in volume production, while Europe and North America focus on high-performance aluminum products | * **Advanced Alloys**: Automotive-grade aluminum includes 5000-series (structural) and 6000-series (body panels) alloys for lightweighting and corrosion resistance. * **EV Market Demand**: Growth in electric vehicles drives demand for aluminum in battery housings, chassis, and motor housings. * **Crash-Resistant Materials**: High-strength aluminum alloys are critical for safety-critical components in automotive manufacturing |
| Aluminum | Industry Trends | * **Sustainability Focus**: Increasing adoption of eco-friendly mining practices to minimize environmental impact, including reduced land degradation and water use. * **Digitalization in Mining**: Use of AI and IoT for real-time monitoring and optimization in bauxite extraction and logistics. * **Consolidation of Mining Assets**: Global producers are acquiring bauxite mines to ensure vertical integration and supply chain stability | * **Energy Efficiency Innovations**: Advancements in low-energy refining technologies, such as the use of renewable-powered smelters, are reshaping the industry. * **Carbon-Free Smelting**: Companies like Alcoa and Rio Tinto are leading the development of **Elysis technology**, which eliminates carbon emissions during smelting. * **Geographical Shifts**: Processing activities are increasingly moving to regions with abundant renewable energy sources, such as Canada and Norway | * **High-Performance Alloys**: Focus on developing alloys with superior strength-to-weight ratios for critical applications. * **Regional Specialization**: Asia dominates in manufacturing volume, while Europe and North America lead in high-performance and specialty aluminum products * **Lightweight Solutions**: Increasing demand for lightweight aluminum components in industries like automotive and aerospace to enhance efficiency and reduce emissions | * **Lightweighting Demand**: Aluminum is increasingly replacing steel in body structures, chassis, and closures to improve fuel efficiency and reduce emissions. * **EV-Specific Applications**: Growth in electric vehicles (EVs) drives demand for aluminum in battery housings, motor cases, and heat management systems. * **Crash-Resistant Grades**: Advanced high-strength aluminum alloys are essential for vehicle safety systems and structural integrity |
| Aluminum | KSA local landscape | * **Bauxite Reserves**: The Al Ba'itha mine in Al-Qassim province contains substantial bauxite deposits, serving as the primary source for aluminum production. * **Integrated Operations**: Ma'aden, in partnership with Alcoa, oversees a fully integrated operation from bauxite mining to alumina refining and aluminum smelting, ensuring a streamlined supply chain. * **Strategic Location**: The Al Ba'itha mine is connected by rail to processing facilities in Ras Al-Khair, optimizing logistics and reducing transportation cost | * **Alumina Refining**: The Ras Al-Khair facility processes bauxite into alumina, a crucial intermediate in aluminum production. * **Smelting Operations**: The aluminum smelter at Ras Al-Khair has an annual capacity of 740,000 metric tons, contributing significantly to domestic and export markets * **Skilled Workforce**: Ongoing training programs develop a proficient labor force adept in advanced processing techniques | * **Product Diversification**: Saudi manufacturers produce a range of aluminum products, including extrusions, sheets, and castings, catering to various industries. * **Industrial Clusters**: The development of automotive and marine clusters is expected to drive demand for aluminum extrusions in the Kingdom * **Export Potential**: Strategic location and robust infrastructure facilitate the export of aluminum products to international markets | * **High-Strength Alloys**: The development of specialized aluminum alloys supports the automotive sector's demand for lightweight, durable materials. * **Automotive Manufacturing Cluster**: The upcoming automobile manufacturing cluster in Saudi Arabia is expected to expand automotive manufacturing, increasing domestic demand for aluminum primary foundry alloys. * **Research and Development**: Ongoing R&D efforts focus on innovating new grades suitable for automotive applications |
| Aluminum | KSA Barriers to entry | * **High Capital Investment**: Establishing bauxite mining operations requires substantial financial resources, posing challenges for new entrants. * **Regulatory Compliance**: Navigating complex environmental and mining regulations can be cumbersome for newcomers. * **Established Players**: Dominance by entities like Ma'aden creates a competitive environment that is difficult for new companies to penetrate | * **Energy Dependence**: Aluminum smelting is energy-intensive, and access to affordable energy is crucial for competitiveness. * **Technological Barriers**: Advanced processing technologies necessitate significant investment and expertise, which may be lacking for new entrants. * **Supply Chain Integration**: Effective coordination with raw material suppliers and manufacturers is essential, requiring established networks | * **Infrastructure Requirements**: Setting up manufacturing facilities demands substantial infrastructure, which can be a hurdle for new companies. * **Skilled Workforce**: A shortage of trained professionals in advanced manufacturing techniques can impede new entrants. * **Market Competition**: Existing manufacturers with established client bases and economies of scale present significant competition | * **Stringent Standards**: Meeting rigorous automotive industry standards for aluminum grades requires advanced R&D capabilities. * **Certification Processes**: Obtaining necessary certifications is time-consuming and resource-intensive for new players. * **Industry Relationships**: Building trust and relationships with automotive manufacturers is challenging for newcomers without a proven track record |
| Aluminum | KSA Strategic Advantage | * **Abundant Bauxite Reserves**: Significant bauxite deposits in the Al Ba’itha region ensure a steady supply for domestic aluminum production. * **Integrated Operations**: Ma'aden's vertically integrated operations streamline the extraction, processing, and production of aluminum * **Strategic Location**: Proximity to export markets in Europe, Asia, and Africa facilitates efficient global distribution | * **Technological Investments**: Adoption of modern smelting and refining technologies improves efficiency and environmental performance. * **Proximity to Raw Materials**: Integration of mining and processing facilities reduces logistical costs and increases operational efficiency. * **Export Readiness**: High-quality processed materials cater to global markets, boosting the Kingdom's trade footprint | * **Diverse Industrial Base**: Aluminum manufacturers cater to industries like construction, aerospace, packaging, and automotive, ensuring a robust demand. * **Industrial Clusters**: The development of specialized industrial zones facilitates integrated manufacturing and export operations. * **Export-Oriented Strategy**: Strategic investments in logistics and port infrastructure support the export of finished aluminum products | * **Strategic Partnerships**: Collaborations with global automotive companies foster technology transfer and market access. * **Sustainability Advantage**: Focus on recyclable aluminum aligns with global automotive trends toward circular economy practices. * **Emerging Automotive Industry**: The establishment of local automotive manufacturing (e.g., Ceer Motors, Lucid Motors) drives domestic demand for automotive-grade aluminum |

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* + - 3.3.2. Supplier Landscape

(Example:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Industry | Global vs Local Suppliers | Raw Material Extraction suppliers | Material Processing suppliers | Manufacturing suppliers | Industry specific grades suppliers |
| Steel | Global Suppliers | * **Vale** * **BHP** * **Rio Tinto** | * **China Baowu Steel Group** * **ArcelorMittal** * **Nippon Steel Corporation** | * **POSCO** * **Tata Steel** * **JFE Steel Corporation** | * **SSAB** * **Thyssenkrupp AG** * **Nucor Corporation** |
| Steel | Local Suppliers | * **Ma'aden** * **Al-Tuwairqi Group** * **ISPC** | * **Hadeed** * **ISPC** * **Riyadh Steel Company** | * **JASCO** * **SNS** * **Ajeej Steel Manufacturing Co** | * **Hadeed** * **ISPC** * **Riyadh Steel Company** |
| Aluminum | Global Suppliers | * **Alcoa Corporation** * **Rio Tinto Group** * **Aluminum Corporation of China Limited (Chalco)** | * **Norsk Hydro ASA** * **Emirates Global Aluminium (EGA)** * **Hindalco Industries Limited** | * **Novelis Inc** * **Constellium SE** * **Arconic Corporation** | * **Kaiser Aluminum Corporation** * **UACJ Corporation** * **AMAG Austria Metall AG** |
| Aluminum | Local Suppliers | * **Ma'aden** | * **Ma'aden** * **Axes Arabia Company for Metal Casting (AAC)** | * **Al-Tuwayijri Factory for Aluminum Extrusion and Coloring (ALTCO)** * **Saudi Alucast** * **Madarco Aluminum Extrusion & Powder Coating Co** | * **Ma'aden** * **Saudi Alucast** * **Vair National Castings Company (VNCC)** |

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* + - 3.3.3. Supplier Case Study

(Example:

|  |  |
| --- | --- |
| Supplier Name | Baosteel |
| Headquarter Location | * Shanghai, China |
| Founding Year | * 2000 |
| Revenue (USD) | * Approximately ¥341.95 billion (FY 2023) |
| Top global operating location | * China * United States * Germany |
| Number of Employees | * Approximately 43,126 (as of 2023) |
| Product Portfolio | * Hot-rolled steel * Cold-rolled steel * Stainless steel * Special steel |
| Service Offering | * Steel smelting and processing * Electricity and coal production * Industrial gas production |
| Global Value Chain Contribution | * Extraction of raw materials * Steel production and processing * Distribution of steel products |

* + - 3.3.4. Value chain localization opportunities

(Example:

Opportunity 1: Steel Product Portfolio Expansion to contribute to the global automotive value chain, specifically AHSS and UHSS

Opportunity 2: Certifications to supply automakers with steel products

Opportunity 3: Collaboration with upcoming OEMs to better understand requirements and develop custom products

Opportunity 4: Aluminium Product Portfolio Expansion to contribute to the automotive value chain

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