

# *UPGRADING THE SAUDI CHEMICAL CLUSTER*

Microeconomics of Competitiveness | Professor Laura Alfaro



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## Required Disclosures

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One of this paper's authors; Yasser Aloadah, is a Saudi Arabia national. Yasser has previous work experience related to the Saudi Oil & Gas and Refining industries that is relevant to the topic of this paper

2

Four experts agreed to be interviewed for this paper under the condition of anonymity. One was a senior executive in one of the largest Saudi Arabian chemicals producers; two were consultants with extensive experience working with the Saudi Arabian chemicals industry; and the fourth has extensive experience working in the industry, as a government policy maker, and now advises both the government and the chemicals producers on industry development and upgrading.

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## I. Country and Regional Context

### 1) Short Profile of the Kingdom of Saudi Arabia

#### *Brief Profile*

With a GDP of USD 1.7 trillion (at purchasing power parity - PPP), Saudi Arabia is the 15th largest economy in the world and the largest in the Middle East and North Africa region. Saudi Arabia has a total population of 27.8 million, and ranks 21st globally in GDP per capita at about USD 54,600 (at PPP). The industrial sector - and mostly the oil and mining industry - accounts for roughly half of the nation's GDP (at 47% in 2015) with services accounting for the bulk of the remainder (agriculture only accounts for around 2% of GDP) (Central Intelligence Agency, 2016).

Saudi Arabia is part of the Gulf Cooperation Council (GCC), a political and economic alliance of six countries of the Arabian Gulf founded in 1981. The alliance evolved progressively to turn into a single trade block with free trade between the six member nations (BBC, 2015).

#### *Endowments*

Three key endowments stand out when analyzing Saudi Arabia:

First, the kingdom is well endowed in **hydrocarbon resources**. The EIA reports that Saudi Arabia is the largest holder of proved oil reserves in the world (16% of the reserves) and has the fifth largest natural gas reserves behind Russia, Iran, Qatar and the US. Oil reserves have been extensively developed over the past few decades making the country the largest exporter of oil (US Energy Information Agency, 2014).

Second, Saudi Arabia is **located** in the Arabian Gulf and has access to key global trading routes. Saudi Arabia has 2,640 kilometers of coastline on the Persian Gulf and the Red Sea

which together capture a significant share of the global maritime trade. With 2.1 million square kilometers, the country is the 13th largest in the world and benefits from extensive land resources (with only the 47th largest population) (Central Intelligence Agency, 2016).

Third, Saudi Arabia has a **large, growing and young population** with a median age of 26.8 years and a dependency ratio of 45.9% (Central Intelligence Agency, 2016).

## 2) Overall Economic Performance and Challenges

Saudi Arabia has achieved significant economic growth over the past few decades as GDP growth averaged 3.7% per year between 1970 and 2015, mainly fueled by the development and monetization of oil resources. Funds made available from oil exports translated into significant improvements to quality of life with the average Saudi household income growing by 75%, 1.7 million jobs created and USD 450 billion invested in health, education and infrastructure (McKinsey Global Institute, 2015).

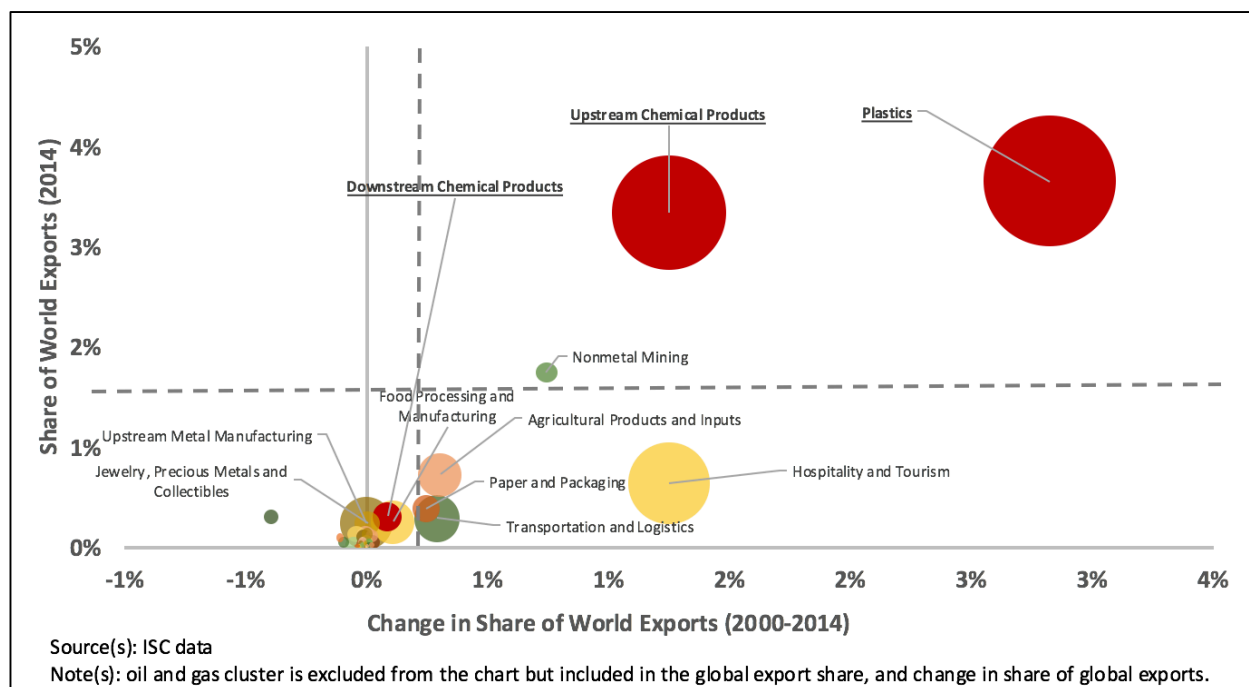
Significant oil resources also allowed the government to maintain very **low levels of debt** (around 1.6% of GDP at the end of 2014, (International Monetary Fund, 2015)) as the fiscal budget registered significant surpluses that were used in part to build substantial foreign reserves. Overall, the macro-economic policies of Saudi Arabia allowed the country to navigate through decades with significant stability. In fact, Saudi Arabia ranks first on Macroeconomic policy on the ISC model for competitiveness.

However, the country faces significant challenges moving forward. First, and most important for the country's leaders, is the urgency to **further diversify the economy away from its heavy reliance on oil**. Hydrocarbon extraction still accounts for ~39% of the GDP in 2015 (down from 79% at the peak in 1973) and 80% of government revenues, exposing the economy to cycles and shocks in oil markets (Saudi Arabia General Authority for Statistics, 2016).

Second, Saudi Arabia has to continuously manage mounting **pressure from a rapidly growing population**. Key challenges include sufficient economic growth to create jobs for the Saudis who enter the job market every year (the Saudi labor force has been growing at around 5% per year), developing and financing social services, and alleviating poverty (International Monetary Fund, 2015). Official statistics from 2009 put the unemployment rate for Saudis aged 15 to 24 at 30% with many arguing that this number is likely to underestimate the reality. Saudi Aramco's (the national oil company) CEO declared in 2010 that the kingdom would "need to create nearly 4 million jobs over the next 10 years. The Kingdom's economy historically has grown between 3-5%, while to generate the number of well-paying jobs required for our youth, the economy needs to grow in excess of 8%." (Woodrow Wilson International Center for Scholars, 2011). This problem is further exacerbated by poverty issues that the country has to grapple with. Reports estimate that between two and four million Saudis live with less than USD 530 per month (or USD 17 per day) - the poverty line in Saudi Arabia (The Guardian, 2013).

### **3) Composition of Saudi Economy and Chemical Cluster**

The chemicals industry is the largest export sector after oil. In 2014, it accounted for 3.7% of GDP, but 38% of the manufacturing sector. It exported over \$35 billion worth of chemicals, or about 11% of total exports, and 78% of non-oil exports. It provided over 89 thousand direct jobs, and between 267 and 356 thousand indirect jobs, of which 79% are held by nationals (GPCA, 2015). Exhibit 1 clearly shows that the chemicals cluster is the fastest growing cluster where Saudi Arabia is demonstrating a comparative advantage.



**Exhibit 1 Performance of Key KSA Clusters (2000 - 2014)**

#### 4) Macro Competitiveness

The macroeconomic environment in Saudi Arabia has been conducive to the growth of the chemicals cluster. The Saudi Riyal is **pegged to the US Dollar**, and since most of the cluster's inputs and outputs are priced in US Dollars, the peg reduces currency risk especially for foreign investors. The peg and the fiscal surpluses also contributes to a stable monetary policy with relatively low inflation and low interest rates (IMF, 2015). The low tax environment and the simplicity of the tax code makes investment more appealing.

Saudi Arabia has an **open policy towards skilled and unskilled migrant workers**, who account for nearly 30% of the population, although it's now beginning to tighten access.

Saudi Arabia **invest 25% of its budget on education** (OBG, 2015), and currently has 200,000 students studying for STEM and management degree abroad (CNN, 2015). However, the quality of local graduates is subpar, and the quantity in many technical areas is insufficient. For example Saudi Arabia graduates only 29% the number of chemical engineers graduating

annually in Germany, even though Saudi Arabia is forecasted to add 15 MTPA<sup>a</sup> of chemicals production capacity in the next 5 years compared to 1.5 MTPA for Germany<sup>b</sup>. In terms of quality, the WEF ranks Saudi Arabia 47<sup>th</sup> in the quality of the education system, and 69<sup>th</sup> in the quality of science and math education, it also ranks 49<sup>th</sup> in the quality of scientific research institutions (WEF, Global Competitiveness Report, 2014).

Saudi policy making can be very slow and lacks procedural transparency. Policy making is usually consensus based, and stakeholders are involved in the process. However, internal deadlock or lack of coordination between different agencies can often lead to ineffective policies<sup>c</sup>. Government regulation can often be burdensome and bureaucratic, and sometimes lacks the necessary sophistication to deal with complex or emerging issues. For example, the judicial system is very inefficient at handling bankruptcies or disputes regarding sophisticated transaction (World Bank, 2014).

## **II. Chemicals Cluster**

### **1) Development of the Saudi Chemical Cluster**

The Saudi chemicals cluster emerged out of the government's desire to reduce the waste and environmental impact of flaring associated gas<sup>d</sup>, and monetize Saudi Arabia's vast gas reserves. The chemical industry was an obvious solution to transform gas into an exportable product. To begin developing the chemicals industry, in 1976, the government established the Saudi Arabian Basic Industries Corporation (SABIC). SABIC set up joint ventures with international chemicals producers to establish the first petrochemical plants in Saudi Arabia. To attract foreign investors

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<sup>a</sup> Million Ton Per Annum

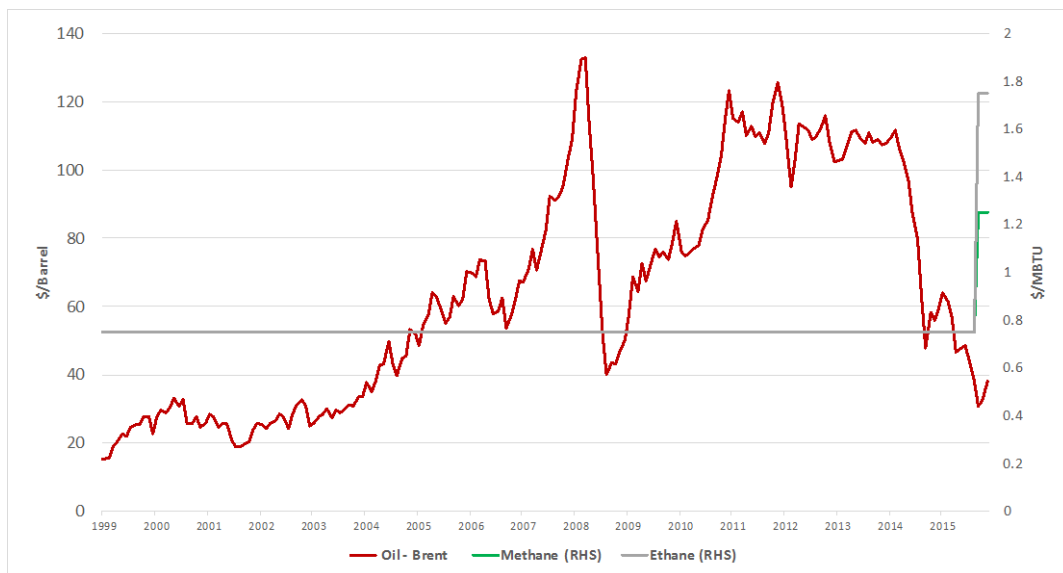
<sup>b</sup> Based on team analysis and data from GPCA and McKinsey.

<sup>c</sup> Based on expert interviews

<sup>d</sup> gas that is dissolved in oil, and is a byproduct of oil production.



willing to share the technology and know-how, the government committed to provide petrochemicals plants in Saudi Arabia with natural gas at a fixed price of \$ 0.75 per MMBTU<sup>a</sup> for the duration of the plant's commercial license, which could last up to three decades (Exhibit 2). The fixed price gas agreements shielded producers from the volatility of Naphtha<sup>b</sup> prices. The government also committed to developing world class infrastructure in Jubail Industrial City. The Royal Commission for Jubail and Yanbu (RCJY) was setup in 1975 to develop the infrastructure and run these two cities independent of the central government (RCJY).



**Exhibit 2 Oil prices vs. Saudi gas prices .**

Note: Oil prices are being used as a proxy for Naphtha prices.

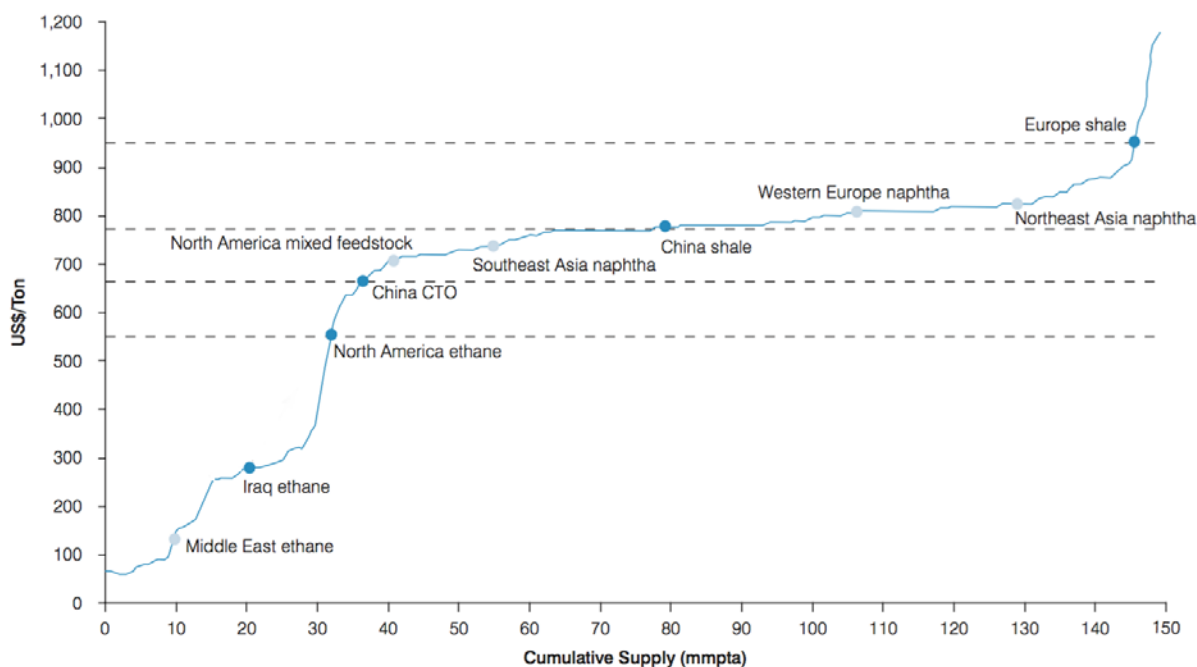
The Saudi chemicals industry was able to develop a competitive advantage based on:

**Relatively low feedstock cost:** using gas as a feedstock for products in the ethane chemical value chain provided a cost advantage due to the higher yield of desired end products, and lower yield of secondary products, reduces the required investment in

<sup>a</sup> Million British thermal unit.

<sup>b</sup> Naphtha is a liquid oil derivate produced in refineries. It is used for as a petrochemicals feedstock, and as a gasoline component.

processing facilities and simplifies the logistics. It also has a simpler production process and technology. And because gas is difficult to trade it is cheaper than Naphtha that is indexed to oil. Exhibit 3 clearly shows that ethane (gas) based feedstock enjoys a cost advantage over other feedstocks.



**Exhibit 3: Global Ethylene cost curve in 2010.**

Source(s): CMAI, Booz & Co, GPCA

**Scale Economies:** While plants in Asia had an average cracker capacity of 300 KT<sup>a</sup>, crackers in Saudi Arabia had an average capacity of 1.2 MMT<sup>b</sup>, which allowed producers in Saudi Arabia to reduce the unit cost of production<sup>c</sup>.

**Access to cheap capital:** Saudi producers needed to ship their production to Europe and Asia which adds up to a month's worth of production to their inventory. Therefore, access to cheap financing minimizes working capital cost. Access to cheap capital also allows Saudi

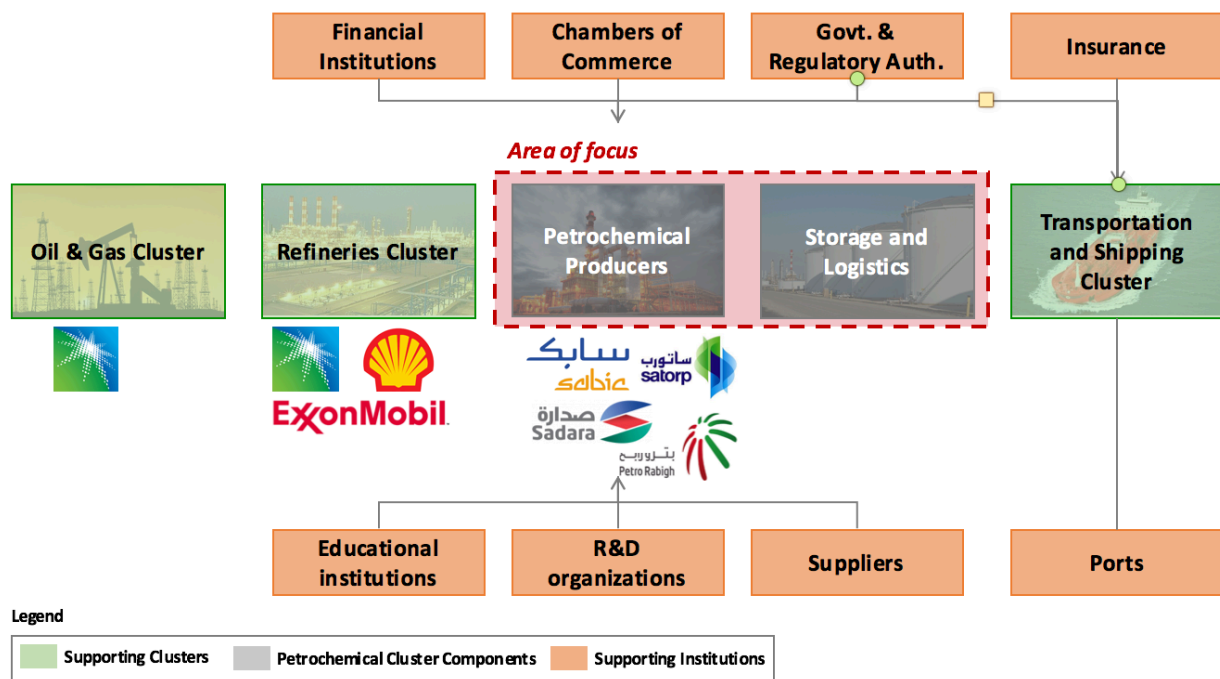
<sup>a</sup> KT = Thousand tons

<sup>b</sup> Million Tons

<sup>c</sup> based on expert interviews.

producers to increase leverage, without significantly increasing financing costs, which enhance profitability, especially in a capital intensive industry such as chemicals.

**Government Support:** The RCJY worked with the industry to design and build dedicated infrastructure to support the chemicals industry. It built a port in Jubail with facilities custom designed for chemicals exports<sup>a</sup>, it built an industrial city dedicated for chemical plants that had shared services such as electric generation, industrial waste water treatment, and training institutes. It also acted as regulator, setting and enforcing environmental standards. Government support and coordination has led to the emergence of the current cluster structure (Exhibit 4).



**Exhibit 4 Saudi chemicals cluster map.**

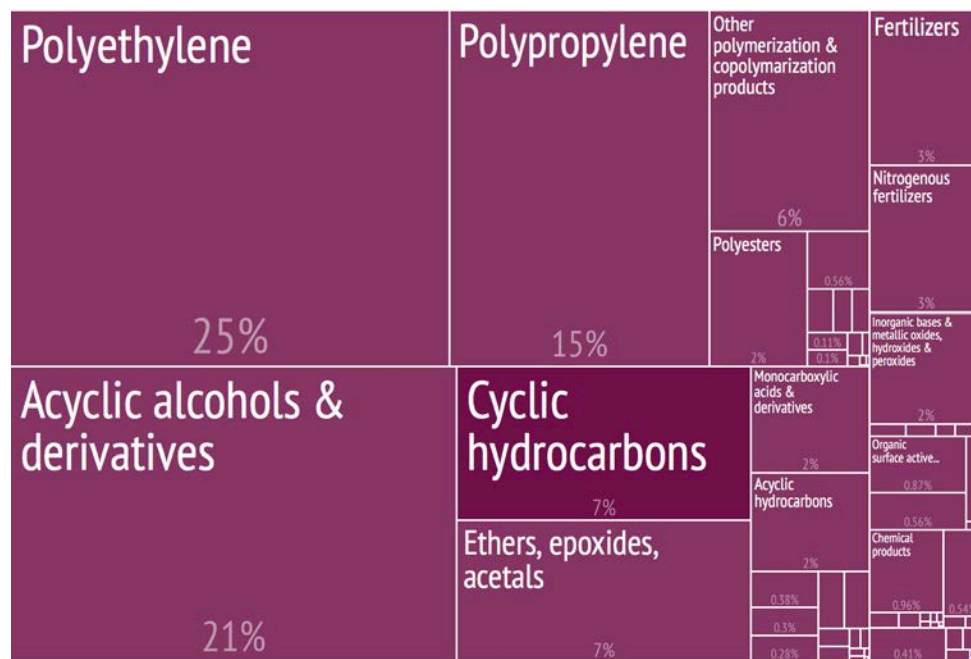
Source(s): team analysis, stakeholder interviews

## 2) Cluster Performance

Since 2005, the cluster's production volume has grown at 8% annually. Saudi Arabia accounts for 2% of the global chemical industry's sales and ranks as the 9th largest polymer producer.

<sup>a</sup> for example, it has lanes dedicated for building pipelines for bulk liquid exports.

Production is mainly centered around a number of basic commodity products. Overall 61% of production is centered on polyethylene, polypropylene, and MEG (acyclic alcohols).



**Exhibit 5 Saudi chemical exports by product**

Source: Atlas of economic complexity, Harvard Center for International Development

### 3) Cluster Competitiveness and Ranking Against Global Hubs

The competitiveness of competing chemical clusters across the world is assessed across five dimensions that determine the economics of chemicals production (KPMG, 2011).

**Technology and know-how.** Technology used for the production of chemicals is often patented and licensed back by major technology providers. Historically, large western players - Dow, DuPont, BASF, Evonik and others - have held the majority of such patents limiting access to technology by players new to the industry. Know how is also critical in building new capacity. Saudi producers have initially depended on foreign partners for technology (licensing manufacturing technologies) and marketing. Joint ventures still account for 60% of current production capacity across the GCC producers. Reliance on foreign technology has made producers dependent on the will of such partners.

Saudi players also face a dearth of talent supply. It is estimated that Saudi Arabia will train around 3,000 chemical engineers in the next seven years with plans to build around 15 million tons per year of additional capacity. Compare with Germany which is expected to train more than three times the number of engineers (10,000) for a tenth of capacity additions (1.5 million tons per year).

**Proximity to growth markets.** While concentrating capacity in one location enhances economies of scale and cluster effects, it puts production away from the demand centers. Saudi producers serving export markets have to deal with cost (tariff and transportation) and non-cost barriers (protective nationalist industrial policies). It is estimated that exporting from the Middle East to key markets (EU, China, North America) adds around USD 30 - 200 per ton in transportation and tariff costs, which represents a significant proportion of prices. (McKinsey).

**Access to feedstock.** Access to feedstock - whether in the form of hydrocarbon resources or of intermediate chemical products - is critical to building capacity. The type and quantity of feedstock available constrain industrial players to corresponding product chains (for example, as mentioned above, production derived from natural gas is constrained to olefins). Second, the pricing of feedstock directly influences the economics of production. For example, propylene (when produced from refining oil and priced at market rates) can account for around 80 to 90% of the price of the final product – polypropylene<sup>a</sup>.

Saudi Arabia was still until recently ranked first on feedstock supply and pricing. This accounted for the majority of the competitiveness of the country's chemical cluster. As the feedstock advantage erodes, there is an urgent case for the Saudi Arabian chemical cluster to strengthen its performance along the remaining dimensions in order to maintain and upgrade its competitiveness. The shale boom in the USA, and development of coal-to-gas (CTO) technology

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<sup>a</sup> Authors' estimates based on data from Nexant)

in China, has given players in those markets a significant edge which translated in increased investments in chemicals capacity.

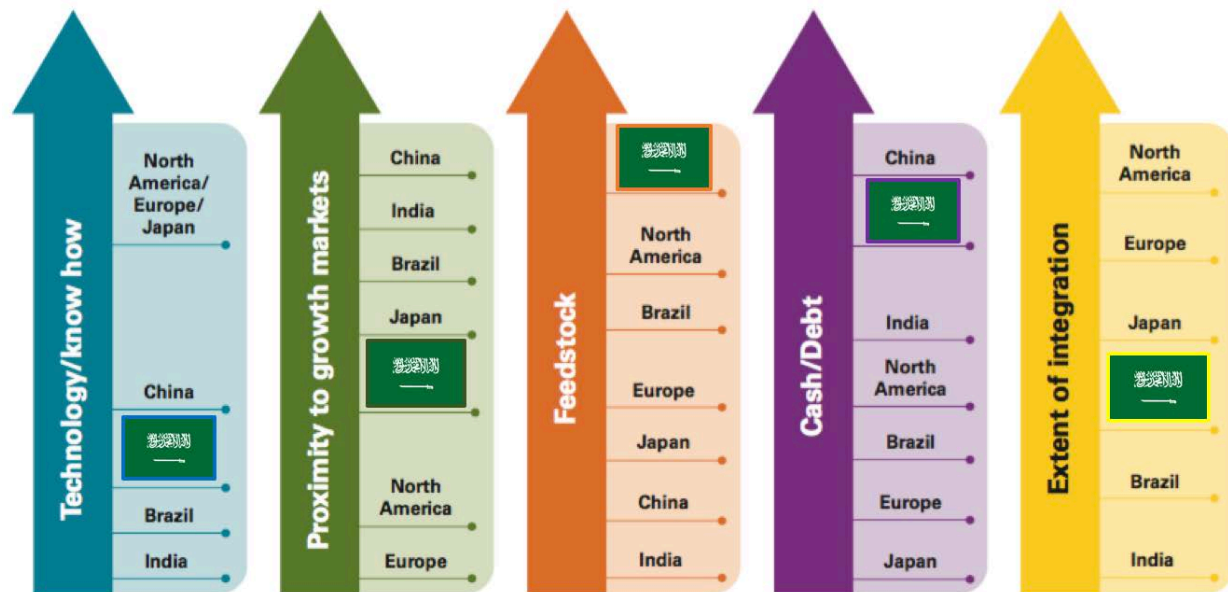
**Access to financing.** Players with access to low cost and largely available sources of financing gain an advantage given the capital intensity of chemical projects. For example, total investments in Sadara amount to USD 20 billion for a production capacity of 3 million tons per year. Players with access to capital are also better positioned to build larger scale operations and benefit from economies of scale. The second element in building scale are Mergers and Acquisitions (M&A). The merger of players with complementary product portfolios and / or capabilities for example allows for the consolidation of assets and increased integration in the value chain of production.

Saudi players have benefited from access to significant sources of financing in the form of both equity and debt. Revenues from oil exports provide abundant liquidity in the market, which is channeled towards building up capacity and larger players currently generate sufficient revenues to fund investments and growth. However, the M&A market remains largely underdeveloped. One deal between two publicly-listed companies was closed since the M&A regulations were issued in October 2007. In June 2014, Sipchem and Sahara - two publicly-listed Saudi chemical players - called off negotiations on a merger, blaming the constraints in the current regulatory framework (Bloomberg, 2014).

**Extent of integration.** The physical integration of production assets across the chemical's value chain is a significant source of competitiveness to the extent that improved integration reduces production costs (e.g. transportation costs) and drives increased collaboration between the different players (e.g. technical specifications developed between naphtha cracker / refinery and the polypropylene producer).

A significant proportion of Saudi chemical capacity was built into the industrial parks of Yanbu and Jubail. Saudi chemical players have developed little capacity integrated with refineries as they have relied mostly on natural gas feedstock.

Exhibit 6 summarizes the relative position of Middle Eastern players - including Saudi Arabia - compared to the major competing clusters across these five dimensions.



**Exhibit 6 Assessment of the KSA's Competitive Strength in Chemicals vs. Other Countries / Regions**  
Source(s): The GCC in 2020: Downstream Expansion of the Middle East Chemical Industry KPMG (2011)

#### 4) Cluster Business Environment and Institutions for Collaboration

##### *Assessment of the Cluster's Business Environment*

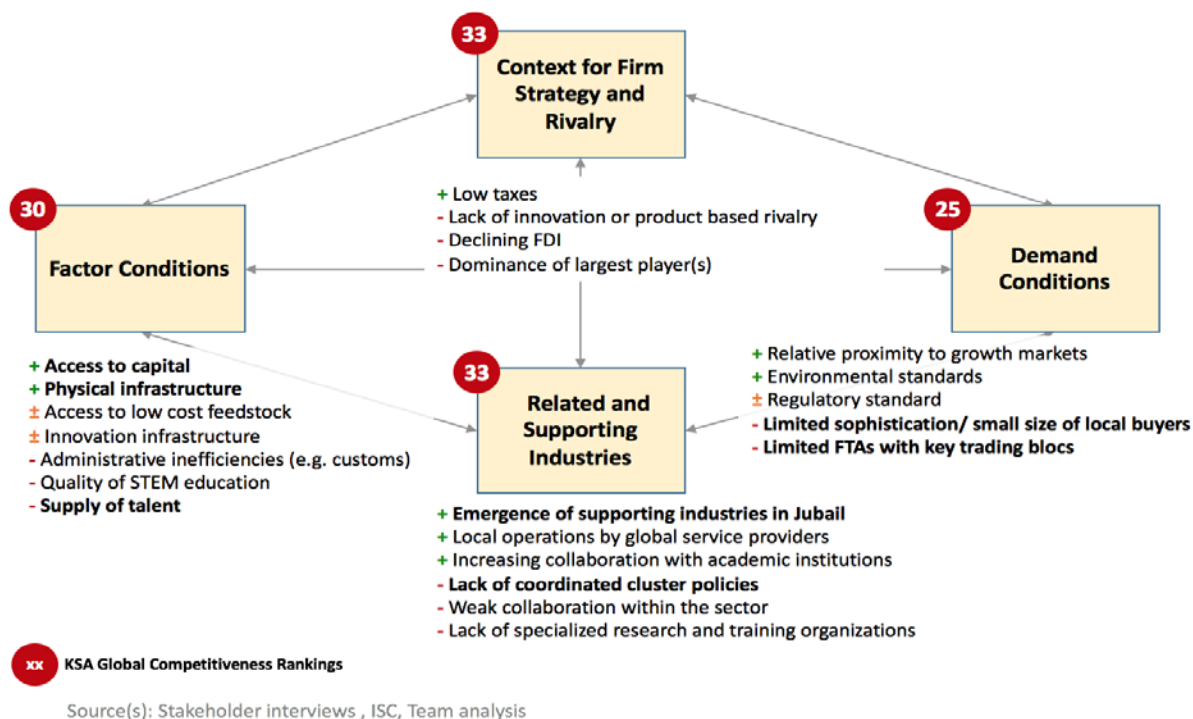
Exhibit 7 highlights the key strengths and weaknesses of the Quality of the Saudi Business Environment in chemical manufacturing. It must be noted that the Saudi Arabia's global rank is based on an assessment of the overall business environment and does not take into account elements specific to the chemical industry.

Our analysis reveals several areas that require immediate attention.

**Factor Conditions.** As mentioned above, the chemical cluster suffers from lack of access to local talent.

**Context for Firm Strategy and Rivalry.** The industry in Saudi Arabia remains dominated by a small number of large players who have benefited from low feedstock prices and growing demand in export markets to generate significant financial returns. This structure has inhibited effective competition between the players. The results are visible in the potential for improvements in functional excellence.

**Demand Conditions.** As mentioned above, Saudi players must heavily rely on export markets. The local market (including the broader Middle Eastern region) remains small relative to the capacity of the KSA. For example, in 2014 polymers consumption was 10 million tons in the Middle East, compared to 35 million in the US and 118 million in China (McKinsey). In fact, downstream sectors that are traditional buyers of chemicals are underdeveloped. For polymers, these sectors include automotive, appliances and electronics.



**Exhibit 7 Assessment of the Quality of the Business Environment for the KSA Chemical Cluster**



**Related Supporting Industries.** The development of the chemical sector has spurred growth in supporting industries with an estimated 7 jobs created in related industries for every job created in chemical manufacturing (McKinsey, 2014). However, the growth of the cluster continues to lack coordination. And the cluster mapping reveals that in fact the related industries are not fully developed – for example, the cluster lacks sufficient research and training organizations.

### *Institutions for Collaboration*

Saudi Arabia currently lacks a national or regional institution for collaboration. Major Saudi Arabia players are however active members of the wider regional Gulf Petrochemicals and Chemicals Association (GPCA).

The articles of association allow for “Associate Members” “legal entities [...] which can contribute to the achievement of the [GPCA’s] objective” such as storage companies or trading corporations. But the organization remains dominated by large chemical manufacturing companies (reflecting the structure of the regional industry) which are the only ones to have access to full membership.

An analysis of the composition of the GPCA membership reveals a significant number of “business partner” and “service company” members including banks, suppliers of raw material, and consulting firms. More specifically, a look at the composition of the six working committees of the GPCA reveals some participation of players outside chemical manufacturing (see Exhibit 8) although insufficient. Committees lack government representation. For example, the International Trade committee does not include government representatives or representatives from the Gulf Cooperation Council. Similarly, the Supply Chain committee does not include any representative from the relevant transportation authorities responsible for investing in and operating key infrastructure assets.

#	GPCA Committee	Total	Chemical Manufacturing	Other	Comments
1	Fertilizers	16	14	2	2 non-manufacturing members are representatives of Muntajat, the Qatari chemical marketing and trading arm
2	Research and Innovation	15	12	3	Includes representatives from 3 KSA universities
3	Plastics	19	13	6	Focuses on developing plastics industry (downstream of chemical); includes representatives from plastics producers as well as RCJY
4	Responsible Care	22	21	1	Focuses on Health, Safety, and Environment initiatives; developed a certification / labeling "Responsible Care"
5	Supply Chain	20	15	5	Includes representatives from Saudi Aramco and logistics companies, as well as one representative from the Royal
7	International Trade	15	11	4	Includes representatives from various trading / marketing companies
Total		107	86	21	

#### Exhibit 8 Composition of the GPCA Working Committees

At a higher level, the GPCA offers a platform for CEOs and senior executives to discuss industry trends and collaboration. The annual GPCA forum brings together CEOs from across the GCC to participate in several strategic workshops organized by consulting firms.<sup>a</sup>

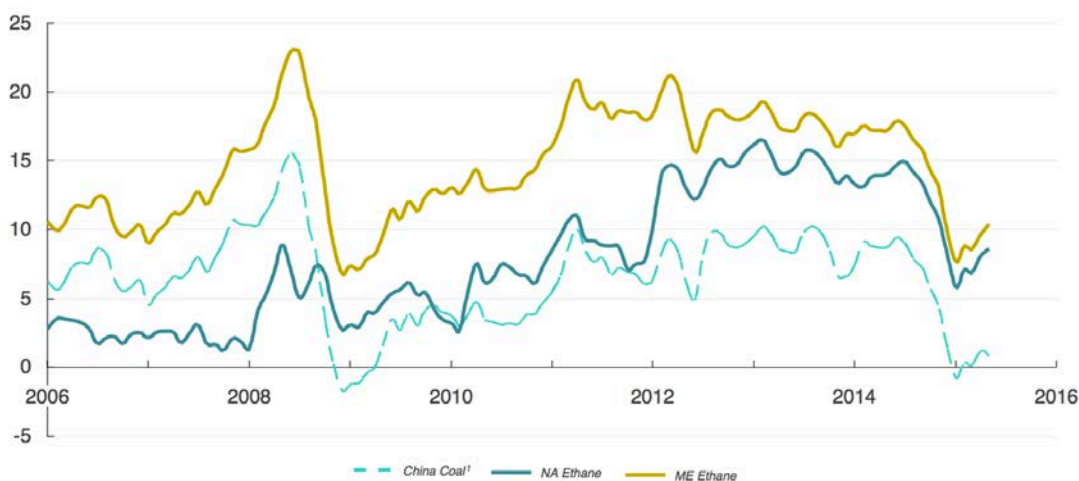
### 5) Emerging Challenges

As a result of the local endowments, human capital shortages, government policies, and industry structure; the chemicals cluster developed its capabilities around the gas value chain. Therefore, it remained in the commodity segment of the market. However, the current business model is being challenged by multiple factors:

**First**, the erosion of the feedstock based advantage which being challenged by the rise in US shale gas production and the rise of coal-to-gas (CTL) technology and it rising use in China (Exhibit 9).

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<sup>a</sup> based on expert interviews



**Exhibit 9 Yield adjusted feedstock cost relative to oil (naphtha), MMBTU basis**

**Second,** Increasing capacity in China which is pushing to increase its self-sufficiency in chemicals, with a goal of reaching 80% self-sufficiency (KPMG, 2013) which it is likely to reach by 2017. China was the largest market for Saudi Arabia's chemical exports in 2014 (25% of exports), therefore rising self-sufficiency shrinks the available market for Saudi producers.

**Third,** Saudi producers are facing issues with market access. Asia is forming more free trade agreements, that are lowering the barriers and cost to trade within those areas, but eroding the price competitiveness of Saudi exports. Furthermore, the EU increase its tariffs on Saudi chemicals exports from 3% to 6.5% in 2014 (E&Y). Saudi Arabia, has only one free trade agreements (with Singapore), and many of the proposed free trade agreements, especially with the US, China and the EU, have been under negotiations for years without significant progress. Higher cost producers are outcompeting Saudi producers in some markets like Turkey because of their better access (Trenwith, 2015). The WEF ranks Saudi Arabia 127<sup>th</sup> out of 138 countries in terms of its exporters' access to foreign markets (WEF, The Global Enabling Trade Report , 2014).

**Fourth,** the recent decline in oil prices beginning in 2014 has also challenged the Saudi chemicals cluster as more Asia producers become equally price competitive with Saudi

production cost once tariffs and transportation costs are included. According to an industry executive, transportation from Saudi Arabia to East Asia adds up to \$130 per ton to their delivered cost. Furthermore, in January 2016, the government raised the price of ethane from \$0.75 to \$1.75/MMBTU. For comparison the price of gas in the US was \$2.24/MMBTU (Gonzalez, 2016).

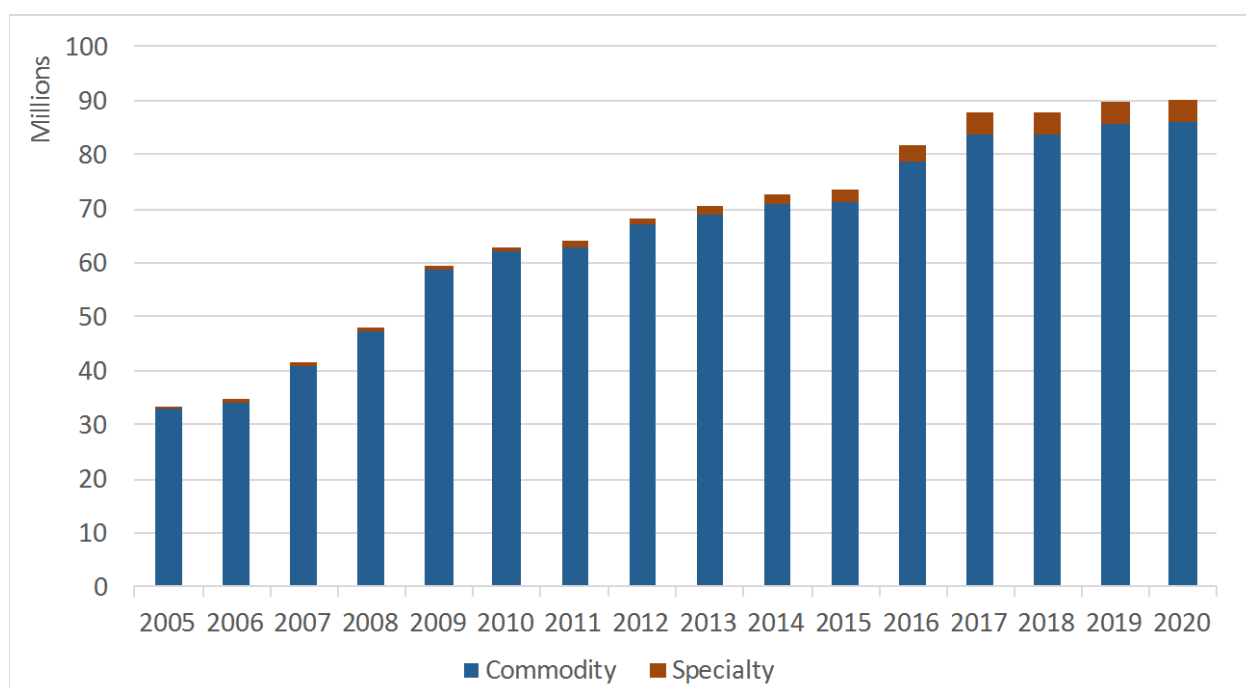
## **6) The Need to Upgrade the Cluster's Competitiveness**

To overcome the strategic challenges that it's facing, and enhance its global competitiveness, the Saudi chemicals cluster needs to minimize its exposure to commodity chemicals by increasing local demand for its commodity chemicals by the conversion industry, and begin using the abundant local Naphtha to produce a wider portfolio of downstream specialty products. As you can see in Exhibit 10, the specialties segment has been growing at about 18% from 2005-2015, and is expected to grow at 8.5% until 2020. However, it is growing from a very small base; specialties accounted for less than 3% of Saudi Arabia's chemicals exports in 2015, and will not exceed 5% in 2020.

Specialty chemicals tend to have lower price volatility or correlation with oil, higher value added, less cyclical demand, less competitive market with very few producers, and customers tend to be sticky and develop deep relationships with a single supplier. However, entering the specialty chemicals is difficult since a major barrier to entry is technology, know-how, and intellectual property protection. Entering this segment will also require Saudi firms to change their business models and upgrade their capabilities<sup>a</sup>. They will also need to work closer with the government and other players in the clusters to improve the cluster's business environment, and upgrade its competitiveness.

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<sup>a</sup> based on expert interviews



**Exhibit 10: Saudi Petrochemical Capacity (tons annually)**  
**Source: Team Analysis, GPCA data**

### III. Recommendations

Upgrading the business environment to better position Saudi Arabia’s chemical cluster will require (for the most of it) working outside. The recommendations are targeted at both the government of Saudi Arabia as well as chemical manufacturers. They are detailed into initiatives (see Exhibit 4) that can be summarized around three main themes:

**Upgrade internal capabilities** - Saudi players should seek to grow the talent pool of engineers and researchers by tightening collaboration with universities and students both within the KSA and abroad. Saudi players should also seek to develop stronger marketing capabilities which are critical to moving downstream in the value chain.

**Upgrade competitiveness of global trade** - Saudi players should focus on upgrading their supply chain capabilities to continuously drive down costs of serving export markets. The

government should also secure Free Trade Agreements to guarantee continued access to these markets.

**Correct feedstock distortions** - revising the prices and allocation mechanisms of feedstock to drive more competition among players and reduce distortion to returns on basic chemicals will naturally force.

The ten most pressing initiatives are detailed in the Appendix.

Ultimately, these recommendations aim at redefining the Saudi Chemical cluster's core source of competitive advantage away from **endowments** (advantaged feedstock) to **human capital** (technology and know how).

	Technology / Know How	Proximity to Growth Markets	Feedstock	Cash / Debt	Extent of Integration
Macro	<ul style="list-style-type: none"> <li>Introduce / refine government fiscal incentives for R&amp;D</li> <li>Upgrade quality of programs and intake capacity at educational institutions</li> </ul>	<ul style="list-style-type: none"> <li>Negotiate FTAs with key trading blocks</li> </ul>	<ul style="list-style-type: none"> <li>Increase feedstock prices</li> <li>Move feedstock allocation process to market-driven approach</li> </ul>	<ul style="list-style-type: none"> <li>Revise and improve the legal framework for M&amp;A</li> </ul>	<ul style="list-style-type: none"> <li>Incentivize /support the development of shared utilities and services</li> </ul>
Micro	<ul style="list-style-type: none"> <li>Strengthen collaboration with academic institutions</li> <li>Develop apprenticeship model</li> <li>Collaborate on R&amp;D between players</li> </ul>	<ul style="list-style-type: none"> <li>Enhance logistical/supply chain capabilities</li> <li>Move from a sales to a marketing driven approach</li> <li>Improve customer value proposition and differentiation</li> </ul>	<ul style="list-style-type: none"> <li>Improve operational excellence</li> <li>Support the development of the downstream industry</li> </ul>	<ul style="list-style-type: none"> <li>--</li> </ul>	<ul style="list-style-type: none"> <li>Increase collaboration with oil &amp; gas cluster</li> <li>Establish an in-country IFC</li> </ul>

Source(s): Team analysis, Stakeholder interviews

Priority Initiatives Details in Appendix

**Exhibit 11 Recommended Initiatives to Upgrade the Saudi Chemical Cluster**

The ten most important initiatives are ranked along two dimensions:

**Impact on Long-term Competitiveness of the Chemical Cluster.** The goal is to identify the impact of each initiative on upgrading the business environment of the chemical cluster.

**Ease of Implementation.** The implementation of each initiative is assessed looking at the number of stakeholders to engage, the timeline for execution, and organizational changes (internal to chemical manufacturers).

The resulting prioritization is captured in Exhibit 12.

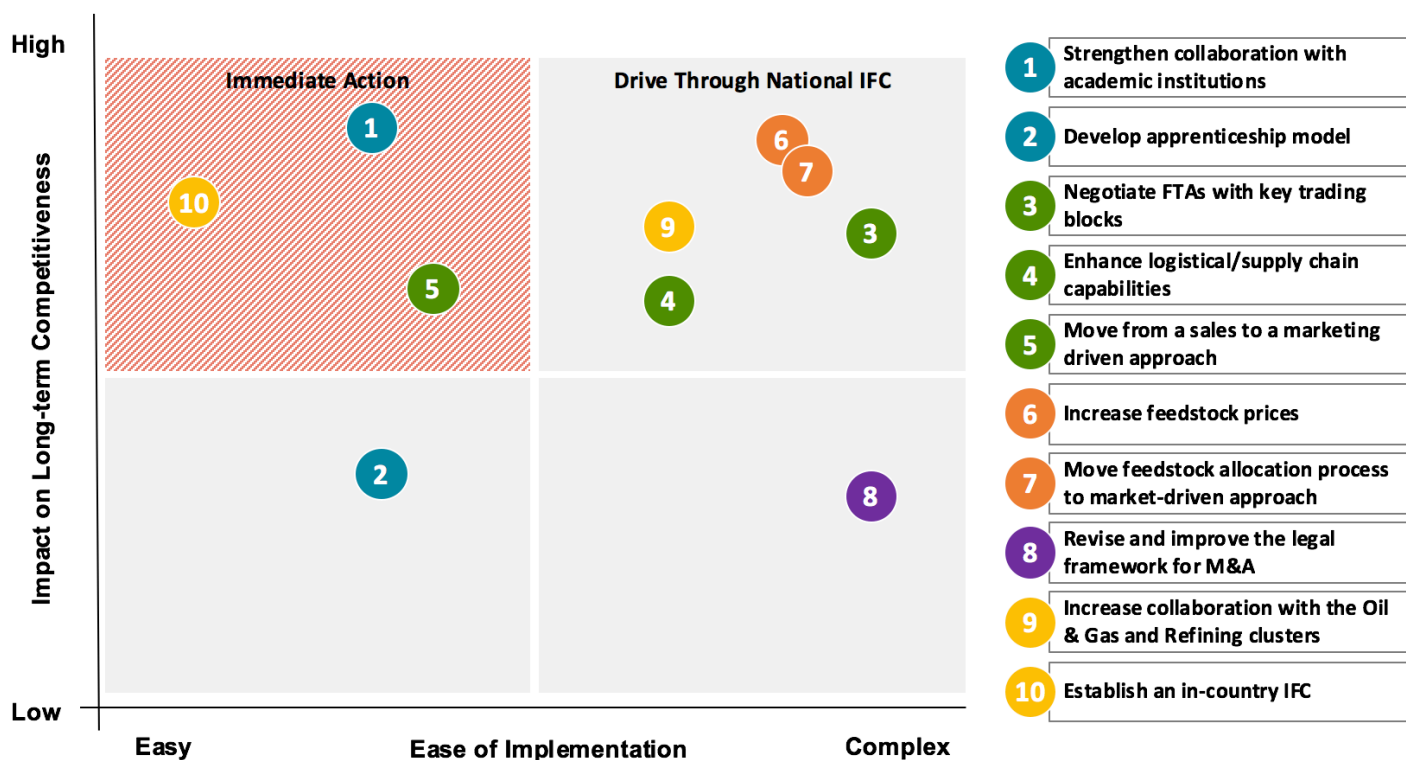


Exhibit 12 Prioritization of Recommended Initiatives

## IV. Appendix

### 1) Detailed Initiatives

Technology / Know How			
Recommendation	Responsible	Impact on Competitiveness	Ease of Implementation
<b>1 Strengthen collaboration with academic institutions</b> <ul style="list-style-type: none"> <li>Start and fund R&amp;D programs and curricula focused on topics relevant to the industry</li> <li>Support the development of vocational schools</li> </ul>	Chemical Manufacturers  Institution for Collaboration	<ul style="list-style-type: none"> <li><b>Factor Conditions.</b> Engaging universities will allow to develop tailored engineering curricula based on industry insights and anticipation of future needs. There are also direct benefits in sharing funding for R&amp;D and leveraging talent at universities.</li> </ul>	<ul style="list-style-type: none"> <li><b>Stakeholder Engagement.</b> Manufacturers can build on existing relationships established with selected universities to expand collaboration.</li> <li><b>Timeline.</b> The development of curricula can be accelerated through knowledge transfer from foreign institutions.</li> </ul>
<b>2 Develop apprenticeship model</b> <ul style="list-style-type: none"> <li>Develop structured apprenticeship and internship (summer and long) programs especially at the engineering level –</li> <li>Advertise in KSA and US / UK universities</li> </ul>	Chemical Manufacturers	<ul style="list-style-type: none"> <li><b>Factor Conditions.</b> The development of closer ties between students / universities and industrial players is critical to create interest in the industry (grow the talent pool) and attract students (channel talent) – especially at engineering schools / departments.</li> </ul>	<ul style="list-style-type: none"> <li><b>Organizational Change.</b> The development of internship and apprenticeship models will require a limited number of changes within players. Models can be based on successful HR practices across the world.</li> </ul>

Proximity to Growth Markets			
Recommendation	Responsible	Impact on Competitiveness	Ease of Implementation
<b>3 Negotiate FTAs with key trading blocks</b> <ul style="list-style-type: none"> <li>Launch negotiations with governments and trading blocks that cover key current and future export markets incl. Asia Pacific, SE Asia, and Africa</li> </ul>	Saudi Government	<ul style="list-style-type: none"> <li><b>Demand Conditions.</b> Free Trade Agreements would lift tariff and non-tariff trade barriers to Saudi players into key export markets. This would reduce costs to serve these markets but most importantly strengthen state-to-state trading ties.</li> </ul>	<ul style="list-style-type: none"> <li><b>Stakeholder Engagement.</b> The initiation of such an effort requires the private sector to effectively lobby the KSA government.</li> <li><b>Timeline.</b> The negotiation process can be lengthy – spread over multiple years – and exposed to political changes in target markets.</li> </ul>
<b>4 Enhance logistical/supply chain capabilities</b>	Chemical Manufacturers  Saudi Government	<ul style="list-style-type: none"> <li><b>Factor (Input) Conditions.</b> The strengthening of capabilities would improve cost structure for export-oriented products; centralizing function into one body (e.g. Qatar's Muntajat) would allow to capture economies of scale.</li> <li><b>Supporting Industries.</b> This would also drive the development of the logistics sector.</li> </ul>	<ul style="list-style-type: none"> <li><b>Stakeholder Engagement.</b> Such initiatives require mostly initiatives that are internal to each of the players; centralization and outsourcing of logistics would require strong collaboration among players.</li> </ul>



## Proximity to Growth Markets

Recommendation	Responsible	Impact on Competitiveness	Ease of Implementation
<b>5 Move from a sales to a marketing driven approach</b> <ul style="list-style-type: none"> <li>Develop internal sales and marketing capabilities – including customer facing technical teams</li> </ul>	Chemical Manufacturers	<ul style="list-style-type: none"> <li><b>Factor Conditions.</b> The development of sales and marketing capabilities is necessary to invest in specialty chemicals.</li> </ul>	<ul style="list-style-type: none"> <li><b>Organizational Change.</b> Upgrading capabilities will require internal changes to the organizations and hiring of talent with relevant expertise.</li> </ul>

## Feedstock

Recommendation	Responsible	Impact on Competitiveness	Ease of Implementation
<b>6 Increase feedstock prices</b> <ul style="list-style-type: none"> <li>Increase feedstock prices, following a clear time schedule.</li> <li>Consider taking into account costs of feedstock production and value add of downstream products.</li> </ul>	Saudi Government	<ul style="list-style-type: none"> <li><b>Context for Firm Strategy and Rivalry.</b> Increasing the feedstock prices will drive players to invest in higher value added products as returns on basic chemicals shrink; this will progressively upgrade the industry's productivity.</li> </ul>	<ul style="list-style-type: none"> <li><b>Stakeholder Engagement.</b> This initiative requires a political decision; reaching the decision and outlining the exact process is expected to require a number of negotiations with different players.</li> </ul>
<b>7 Move feedstock allocation process to market-driven approach</b> <ul style="list-style-type: none"> <li>Gradually transition allocation scheme to a competitive bid amongst players</li> </ul>	Saudi Government	<ul style="list-style-type: none"> <li><b>Context for Firm Strategy and Rivalry.</b> The competitive allocation of feedstock would drive competition among large players; producers seeking a quota of natural resources would have to demonstrate better returns. Treating all players on an equal footing would also</li> </ul>	<ul style="list-style-type: none"> <li>(same as above)</li> </ul>

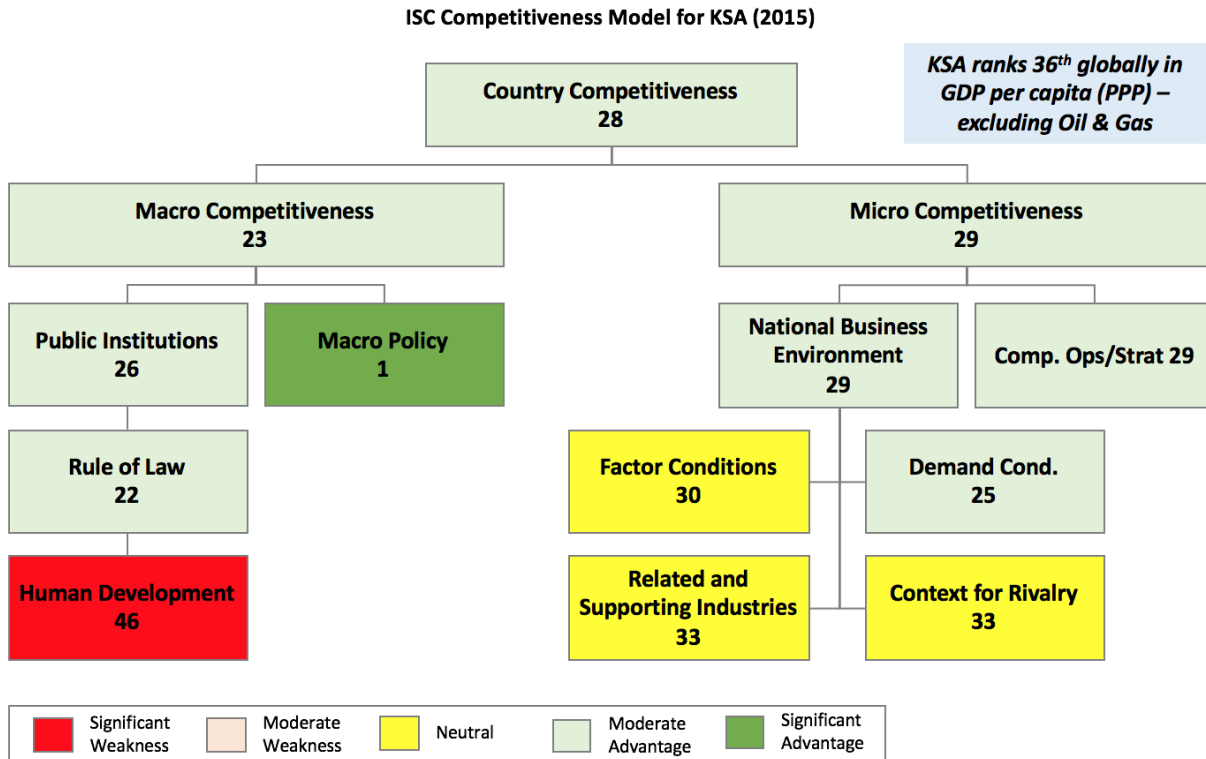
## Cash / Debt

Recommendation	Responsible	Impact on Competitiveness	Ease of Implementation
<b>8 Revise and improve the legal framework for M&amp;A</b> <ul style="list-style-type: none"> <li>Revise the 2007 M&amp;A regulations covering publicly listed companies to resolve grey areas / limitations to mergers.</li> </ul>	Saudi Government	<ul style="list-style-type: none"> <li><b>Context for Firm Strategy and Rivalry.</b> M&amp;A allows smaller players (new entrants) to achieve scale. M&amp;A drives competition among firms by allowing capital markets to function effectively.</li> <li><b>Factor Conditions.</b> Merging firms with complementary capabilities will drive the competitiveness of players.</li> </ul>	<ul style="list-style-type: none"> <li><b>Stakeholder Engagement.</b> Changes to the current regulations will require action by the Capital Market Authority. The industry players can rely on the recent Sahara – Sipchem experience to raise recommendations for changes. Other clusters should also be approached to leverage their experience.</li> </ul>

## Extent of Integration

	Recommendation	Responsible	Impact on Competitiveness	Ease of Implementation
9	<b>Increase collaboration with the Oil &amp; Gas and refining clusters</b> <ul style="list-style-type: none"> <li>Build ties with Saudi Aramco and consider co-investing in chemical plants integrated with refineries.</li> </ul>	Chemical Manufacturers	<ul style="list-style-type: none"> <li><b>Factor (Input) Conditions.</b> Improve the economics of manufacturing for naphtha-based products. Integration with refining could increase margins on a ton of ethylene by \$50 to \$100 (McKinsey estimates).</li> </ul>	<ul style="list-style-type: none"> <li><b>Stakeholder Engagement.</b> The chemical manufacturers will primarily engage one player - Saudi Aramco (national oil company); Saudi Aramco has already invested in chemicals (JV with Dow – Sadara).</li> <li><b>Timeline.</b> Resulting investments will require a number of years to take place.</li> </ul>
10	<b>Establish an in-country IFC</b> <ul style="list-style-type: none"> <li>Start a national Saudi institution including all key cluster players.</li> <li>Focus priority on upgrading the competitiveness of the cluster.</li> </ul>	Chemical Manufacturers	<ul style="list-style-type: none"> <li>The establishment of an IFC will enable the execution of several initiatives outlined in this document.</li> <li>The forum will focus on Saudi-specific challenges and potentially have a stronger credibility to engage the KSA government (vs. the GPCA).</li> </ul>	<ul style="list-style-type: none"> <li><b>Stakeholder Engagement.</b> The current structure of the industry (highly concentrated) allows for the leading players (e.g. SABIC, Saudi Aramco) to lead the creation of an IFC and bring other players onboard both from the private sector and from the government.</li> </ul>

## 2) ISC Competitiveness Model for Saudi Arabia



Source(s): ISC

Note(s): Color coding based on ranking relative to non-oil GDP per capita

### 3) Cluster players (*illustrative and non-exhaustive*)

#### *Producers:*

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**SABIC** The Saudi Arabian Basic Industries Corp (SABIC) was created by royal decree in 1976 and started production in 1981. Chemicals, representing 60% of overall company revenue, forms SABIC's largest business unit. The company is the world's third-largest producer of polyethylene and polypropylene and also has market share in a wide variety of other basic and specialty chemicals. The firm is active in over 50 countries with 65 facilities located across the Middle East and further afield. Saudi Arabian facilities are situated primarily around Jubail aiding government efforts at creating a cluster in the region. SABIC's R&D facilities have patented over 10,000 innovations creating a regional center of excellence for petrochemicals-based research. SABIC is 70% owned by the Saudi government with the remaining 30% either privately held by Saudi investors or by other GCC countries

**Sadara** Established in 2011, Sadara is a \$20 billion joint venture between Saudi Aramco and Dow Chemicals. Under this JV, 26 manufacturing units with a production capacity of over 3 million tons are being constructed in Jubail. This facility, once completed, will be the world's largest integrated chemicals complex ever built in a single phase. The complex will be adjacent to a new industrial park where downstream manufacturers will be situated aiding clustering efforts. 14 of the 26 manufacturing facilities will bring technology that is new to the Saudi chemical cluster while the complex will be the first to crack naphtha throughout the GCC. The complex is expected to achieve full operational status in 2016.

**PetroRabigh** Created as a JV in 2005 by Saudi Aramco and Sumitomo Chemical, PetroRabigh started production in 2009. The PetroRabigh enterprise consists of a petrochemicals complex integrated with an oil refinery that Saudi Aramco transferred into the venture. The integrated nature of the enterprise has meant that PetroRabigh is well placed to produce a range of polymer products. The JV is still majority owned by the consortium with 25% ownership floated on the Saudi stock exchange.

#### *Enablers – R&D*

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**KACST** The King Abdulaziz City of Science & Technology (KACST) is Saudi Arabia's premier national science agency and its national laboratories. KACST is involved in scientific research and technological development related to the oil, gas and petrochemicals industries with a view to enhancing the competitive capabilities of these sectors.

**KFUPM** The King Fahd University of Petroleum & Minerals (KFUPM) is Saudi Arabia's most selective university offering specialist courses in various engineering and scientific disciplines. The university's research institute has a center dedicated to research into petrochemical development. KFUPM's Dhahran campus also runs the Dhahran Techno Valley initiative which contains various initiatives focused on technology innovation and incubation with strong links to the petroleum and petrochemicals industry in Saudi Arabia and further afield.

**KAUST** The King Abdullah University of Science & Technology was founded in 2009 and focuses on graduate programs related to a wide variety of science and engineering fields. Established as a world-class research facility the university also has a research and technology park which houses tenants such as Saudi Aramco, Dow Chemicals and SABIC.

#### *Enablers – Institutions for Collaboration (IFCs)*

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**GPCA** The Gulf Petrochemicals & Chemicals Association (GPCA) was established in 2006 to represent downstream hydrocarbon producers and supporting actors in the Persian Gulf. With more than 240 members who make up around 95% of chemical output in the region the GPCA is a powerful supporter of the sector within the region and manages six committees looking into issues related to the sector with international trade and research and innovation being a particular focus for two of the committees. Members of the GPCA are drawn from across the GCC as well as international firms active within the region.

#### *Enablers – Government*

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**RCJY** The Royal Commission for Jubail & Yanbu (RCJY) was established in 1975 with the purpose to develop and implement government policies related to the establishment of the petrochemicals cluster in Jubail and Yanbu. The independent commission is therefore responsible for creating an investor-friendly environment which can promote coordination between Saudi Arabian firms, and foreign investors with the technical know-how.

**Ministry of Petroleum** The ministry is responsible for overall government policies related to the petroleum and petrochemical sectors in Saudi Arabia. The ministry has close oversight over the activities of Saudi Aramco and SABIC. In maintaining this oversight, the ministry is well-placed to coordinate actions across the petroleum and petrochemicals sectors to ensure that sustainable growth in the downstream petrochemicals cluster can be achieved.

#### *Enablers – Finance*

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**SIDF** The Saudi Industrial Development Fund (SIDF) is a government-run finance agency that provides financial support in the form of medium and long-term soft loans to support the industrial development and diversification of the Saudi economy. It is also known to provide administrative, financial and marketing consultancy services to its borrowers. SIDF will always work alongside the relevant government departments who can bring the technical expertise to bear while SIDF provides the necessary financing. SIDF currently has capital of around 40 billion Saudi Riyals and have oversight from the Ministry of Commerce & Industry.

**PIF** The Public Investment Fund (PIF) was established in 1971 to invest and finance projects inside Saudi Arabia and to hold all government stakes in publicly-traded companies. While the size of PIF's total assets is unknown an analyst quoted in the Financial Times quoted their AUM to be more than \$380 billion in 2008 (Financial Times, 2008).

#### 4) Historical Development of the Saudi Chemical Cluster

The chemical cluster in Saudi Arabia started in 1965 with the Saudi Arabian Fertilizer Company (SAFCO) which was the first petrochemical company established in the Kingdom. Since then SAFCO has become one of the largest chemical producers in the world producing nearly 5 million tons of fertilizer per year.

Clustering efforts were formally launched in 1975 with the creation of the Royal Commission of Jubail and Yanbu (RCJY). This coincided with Dr Ghazi Al Gosaibi being appointed as the Minister of Industry & Electricity and being given the mandate to create a petrochemicals industry in Saudi Arabia. The following year, in 1976, Saudi Arabian Basic Industries Company (SABIC) was created. The creation of RCJY and SABIC would set the stage for the future development of the chemical cluster in Saudi Arabia.

The 1980s saw further development of the industry with SABIC opening its Technical Services Lab in 1988. This would eventually evolve into SABIC's first R&D center in 1994 and by 2014 would see SABIC becoming the Middle East's largest patent developer with over 10,000 patents to their name. At around the same time the Saudi Formaldehyde Company (now Chemanol) was formed as Saudi Arabia's first privately owned petrochemicals company.

Over the next decade various other players would also enter the petrochemicals industry in Saudi Arabia with notable facilities constructed including Saudi Chevron's aromatics plant in Jubail in 2000. From 2005 onwards there has been a trend for Saudi Aramco to add production capacity through JVs with prominent international players. This was evidenced in 2005 when Saudi Aramco partnered with Sumitomo Chemicals to form the Rabigh Refining & Petrochemical Company (PetroRabigh). Another JV the same year saw Saudi Aramco and Total create SATORP at Jubail as an integrated refinery and aromatics complex.

Saudi Aramco has continued its JV efforts most recently partnering with Dow Chemical in 2011 to form the Sadara Chemical Company which is building and operating one of the world's largest integrated chemical facilities. The complex also includes a downstream industrial park creating potential for greater value add initiatives in the near future.

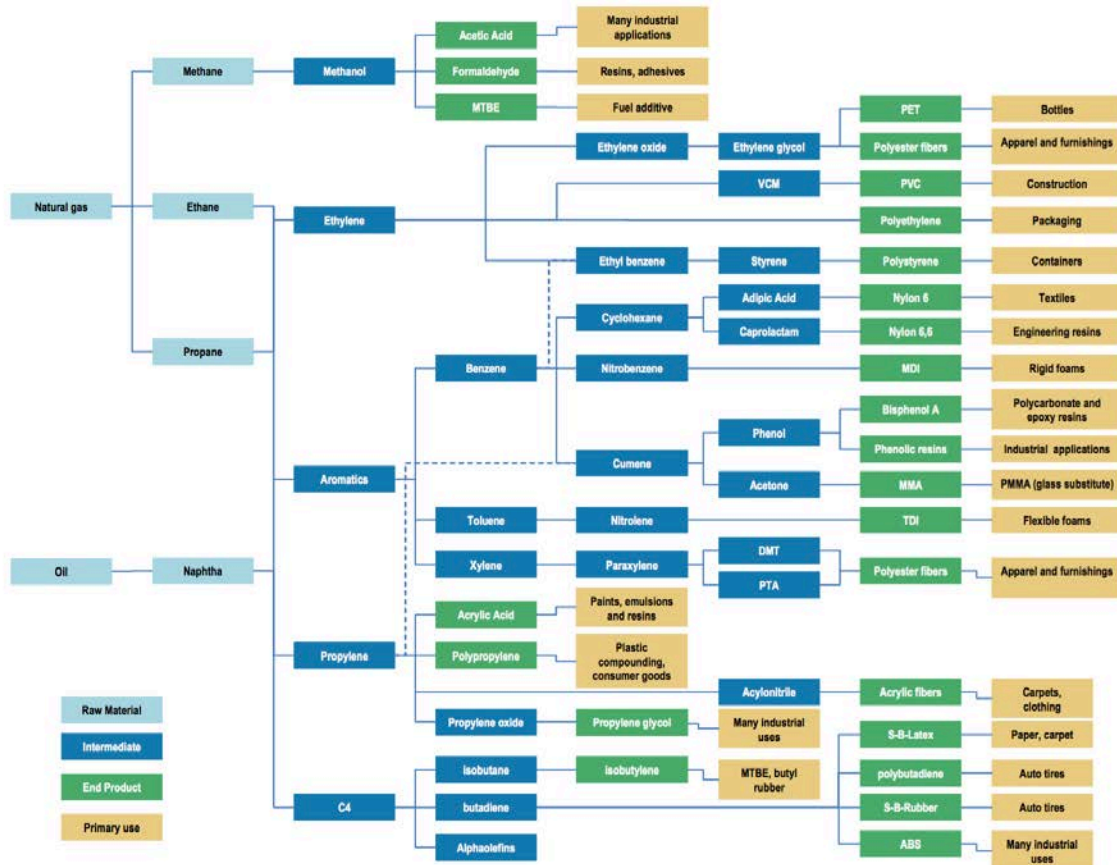
A timeline of the development of the Saudi Arabian chemical cluster is given below:

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<b>1965</b>	Saudi Arabian Fertilizer Company (SAFCO) created
<b>1975</b>	Royal Commission for Jubail & Yanbu (RCJY) created
<b>1976</b>	Saudi Arabian Basic Industries Corp (SABIC) created by royal decree
<b>1978</b>	Work commences on second industrial city at Yanbu
<b>1988</b>	Opening of SABIC's Technical Services Lab (TSL) which later becomes SABIC's first R&D center in 1994
<b>1989</b>	The Saudi Formaldehyde Company (now Chemanol) is the first private Saudi petrochemical company formed
<b>2000</b>	Saudi Chevron aromatics plant is commissioned - the first wholly privately owned major aromatics complex in Jubail
<b>2005</b>	Saudi Aramco and Sumitomo Chemical of Japan form a JV - Rabigh Refining & Petrochemical Company (PetroRabigh)
<b>2005</b>	Saudi Aramco and Total sign a JV to construct a refinery and an aromatics complex at Jubail. JV eventually known as SATORP and comes online in 2013
<b>2011</b>	Saudi Aramco and Dow Chemical agree to form the Sadara Chemical Company to build and operate one of the world's largest integrated chemical facilities. The complex will also include a downstream industrial park
<b>2014</b>	SABIC becomes the largest patent developer in the Middle East by surpassing the 10,000 patent mark

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## 5) Chemical product value chain



Source: Morgan Stanley, 2014, Global Chemicals Investor Guide

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