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Building a self-sufficient petrochemical intermediates industry in India by 2025

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Contents

Executive Summary

An ideal "Make in India" opportunity

Petrochemical intermediates are ideal candidates for a "Make in India" strategy because of several reasons. First, they are a vital link in the Indian chemical industry. Intermediates such as ethylene oxide, propylene oxide, polyols, phenol, acrylic acid, styrene and rubber derivatives are the primary feedstock for producing specialty chemicals, which are essential for manufacturing almost all consumer and technology products.

Second, India has been facing significant shortages in almost all petrochemical intermediates. This has led to an import dependency of 45 percent, one of the highest in any manufacturing industry.

Third, petrochemical intermediates offer a significant growth opportunity driven by downstream industries. The speciality chemical industry is poised to undergo rapid growth over the next decade and will be the primary driver for demand in petrochemical intermediates. Growth in speciality chemicals will stem from both the growth of end industries such as construction and consumer goods and the rising sophistication of end products such as passenger cars.

Fourth, the petrochemical intermediates industry is a highly value-creating one. It has delivered returns to shareholders 50 percent higher than the average Indian corporate sector over the past five years. If its full growth potential can be unlocked, it could generate yet further value by boosting entrepreneurship, technology and research and development, and by unlocking latent demand in downstream industries.

A major weak link for the economy

Notwithstanding the opportunity, the import dependency of this critical segment represents a major weak link for India's economy. A constrained development of the petrochemical intermediates industry could compromise a growth opportunity of INR 400,000 to 600,000 crore (USD 65–100 billion) in the speciality chemical industry by 2025, by depriving it of some key chemicals especially those that are logistically complex to import.

Four primary constraints are currently holding back the petrochemical intermediates industry:

1. Lack of specialised infrastructure such as pipelines (e.g., cryogenic pipelines for ethylene and propylene, high-pressure pipelines for C4 and C5 streams), water desalination plants, and reliable and cost effective effluent treatment facilities

2. Slow implementation of world-scale diversified petrochemicals clusters that would enable co-location of bulk, intermediate and specialty petrochemicals players

3. Utilisation of more than 90 percent of the propylene and ethylene produced in India for manufacturing of bulk plastics, leaving only modest volumes available for manufacturing higher value added intermediates

4. Challenges faced by petrochemical majors in negotiating technology agreements with multinationals

The 2025 outlook raises a fundamental question

The situation is at risk of deteriorating further as India is set to consume an additional 20–25 million tons (MT) of petrochemical intermediates annually by 2025. In a theoretical scenario where the installed capacity of 6 million tons per annum (MTPA) would be only complemented by current capacity announcements of 2 MTPA, India would fall short by 25–30 MT by 2025, implying an additional import cost of INR 150,000 to 200,000 crore (USD 24 to 32 billion) a year for intermediates.

This outlook raises a fundamental question for India: can the country's downstream chemicals sector afford to wait years for the petrochemical intermediates industry to resolve its challenges? If not, how can the industry and policymakers work together to accelerate the development of petrochemical intermediates through world-class integrated clusters?

Six priority areas for achieving 85 percent self-sufficiency

We believe that a level of 85 percent self-sufficiency in petrochemical intermediates is a necessary and achievable aspiration for the country, to ensure a vibrant downstream chemical industry providing critical inputs to a growing manufacturing sector. Achieving this aspiration would require India to install 20–25 MTPA of additional petrochemical intermediate capacity – a number four times the volume of the entire current installed capacity. This translates into 70–90 additional plants (at economically viable scale) across 30–40 products falling in seven chemical value chains.

The challenges of making this aspiration a reality are not unique to India. Other major chemical-producing economies such as China, the European Union and Singapore have faced and resolved similar challenges. Examples exist of countries creating networks of cryogenic pipelines to enable widespread access to difficult feedstock (Antwerp, Belgium); developing master plans to demarcate petrochemical intermediates units to be connected to cracker complexes (Jurong, Singapore); providing tax breaks and other economic incentives to attract investors (Jurong, Singapore; Fujian, China); and of state-owned enterprises enabling forward integration and supply agreements with smaller private sector downstream companies (Fujian, China).

Building on the examples mentioned, we recommend concerted joint action considering six priorities:

1. Creating an integrated petrochemical intermediates master plan for India which would match feedstock availability with downstream and end-use demand for seven critical value chains

2. Conceptualising, building, operating and maintaining specialised common petrochemicals infrastructure and utilities such as cryogenic and high-pressure pipelines, water desalination and effluent treatment

3. Encouraging or mandating anchor producers of clusters to make specified volumes of critical building blocks available for downstream units

4. Supporting direct investment by petrochemical players in intermediates by re-examining duty structures and considering fiscal and other economic incentives

5. Establishing petrochemical intermediate clusters as frontrunners in the national campaign to improve the ease of doing business, by accelerating the simplification of key procedures such as land acquisition or environmental clearances

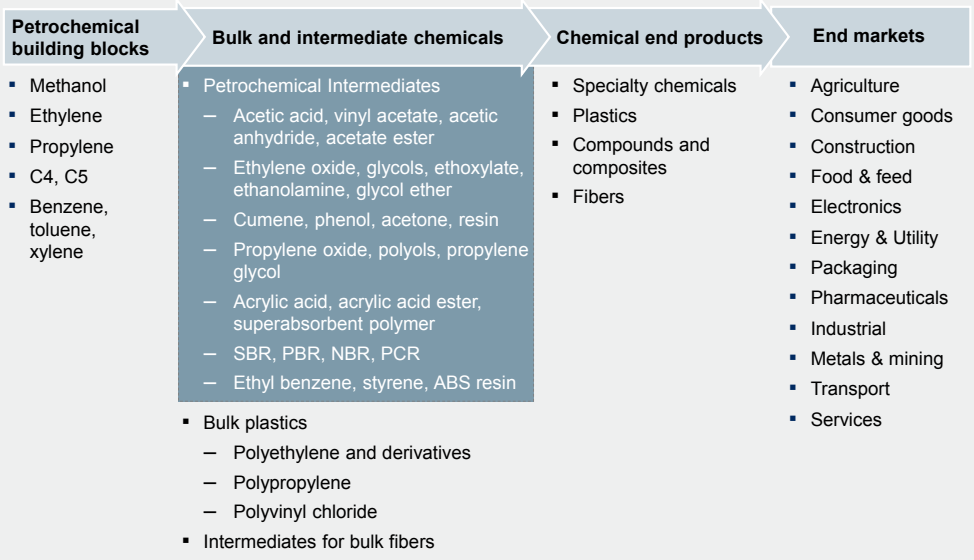
6. Developing functional capabilities of petrochemical intermediates companies, by leveraging international best practices – for example reliability-oriented maintenance, new supplier development and transaction-level pricing – in order to sustain profitability and international competitiveness.

The need for action is clear. Industry bodies and the government need to develop a joint vision and plan to address the industry's perennial challenges.

Introduction

Petrochemical intermediates – produced using petrochemical building blocks such as ethylene and propylene – are a vital link in the Indian chemical industry. Intermediates like ethylene oxide, propylene oxide, polyols, phenol, acrylic acid, styrene and rubber derivatives are the primary feedstock to produce specialty chemicals. These speciality chemicals in turn, are essential to manufacture a vast majority of consumer and technology products required in the economy (Exhibit 1).

Exhibit 1: Examples of petrochemical intermediates



SOURCE: McKinsey analysis

Upstream of petrochemical intermediates, the Indian petrochemical industry has grown rapidly in the last 10 years with capacity expansions leading to much greater self-sufficiency for major petrochemical building blocks such as ethylene, propylene, butadiene, and aromatics to name a few. These building blocks all had surplus capacity of at least 0.5 million tons per annum (MTPA)[1] as of 2013. Robust expansions in the refining sector and surplus availability of naphtha as feedstock for petrochemical plants supported this growth. Over the next five years, the capacity expansion projects announced by all major Indian petrochemical companies will lead to a balanced supply–demand scenario for most of the major petrochemical building blocks.

Given the strategic importance of petrochemical intermediates and the advantage of domestic naphtha and building block availability, this report aims to create a dialogue between all the stakeholders in the petrochemical industry on how petrochemical intermediates could attain self-sufficiency by 2025. It does so by explaining the rationale for creating a "Make in India" strategy, establishing its strategic importance, identifying the challenges that such a strategy would need to resolve, defining an aspiration and a starting set of ideas to help improve the situation. This would only be possible through joint discussions between the industry and the government.

1 Ministry of Chemicals and Petrochemicals

An ideal "Make in India" opportunity

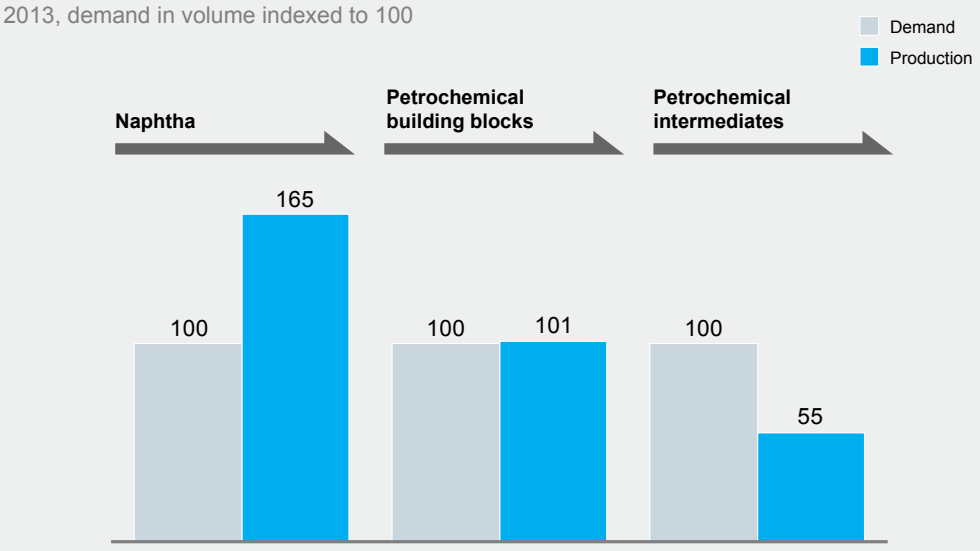
A strategic need to reduce a particularly high import dependency, a proven opportunity driven by downstream demand growth, and substantial benefits for the economy provide a strong "Make in India" case for petrochemical intermediates.

Reducing import dependency

Despite sustained growth in the industries that lie in upstream and downstream, India's petrochemical intermediates industry has not developed at the same pace and remains import-dependent in key products. In 2013 India's refinery industry and consumer market were about a third the size of China's, but India's petrochemical intermediates industry was just one tenth the size of China's.[2] Consequently, India is one of the largest net importers of petrochemical intermediates, with net imports totaling approximately 5 million tons (MT)[3] in volume and INR 35,000 crore (USD 5.6 billion)[3] in value in 2013. The resulting self-sufficiency ratio of 55[3] percent in petrochemical intermediates is one of the lowest in any manufacturing industry in India (Exhibit 2).

For some key intermediates – such as acetic acid, vinyl acetate, acrylic acid, acrylic acid ester, superabsorbent polymers, polycarbonate and styrene – India has no domestic capacity or negligible capacity, with no announced plans to fill the gap.

Exhibit 2: Supply-demand gaps at different steps of value chain



SOURCE: Ministry of Chemicals and Petrochemicals; McKinsey analysis

A significant growth opportunity driven by downstream industries

On the downstream side, India's specialty chemical industry has the potential to grow faster than the gross domestic product driven by end-market growth, an increase in intensity of per unit consumption, and evolving consumption standards. Construction, consumer durables, agriculture and packaging are all fast-growing sectors which will also drive growth in specialty chemicals. Consumption standards are also set to rise significantly in a number of industries, driving higher sophistication in end-products. For instance, admixture and

2 US Energy Information Administration

3 Ministry of Chemicals and Petrochemicals, Ministry of Commerce and Industry, McKinsey analysis

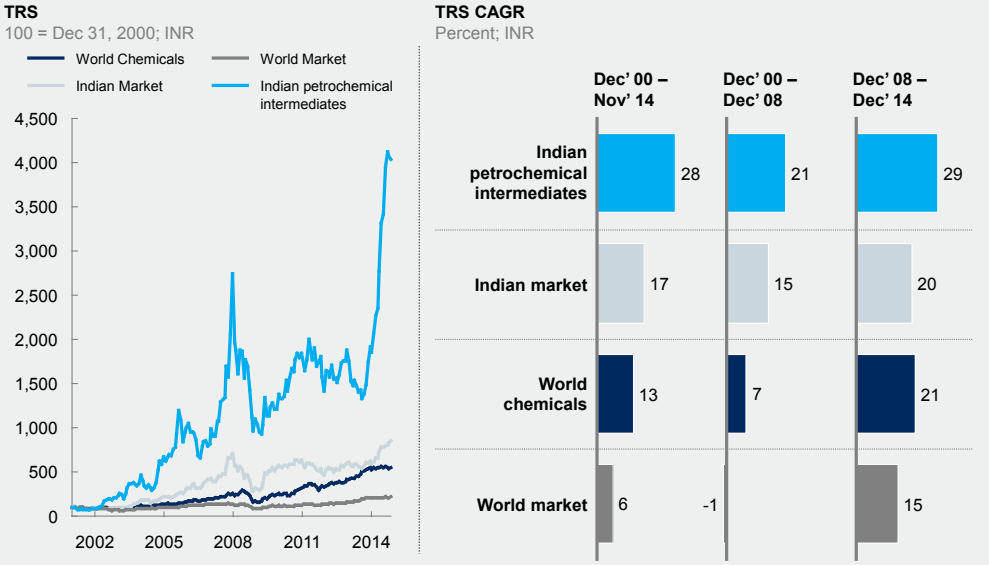
waterproofing materials are fast gaining importance in construction procurement. Another example is the increased prevalence of glazing in the automotive industry.

As a result, demand for petrochemical intermediates is forecast to grow at about 11 percent per annum,[4] leading a total consumption of petrochemical intermediates of 33 to 38 MT[4] by 2025.

A value-creating growth opportunity

Indian petrochemical intermediates have been a highly value-creating industry over the past six years, achieving a return to shareholders of 29 percent annually, compared to 20 percent for Indian markets overall[5] (Exhibit 3).

Exhibit 3: Industry-wise total return to shareholders (TRS)



SOURCE: Datastream; McKinsey analysis

The primary reason for this is the rising interest and confidence in the industry among investors, reflected by a weighted average price-to-earnings ratio of 14.3 for petrochemical intermediate companies, against 13.1 for Indian markets overall.[6]

Higher profitability levels are the second most important reason for this very high level of shareholder value creation. Indian petrochemical intermediates companies had a median pre-tax return on invested capital[7] of 14.4 percent over 2009 to 2014, a level very similar to that of global chemical companies, and significantly higher than that of Indian companies overall, which averaged 11.8 percent over the period. In spite of their relatively higher levels, the industry's return on invested capital have fallen over the period, highlighting the need for renewed sources of profitability improvement.

4 McKinsey analysis
5 Datastream
6 CPAT, Datastream, McKinsey analysis
7 Including goodwill

In addition to creating value for investors, a "Make in India" strategy in petrochemical intermediates would have a material impact on entrepreneurship, technology and research and development in the sector. The growth of the industry would also result in the creation of highly skilled jobs.

Importantly, a higher level of self-sufficiency in petrochemical intermediates would unlock some of the latent demand in downstream industries. For instance, when the capacity for ABS Resins was increased from 60 kilo tons per annum (KTPA) in 2004, to 80 KTPA in 2006, consumption jumped from 48 to 75 kilo tons (KT) within a year.[8] Similar situations arise in other sectors in India, such as the spurt in India's mobile subscriber base from 5.6 million in 2001 to 10.7 million in 2002[9] following the entry of CDMA players. Similarly, the sale of luxury vehicles (cars costing more than INR 20 lakh, or USD 32,000) shot up from 9,000 to 15,000 units in 2009–10[10] following the expansion of manufacturing and assembly capacity by high-end German manufacturers in India.

Notwithstanding the opportunity and the reasons to be optimistic, the import-dependency of this critical segment represents a major fault line for India's economy and in particular for the downstream industries.

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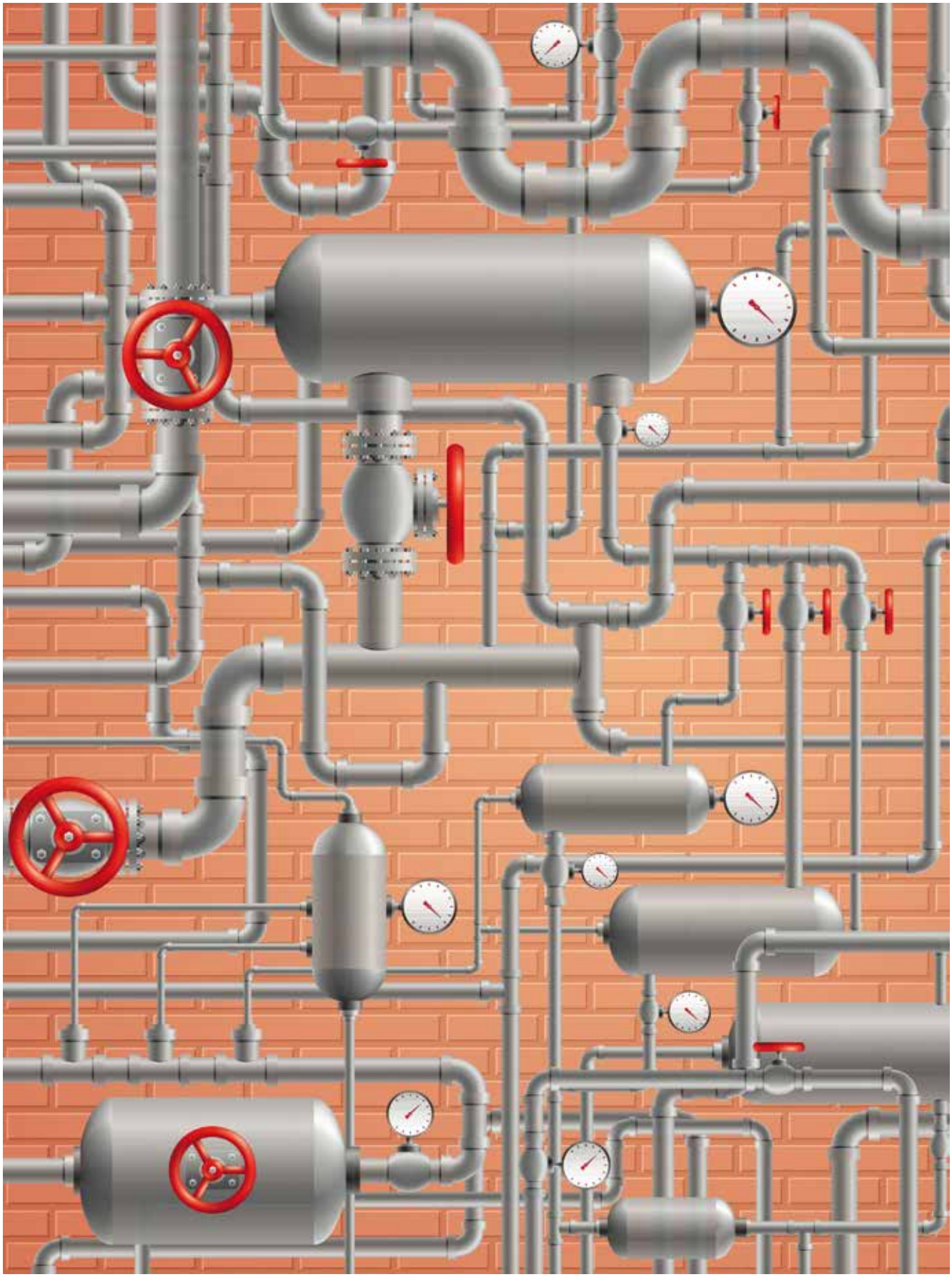
8 Ministry of Chemicals and Petrochemicals

9 Telecommunications Regulatory Authority of India

10 Society of Indian Automobile Manufacturers



A major weak link for the economy

Putting downstream industries at risk

In a whitepaper published by McKinsey in 2011, 'Building a global scale specialty chemical industry in India', specialty chemicals were identified as a high-growth segment for the Indian economy. Between 2013 and 2025, their annual production could grow by INR 400,000 to 600,000 crore (USD 65–100 billion). However, low growth and availability of petrochemical intermediates could curb that growth – especially in the cases where importing a given petrochemical intermediate is logistically complex and costly. This would in turn constrain growth in end-industries, making petrochemical intermediates a major weak link for the Indian economy.

Four primary constraints

However, the growth of petrochemical intermediates production – 5 percent per annum between 2005 and 2013 – has been perennially lower than the growth of the gross domestic product. This is because most of the critical petrochemical intermediates value chains have faced difficulties in securing investments for growth. These difficulties surface four primary constraints that are holding back the growth of the industry.

Lack of specialised infrastructure

Manufacturing petrochemical intermediates requires specialised infrastructure which is in general too costly for any single mid-sized company to install. Networks of pipelines are critical in making the markets for petrochemical building blocks liquid by aggregating supply and demand in a given geography. In addition, some building blocks require specialised pipelines – cryogenic pipelines for ethylene and propylene, and high-pressure pipelines for C4 and C5. Other specialised infrastructure needed for the development of the industry include regular and cryogenic storage containers. Processed water is also of importance given the increasing water scarcity, and can be produced through desalination plants for the clusters located near ports.

Slow implementation of world-scale diversified petrochemicals clusters

Although there are instances of petrochemical players supplying feedstock to downstream companies (for example, Indian Oil supplies propylene to Manali Petrochemicals), infrastructure enabling co-location of players across the value chain is necessary to develop such supply agreements at scale. By earmarking Petroleum, Chemicals and Petrochemical Investment Regions (PCPIRs) in Dahej, Vishakhapatnam, Paradip and Cuddalore, the Government has taken a first step in that direction.

However, the development of communications and transport infrastructure (e.g., ports), utilities (e.g., power and steam), support services and simplification of administrative processes (e.g., land acquisition process) have been inconsistent from one PCPIR to the other. As a result, private sector investments in PCPIRs have been nominal overall.

Utilisation of more than 90 percent[11] of produced propylene and ethylene for manufacturing of bulk plastics

Capacity growth of petrochemical intermediates has been constrained by low availability of ethylene and propylene. Instead, petrochemical players tend to give priority to adding capacity in bulk polymers, for several reasons. First, the downstream sector is fragmented, with demand for petrochemical feedstock from each player limited to a few hundred kilotons. The scale is therefore not sufficiently attractive for the large petrochemical players.

11 Expert interviews, press search, McKinsey analysis

Second, supply logistics are rarely convenient in the absence of co-located facilities. Thirdly, the scale of the bulk polymers markets makes it easier to sell the output of a large plant.

The industry and the government are becoming increasingly aware of the consequences that this phenomenon is having on the development of the petrochemical intermediates industry. However, they joint strategy for solving this issue.

Challenges in negotiating technology agreements with multinationals

In recent years, Indian petrochemical players in India have attempted several times to negotiate technology agreements with multinational companies. However, only few of such attempts have born fruition, such as Indian Oil's joint venture with Marubeni and TSRC in Panipat. Most attempts have been stalled due to three primary challenges. First, differences in stakes between large petrochemical players and mid-sized potential technology partners make it difficult to align interests. Second, potential international partners that have high negotiation power for scarce technologies tend to demand joint-venture arrangements which are mostly difficult to grant for Indian petrochemical players. Third, the dependency of players on each other in the context of single-company complexes makes it difficult to write satisfactory exit clauses for both parties.

In addition, multinationals themselves have adopted a careful attitude towards investing in India over the years. This is based on a widely shared perception among foreign players that even once a project is approved, there can be numerous obstacles stemming from various stakeholders that significantly slow down the process and adversely impact the project's economics. This, especially in contrast with the Chinese government's approach of expediting administrative processes for international investors, further reduces the number of opportunities for Indian players to sign agreements with foreign technology companies.

Exhibit 4: Value chain-wise illustrations of primary constraints

	Value chain			Key constraints
1	Acetic acid	Vinyl acetate, acetic anhydride, acetate esters		▪ Availability of syngas ▪ Only 4–5 players with technology (need for JVs)
2	Ethylene oxide	Glycols, surfactants, glycol ether, ethanolamines		▪ Domestic ethylene primarily converted to poly-ethylene ▪ Difficulty to transport ethylene over long distances
3	Propylene oxide	Polyether polyols		▪ Limited sharing of propylene with downstream players; primarily used for making polypropylene
		Propylene glycols		
4	Acrylic acid	Acrylic acid ester		▪ Technology with only 4–5 players ▪ JV attempts have not succeeded
		Superabsorbent polymer		
5	PBR, SBR, EPDM, NBR, PCR, styrene butadiene copolymer latexes, adiponitrile/HMDA, IR, SIS, hydrocarbon resins, cyclo-olefin polymers			▪ Requirement for co-location and pipeline infrastructure to return depleted streams to petrochemical unit
6	Ethyl-benzene	Styrene	ABS/SAN resins	▪ Domestic ethylene primarily converted to polyethylene ▪ Difficulty to transport ethylene over long distances
7	Cumene	Phenol, acetone	Phenolic resin, epoxy resin, polycarbonate	▪ Limited supply of propylene to downstream players; primarily used for making polypropylene

SOURCE: Expert interviews; press search; McKinsey analysis

While the current situation and the risk it poses for future growth in downstream industries are matters of concern, the complexity of the problems is such that there is no simple resolution in sight. This will require joint intervention by the industry and government.

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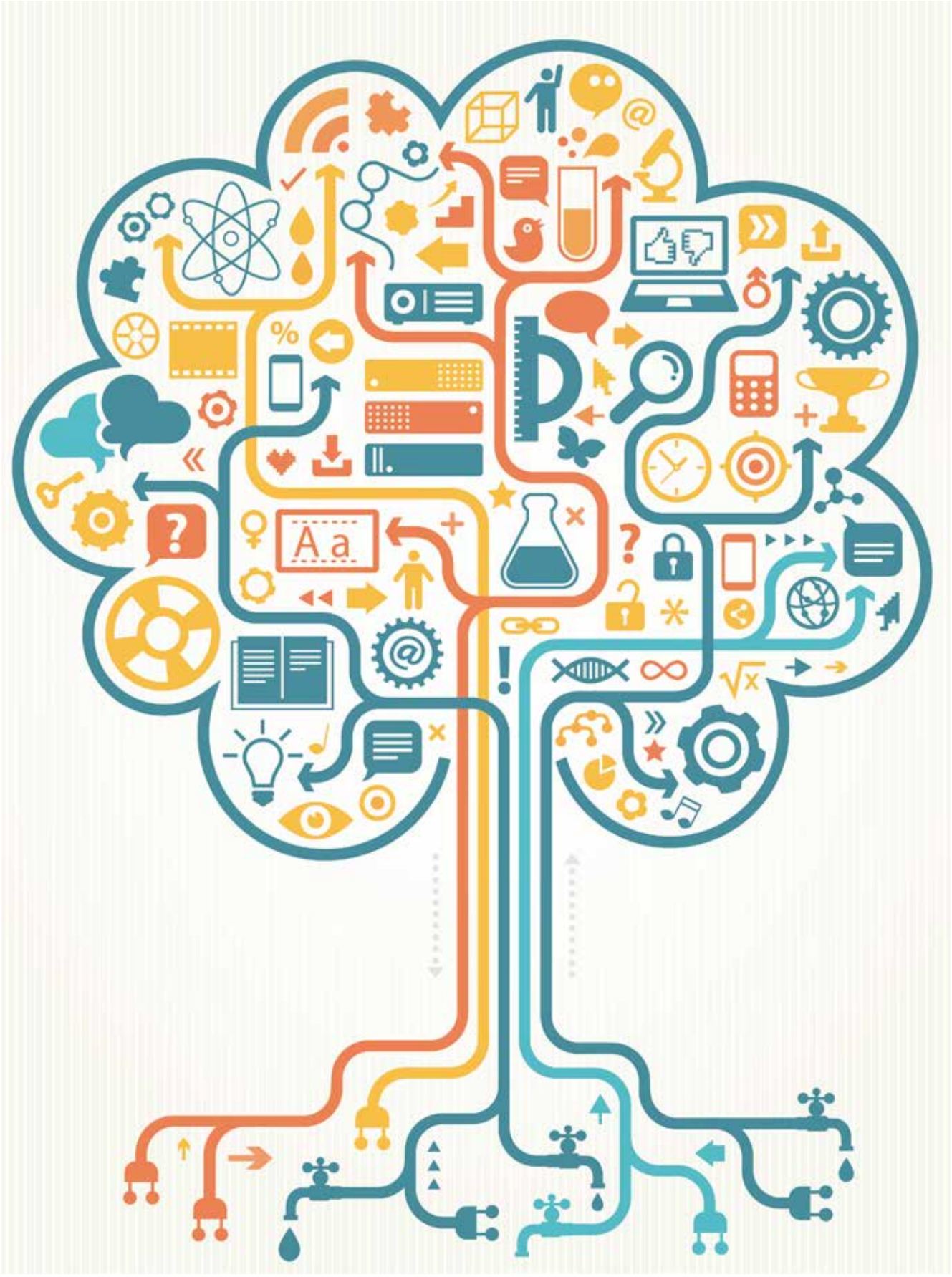
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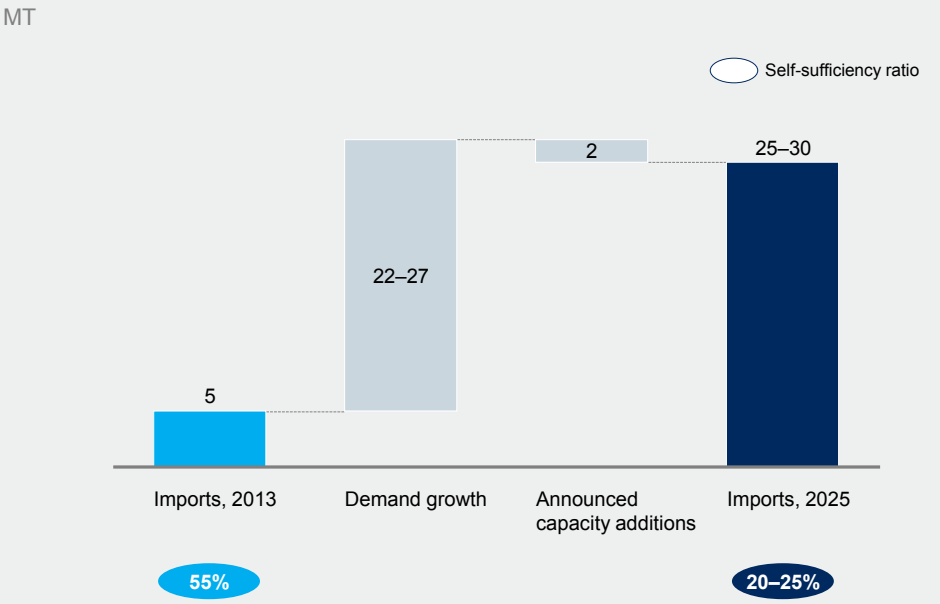
The 2025 outlook raises a fundamental question

In the current 2025 scenario, import dependency is at risk of further deteriorating. In fact, the announced capacity additions are set to resolve demand-supply gaps only for select products such as ethylene oxide and ethylene glycol – and sometimes only in the near term. In total, the announced capacity additions add up to only about 2 MT,[12] covering less than a tenth of the incremental demand expected to arise between 2013 and 2025. As a result, in a theoretical scenario where no additional significant capacity announcements would be made for the period, India would fall short of 25–30 MT of capacity by 2025[12] (Exhibit 5), corresponding to an implied import value of INR 150,000 to 200,000 crore (USD 24 to 32 billion).[12]

Exhibit 5: Growth in imports in the current 2025 scenario



SOURCE: Ministry of Chemicals and Petrochemicals; McKinsey analysis

This outlook raises a fundamental question for India: can the country's downstream chemicals sector afford to wait years for the petrochemical intermediates industry to resolve its own challenges? If not, how can industry and policymakers work together to accelerate the development of petrochemical intermediates through world-class integrated clusters?

□ □ □

12 Press search, expert interviews, McKinsey analysis

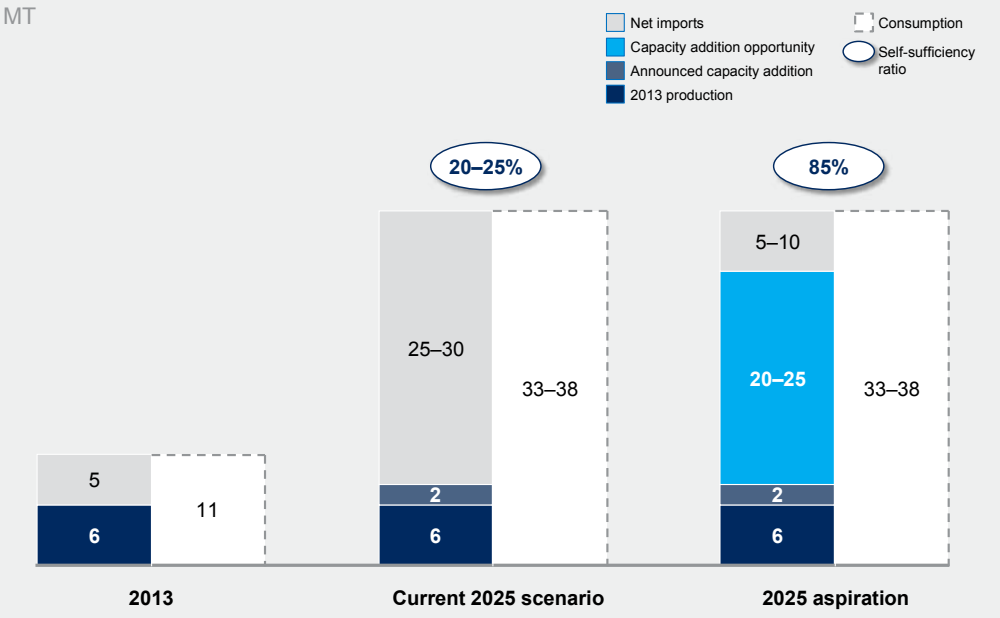
Six priority areas for achieving 85 percent self-sufficiency

A necessary aspiration

We believe that a level of 85 percent self-sufficiency is a necessary aspiration for the country, to ensure a vibrant downstream chemical industry providing critical inputs to a growing manufacturing sector. This would require India to install 20–25 MT of additional annual capacity, about four times the volume of the current installed capacity of 6 MTPA (Exhibit 6). It would translate into 70–90 additional plants across 30–40 products falling in seven chemical value chains[13, 14] (Exhibit 7).

This aspiration should however be carefully calibrated at a product-by-product level, taking the global supply scenario into account. At an aggregate level, regions with low-cost feedstock like the U.S. and the Middle East don't have enough capacity to entirely supply high-cost regions like India with their exports. This creates the need for overall self-sufficiency in higher-cost regions, which is what the Chinese petrochemical industry is attempting to achieve. But for some specific chemicals, excess capacity in low-cost regions might make production in India uneconomical.

Exhibit 6: 2025 aspiration for India's petrochemical intermediates industry



SOURCE: 12th 5 year plan; Ministry of Chemicals and Petrochemicals; McKinsey analysis

13 Prospective investors should conduct a detailed assessment of project economics and internal rates of return, as these can be affected by global supply–demand imbalances as well as feedstock and technology availability conditions

14 McKinsey analysis

Exhibit 7: Additional capacity opportunities as of 2025, by value chain

MT

	Value chain			Demand-supply gap
1	Acetic acid	Vinyl acetate, acetic anhydride, acetate esters		2.5–3.5
2	Ethylene oxide	Glycols, surfactants, glycol ether, ethanolamines		2.5–3.5
3	Propylene oxide	Polyether polyols		2.5–3.0
		Propylene glycols		
4	Acrylic acid	Acrylic acid ester		1.0–1.5
		Superabsorbent polymer		
5	PBR, SBR, EPDM, NBR, PCR, sb-copolymer latexes, adiponitrile/HMDA, isoprene rubber, SIS, hydrocarbon resins, cyclo- olefin polymers			2.0–2.5
6	Cumene	Phenol, acetone	Phenolic resin, epoxy resin, poly carbonate	6.0–7.0
7	Ethyl-benzene	Styrene	ABS/SAN resins	3.5–4.0
			Total	**20–25**
			Number of plants of viable economic scale	*70–90*

SOURCE: Ministry of Chemicals and Petrochemicals report; McKinsey analysis

Learning from international examples

The challenges of making this aspiration a reality are not unique to India. Other major chemical-producing economies such as China, the European Union and Singapore have faced and resolved similar challenges.

Antwerp cluster, Belgium: A pipeline corridor supplemented by a promoting agency[15]

With 40 MTPA of refining capacity split across two major petrochemical players with three ethylene crackers, and more than 60 chemical companies as tenants, the Antwerp Port's cluster is one of the largest in Europe.

Its key success factor has been the establishment of a pipeline corridor by the local government, whereby land has been demarcated and basic facilities have been provided for private sector players to invest in building and operating pipelines. Although the seed investment initially came from the government, private sector companies now operate a network of 57 different product pipelines covering more than 1000 kilometres, including connections with neighbouring Germany and Netherlands.

Another factor explaining the success of the cluster is European Chemical Site Promotion Platform (ECSPP), a professional agency that promotes various European clusters including Antwerp's among potential investors.

15 Sources for all the facts in this sub-section: Experts interviews, Port of Antwerp Authority

Fujian complex, China: A joint-venture petrochemical reserving feedstock capacity for a downstream cluster[16]

The Fujian complex in Eastern China is developing around a state-owned petrochemical company's joint venture established with international majors. The joint-venture. Based on a 12 MTPA refinery, the complex has a capacity of 800 KTPA of polyethylene, 400 KTPA of polypropylene, 700 KTPA of paraxylene, and is in discussions with technology players to enter into production of C5 and C9 intermediates. In addition, the Gulei cluster is under development near the Fujian complex and will benefit from its utilities and feedstock supply to manufacture petrochemical intermediates.

This example shows the impact of a state-owned company developing a joint-venture specialised in petrochemicals with international majors. The focused petrochemicals player is in this case taking active interest in the development of an intermediates cluster in Gulei, reserving feedstock capacity for it and investing in the required infrastructure to supply the petrochemical building blocks at scale.

Further, the local government is supporting the development of the Gulei cluster through preferential tax regimes (e.g., tax exemptions or bonded discounts for specified goods, VAT exemptions for goods traded between enterprises, and preferential tax rate of 15 percent for enterprises that qualify under the "Pingtan industrial catalogue") and simplified administrative formalities such as parallel registration for tax, customs, and foreign exchange.

Jurong cluster, Singapore: investmentsWorld-class infrastructure and a demarcated master plan[17]

Jurong is a well-known example where the government played an end-to-end role in creating a world-class infrastructure providing a cost advantage to its tenants, managed by the Jurong Town Corporation. It currently hosts more than 40 downstream chemical companies.

Additionally, the cluster was able to attract a large number of tenants through a master plan with areas demarcated for specific chemical activities, and a government agency playing the role of a match-maker between players at different levels of the value chain, thereby embedding feedstock-supply agreements into the initial business and operating plans. Such agreements systematically include exit clauses, a factor which in most cases eases negotiations between players.

The Jurong cluster also successfully developed an advantageous economic environment supported by free-trade agreements, tax rates reduced by about 20 percent, and the availability of seed capital.

16 Sources for all the facts in this sub-section: Expert interviews, Fujian Provincial Department of Foreign Trade and Economic Cooperation

17 Sources for all the facts in this sub-section: Expert interviews, Jurong Town Corporation, Singapore Economic Development Board

Six priorities for concerted action

Building on these examples, the following ideas suggest a path for petrochemical majors, public sector units, mid-sized chemical companies and government bodies to create a joint agenda on a "Make in India" strategy aimed at accelerating development of the petrochemical intermediates industry in India.

1. Creating an integrated petrochemical intermediates master plan for India which would match feedstock availability with downstream and end-use demand for the identified seven critical value chains

Emulating the Jurong master plan which demarcates zones by type of chemicals, PCPIRs could – following the recommendation including the PCPIR policy – develop detailed master plans at the cluster level. Stakeholders in the Indian petrochemical intermediates industry need to go one step further and create a body to develop an integrated master plan across clusters.

The master plan could answer critical questions such as the number of plants required for each petrochemical intermediate and their location, after considering demand-supply scenarios, profitability, employment generation potential and proximity to feedstock sources and consumption centres. For instance, the body could consider currently planned capacity expansions in propylene units for setting up production of C3 intermediate products.

Ideally, the master plan should be developed in conjunction with plans for refinery capacity investments and for infrastructure linking up clusters with each other. This is India's chance to create a world-class hub of the scale of Jurong in Singapore or Jubail in Saudi Arabia, and to create a significant competitive advantage.

2. Conceptualising, building, operating and maintaining specialised infrastructure and utilities

The availability, quality and competiveness of a cluster's infrastructure, utilities reducing and services are key success factor to attracting a critical mass of companies. In fact, several international examples show that a world-class cluster can enable tenant companies to reduce capital expenditure by 25 to 30 percent and logistics costs by 10 to 15 percent.[18]

As a first step, the integrated master plan and the cluster-specific master plans could include specialised infrastructure, key utilities and connectivity infrastructure, including:

- Pipelines for key petrochemical building blocks, including cryogenic pipelines for ethylene and propylene feedstock, and high-pressure pipelines for C4 and C5 products
- Water supply and effluent treatment, following the example of Vishakhapatnam, industrial water project – India's first of this kind
- Connectivity through ports, roadways, and railways. For instance, projects such as the Ahmedabad-Vadodara-Mumbai national expressway, or capacity increases in the Paradip, Bharuch and Vishakhapatnam ports could be accelerated

In addition, a dedicated site operator is needed to build and manage the high quality infrastructure and turn it into an economic advantage for its tenants. Any of the top ten

18 Singapore Economic Development Board

engineering players in India and/or any of the leading global chemical infrastructure service providers could be chosen to take on the role of site operators.

3. Encouraging or mandating anchor producers of clusters to make specified volumes of critical feedstock products available for downstream units

One of the industry's primary constraints is that bulk of the feedstock is channelled towards manufacturing of the bulk polymers. Creation of an economic environment conducive to long-term supply-sharing agreements is essential to achieve higher self-sufficiency. Actions could include:

- Encouraging large upstream petrochemical players to supply feedstock to smaller downstream players, for instance through fiscal benefits
- Conditioning petrochemical complexes' access to key infrastructure and utilities offered by clusters to their allocating a certain share of their building block production (e.g., 10–20 percent) to downstream intermediate companies
- Embedding supply-sharing agreements at the master-planning and business planning stage – as in Jurong
- Encouraging the presence of multiple feedstock suppliers in a given cluster – as in Jurong and Antwerp – to create a more liquid market where petrochemical players compete for downstream opportunities

4. Supporting direct investment by petrochemical players in intermediates by re-examining duty structures and considering fiscal and other economic incentives

In addition to encouraging supply-sharing agreements, industry stakeholders could also encourage direct investments in intermediates by petrochemical players. In order to enhance the attractiveness of such investments against other opportunities available to petrochemical players, the following could be considered:

- Re-examining duty structures: Duty levels for downstream intermediates are currently higher than those for bulk intermediates and building blocks in many chemical value chains. This encourages the industry to import some intermediates as opposed to producing them
- Considering economic benefits for investments in intermediates: For instance proposing fiscal advantages for facilities making intermediate products would help the industry attract more investments

5. Establishing petrochemical intermediate clusters as frontrunners in the national campaign to improve the ease of doing business by accelerating the simplification of key procedures

Across the globe, CEOs highlight ease of doing business as a key factor when considering countries in which to invest. Development of a conducive business environment is already underway through the "Make in India" policies, with measures emerging such as the single-window system, an online process for construction permits and a shorter turnaround time on environment clearances.

There is a need to broaden the scope of such reforms to include pre-registration for select companies investing in the cluster; parallel inspections and an efficient clearance process for labour, land and environment; and increased ease of foreign exchange transactions – among others possibilities. Petrochemical clusters could be a role model for the rest of the country.

6. Developing functional capabilities of petrochemical intermediates companies by leveraging international best practices – for example reliability-oriented maintenance, new supplier development and transaction-level pricing – in order to sustain profitability and international competitiveness

While many critical factors for the success of the industry lie either in the hands of the government or in creating a collaborative model across stakeholders, improving profitability is a prerequisite to expansion for most companies in the industry. However, profitability levels in the Indian chemical industry have dipped in recent years, with a loss of five points in returns on invested capital between 2009 and 2013.[19]

Establishing functional excellence is one way to overcome this obstacle. A recent report by McKinsey & Company[20] suggests the potential to improve EBITDA by four to seven points for Indian chemical companies within one to two years, by developing world-class practices in areas such as manufacturing, marketing and sales, and procurement with nominal investment, sustained improvements, and a possible time to impact of one to two years.

A holistic manufacturing excellence programme can drive up margins through improved variable and fixed costs, and unlock further production capacity through improved plant reliability and throughput. For instance, Indian petrochemical companies could refocus their maintenance systems towards proactive reliability, with a potential to reduce unscheduled shutdowns by 60 to 80 percent. Commercial excellence can also improve margins through more effective pricing with a specific opportunity to move towards transaction-level pricing. Volume growth can also be accelerated through a more granular understanding of markets and more effective allocation of marketing and sales resources to granular growth pockets. The total impact of commercial excellence can reach 2 to 4 percent improvement in return on sales. Procurement excellence can help companies optimise input costs and, hedge against volatility in material prices, resulting in 4 to 6 percent of sustainable gains in total procurement spend. In addition, practices like new supplier development can help build a broader and safer supplier base in an uncertain environment.

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This agenda for a self-sufficient petrochemical intermediates industry in India by 2025 is ambitious but by no means unachievable. Building on the PCPIRs and other initiatives which are already underway, industry bodies and the government need to develop a joint vision and plan to address the industry's perennial challenges.

19 Datastream its strong track record of value creation

20 McKinsey & Company, "Boosting profitability in the Indian chemical industry through functional excellence", 2015

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