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Indian Chemical Council



MAKING INDIA A GLOBAL CHEMICALS POWERHOUSE: VISION FOR THE 2020s

THE \$300 BILLION OPPORTUNITY FOR INDIA

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The Indian Chemical Council (ICC) is the apex national body representing all branches of the Chemical Industry in India such as Organic & Inorganic Chemicals, Plastics & Petrochemicals & Petroleum Refineries, Dyestuffs & Dye-intermediates, Fertilizers & Pesticides, Specialty Chemicals, Paints etc. ICC is dedicated to the growth of the Indian Chemical Industry. Established in 1938, ICC has over the years grown its functions and offerings to cater to the varying needs of the Indian Chemical Industry.

MAKING INDIA A GLOBAL CHEMICALS POWERHOUSE: VISION FOR THE 2020s

THE \$300 BILLION OPPORTUNITY FOR INDIA

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FOREWORD

THE INDIAN CHEMICAL INDUSTRY is in a sweet spot of unrealised potential and tremendous opportunity. It should experience significant growth in the 2020s, driven by rising household incomes, the existing consumption gap and a huge export opportunity.

While the shift will help increase “base” consumption across all industries, there will be a marked shift to higher specialty chemical consumption as categories premiumize. Currently, a large part of the domestic demand for specialty and downstream chemicals is served via imports—offering large headroom for local production to increase.

In addition to significant growth in domestic demand, the geopolitical shifts underway in international markets offer an opportunity for India to emerge as a global production and export powerhouse.

The Indian Chemical Council (ICC) and Boston Consulting Group (BCG) have created this whitepaper to guide the Chemical industry's growth trajectory—highlighting a 15-point priority agenda.

A focused execution of this agenda will help the Chemical industry change trajectory and ensure that the 2020s will be the decade in which India emerges as a global Chemical powerhouse.

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EXECUTIVE SUMMARY

THE INDIAN CHEMICAL INDUSTRY holds a prominent position on the global stage—it is the sixth largest in the world, and the third largest in Asia. It has, however, perennially been the “latent potential” sector—a promising future, but significant short term under-delivery. As an example, the Indian Chemical Industry has had an average annual growth of ~4 percent (dollar terms) and ~8 percent (rupee terms) from 2008-2018.

The 2020s could change this. There are several megatrends which will act as tailwinds to propel the Indian Chemical Industry. A significant shift in income demographics is expected to take place, driving domestic consumption of Chemical products in the country. While the shift will help increase “base” consumption across all industries, there will be a marked shift to higher specialty chemical consumption as categories premiumize.

India could also benefit significantly from exports, thanks to its inherent geographical proximity to large South East Asian, Middle Eastern and Western markets. Being cost competitive is critical, where India again has a strong starting point.

Within the next decade, these advantages could translate into tangible outcomes for the Chemical Industry in India. With the right technology, investments, and policy, the industry could potentially grow from USD 125 billion in 2018 to ~USD 300 billion by 2025. This is likely to nudge a reversal of India’s Chemical trade deficit from ~USD 20 billion in 2018 into a trade surplus of ~USD 30 billion by 2025. Finally, the growth of the Indian Chemical Industry could add up to 10 Million direct and indirect jobs to the Indian economy.

To pave the path for the Chemical sector’s journey in the 2020s, one must derive inspiration from other countries that have built large chemical industries. A prime example of growth has been South Korea. Rewinding 30 years, the Chemical industry of South Korea was compa-

rable to India, both on absolute size as well as the number of “at scale” companies. Within these three decades, not only has the chemical sector in South Korea grown at pace, it has created many companies of billion-dollar scale. The formula for this is clear: (i) driving heavy investments to boost production, (ii) prioritizing innovation and cutting-edge research, and (iii) enabling ease of doing business by promulgating laws and regulations which made it easier for foreign companies to enter, form JVs, set up industrial parks and facilitate production.

On the other side of the globe, chemical companies in western economies such as Germany, have taken the lead on fundamental innovation and building ‘digital’ as a strategic advantage.

With the blueprint for success already laid out by these countries, India can pick and choose the best attributes and use them to accelerate its Chemical Industry in the 2020s. It must specifically focus on 4 key priority areas.

Accelerate Production Capacity

The Indian Chemical Industry needs to accelerate its domestic production capacity by as much as 140 percent to help the sector grow from USD 125 billion in 2018, to USD 300 billion by 2025. The capex requirements for enhanced production capacity are significant, and apart from domestic capital, will require ample infusion of foreign capital. This will require instituting a dedicated FDI cell and smart, sustained outreach, through dedicated roadshows and campaigns targeting global Chemical Companies and Industry Associations.

In addition, the Chemical Industry can tap into its excess naphtha supply, by attracting investments in ‘condo’ crackers to boost building block availability. India would need to create 6-8 consortiums of 2-3 upstream and downstream players each with one “anchor” player. This needs to be supported with adequate incentives in the form of feedstock allocation policies, investment linked tax holidays / waivers, Production Linked Incentive (PLI) schemes, targeted duty structures, etc.

Further, to attain its stated objective, India needs to critically evaluate opportunities to rationalize duty structures, for example ladder up duty for chemicals and duty drawback rates as well as revisit India's stance on FTAs and address any duty inversions to reduce import dependence and boost downstream capacity.

Streamline Day-to-Day Operations

The Indian Chemical Industry would benefit by streamlined day-to-day operations while ensuring strong environmental oversight. A thorough review across all key stages could prove beneficial: ‘while setting up the plant,’ ‘during emissions management,’ and ‘while undergoing expansion.’ Additionally, having unified policies, procedures and governance with representation from CPCBs and SPCBs would further help fast track clearances.

In addition, there is a need to ensure seamless chemical logistics. This can be achieved via a digital centralized repository of all Chemicals combined with GHS-aligned Chemical smart labelling / classification for international chemical freight containers, and by aligning rules and regulations across multiple departments into a unified “REACH-like” framework.

Structurally Upgrade Technical Capability

To be competitive in the Chemical R&D space, India should fast-track the development of a comprehensive R&D ecosystem to structurally upgrade its technical capabilities. The government should consider setting up “Indian Chemical Collaborative Research Centres” (ICCRCs), which could act as dedicated centres for advanced exploratory research across the chemicals value chain. These ICCRCs could also act as collaborative research hubs for leading researchers and experts from industrial and academic backgrounds.

To be effective, ICCRCs should be established near major chemical hubs in India either as independent institutions or in partnership with institutes of eminence in the field of chemical research. A dedicated “R&D Steering Council” should be set up to act as the governing body to oversee and facilitate ICCRCs through regulatory and operational assistance. The council would also help steer collaborative R&D efforts through partnerships with domestic and international bodies—Industries, Universities and Research units. Additionally, along the lines of the PLI scheme, government could potentially announce a “First in India” scheme for products not produced in India for the last five years. This could potentially be effective upto 2025 to accelerate innovation and commercialization of these products. Beyond this, critical research programs can be enabled through collaborations between existing research institutions, industry associations and government departments.

Enhance Competitiveness of Domestic Players

Digital is fast becoming the ‘secret sauce’ for maintaining a competitive edge—focused on “next generation” productivity improvements in operations and digitally integrated supply chains. To promote the adoption of Digital in the Indian Chemical industry, India should set up an ‘Innovation Center for Chemical Operations’ (ICCO). The ICCO would be a representative model of a chemical supply chain with actual Digital technology integrated across different segments of the model. Various representatives from the Chemical industry, including large corporations and MSMEs, could be taken through a journey across the model to fast track adoption of these technologies which would allow them to compete on a global stage.

In closing, there is a 15-point agenda for the industry. If executed at speed, the 2020s could well be the decade in which the Indian Chemical Industry accelerates and achieves its full potential to become a global Chemicals powerhouse.

INDIA CHEMICALS: THE \$300 BILLION OPPORTUNITY

The Pivotal Role of India's Chemical Industry

India's Chemical industry has long been noted by analysts and industry insiders as the sector to watch for its latent potential. This, in part, is due to its significance; it is the sixth largest in the world, and the third largest in Asia, while producing only 2-2.6 percent of the world's total chemical output.

While it holds a prominent position on the global stage, the industry has had a modest decade of growth—over 2008-2018, the sector averaged ~4 percent (dollar terms) and ~8 percent (rupee terms) growth annually, under-delivering significantly (Refer Exhibit 1).

If India is to achieve its overall manufacturing aspirations, changing the trajectory of the Chemical industry is pivotal—apart from opportunities arising from global demand, the domestic demand for chemicals is rapidly increasing from industries as varied as packaging, textiles, automobiles, construction, healthcare and agriculture. The industry's importance for the Indian economy is further underscored by the fact that it is a major employer at scale, providing direct employment to more than 800,000 workers.

India has many fundamental advantages—with the right push, the 2020s could well be the decade in which the Chemical industry accelerates and achieves its full potential.

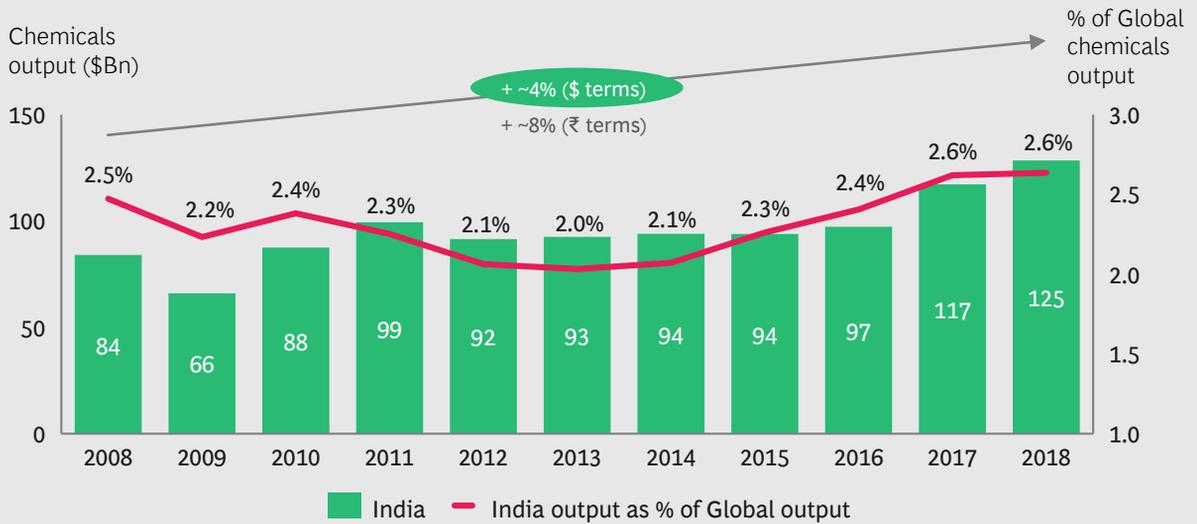
Inherent Sectoral Advantages: Providing the Engine for Growth

There are several megatrends propelling the growth of the India Chemical industry. The primary one is higher affluence leading to higher domestic consumption. Indians currently have a very low per-capita consumption of Chemical products—only USD 103 per annum—which is a tenth of the world's per capita Chemical consumption. Compare this to the domestic consumption of Chemical products in Germany, for example, which is USD 2,265 per annum; while in China, it is USD 1,066 per annum (Refer Exhibit 2).

This will change—as India becomes more prosperous, a significant shift in income demographics is expected to take place. By 2025, India is likely to double the number of affluent and elite households, unleashing latent demand for Chemical products. The effect will be at two levels: increased “base” consumption across all industries that are key users of chemicals, such as consumer goods, electronics, construction, and automobiles. In addition, Indian households will seek premium products that fit their new lifestyle—for example, there will be a natural gravitation towards higher-end personal care and cosmetics, thereby increasing demand for chemicals like Tri-decane which is used in a range of emollients from sunscreen to lipstick as well as anti-dandruff ingredients in shampoos. Likewise, better health awareness would drive demand for

EXHIBIT 1 | Indian Chemical Industry Grew At ~4% CAGR During 2008-18 and Currently Ranks 6th in Global Chemical Production

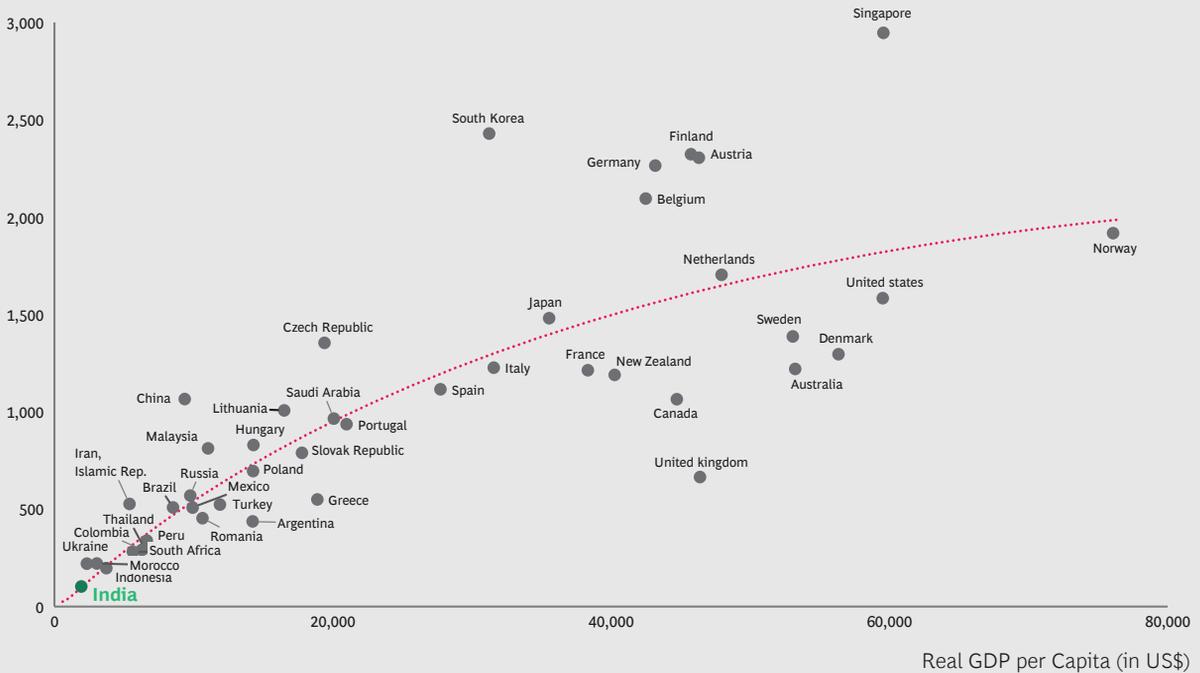
AT \$125 BN OF ANNUAL PRODUCTION, INDIA COMPRISES 2.6% OF GLOBAL CHEMICAL INDUSTRY



Source: Oxford Economics, Invest India, TradeMaps, Department of Chemicals and Petrochemicals, NSSO.

EXHIBIT 2 | Chemical Consumption has Strong Linkage to GDP per Capita; Hence, India Set to have Large Headroom for Growth in Chemicals

Chemical consumption per capita (in US\$)



Source: Oxford Economics, German Chemical Industry Association (VCI), BCG analysis.

nutraceuticals such as Tyrosine, and bio-pesticides for organic food alternatives (figure 2.6). With increase in income levels and improved GDP per capita, India's chemicals demand is expected to jump from USD 147 billion in 2018 to ~USD 270 billion in 2025.

This steep growth in domestic demand creates an opportunity for indigenous chemicals manufacturing at scale. Many specialty and downstream chemicals will see market sizes which allow for local scale manufacturing, with the dependence on domestic demand making it more viable.

In addition to domestic demand, India has other advantages that augur well for global market competitiveness. There is a significant cost benefit, for example in labor supply. India has the lowest labor cost among the top six global Chemical majors. In 2018, the hourly wage rate in India was at USD 4.3, as against USD 6.7 in China and USD 20.3 in South Korea, a material plus for any major production hub. Furthermore, India's proximity to large South East Asian and Middle Eastern markets gives it a significant geographic advantage as a key manufacturing destination for these countries.

The Opportunity for the 2020s

Within half a decade, these advantages backed by strong fundamentals, can translate into tangible outcomes for the Chemical industry in India.

With domestic consumption set to grow from USD 147 billion in 2018 to ~USD 270 billion by 2025, India needs to gear up and build additional capacity to be able to substitute imports with domestic manufacturing and, at the same time, drive up exports. Fast and efficient capacity building will be the key to success. It is estimated that an additional building block capacity of over 6 MMTPA and additional downstream capacity of over 30 MMTPA would be required just to meet the domestic demand projected for 2025.

This should help address India's chemicals trade deficit—which was ~USD 20 billion in 2018. With the right technology, investments, and policy, a substantial volume of imports

can be substituted by domestic production. However, it needs setting ambitious targets—for instance, halving the dependence on imports from the current ~35-40 percent to ~20 percent by 2025. This will ensure sufficient headroom for local production to increase and help address the trade deficit (Refer Exhibit 3).

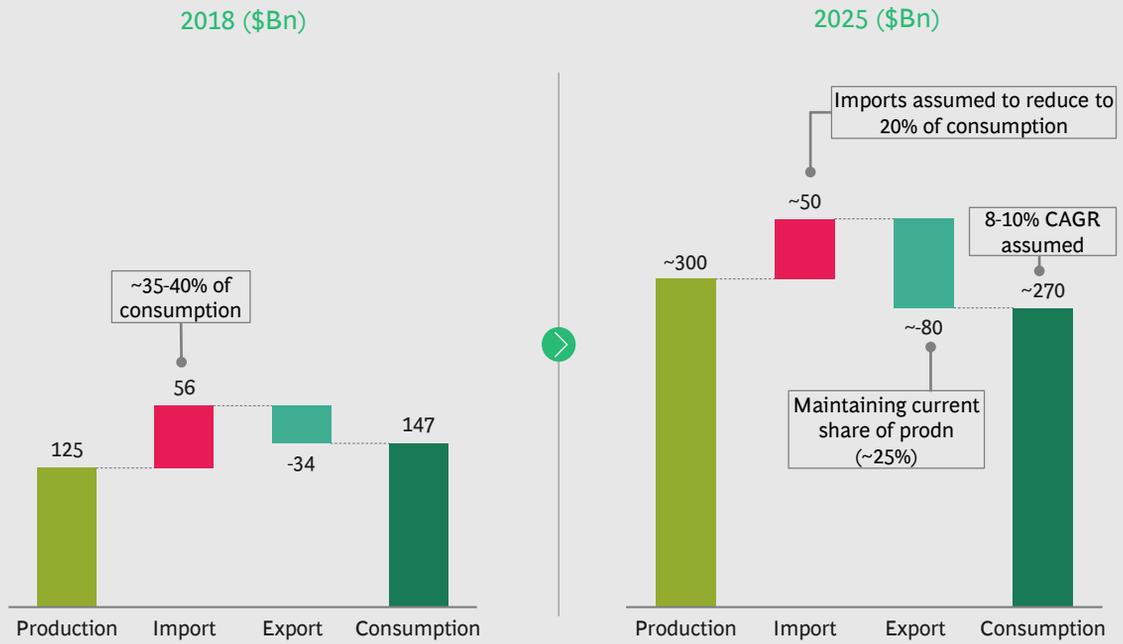
With these ambitious targets, as India seeks to independently serve its domestic demand, the industry would need to grow from USD 125 billion in 2018 to ~USD 300 billion by 2025. These efforts would have far-reaching consequences for the Indian Chemical sector. In reaching the USD 300 billion mark by 2025, India could jump from Rank 6 to Rank 3 in global Chemical production, ahead of Germany, Japan and South Korea—this would be a singular achievement for the industry in a very short span of time.

The shift towards domestic production and boosting gross Chemical exports from the country is also likely to push a reversal of India's Chemical trade deficit from ~USD 20 billion in 2018 into a trade surplus of ~USD 30 billion by 2025. And finally, there would be a hugely positive impact on human capital and the employment sector as the increase in chemical production could add up to 10 million direct and indirect jobs to the Indian economy.

The Indian Chemical industry has significantly under-delivered in the last decade, and has been outpaced by its rivals. However, this could change as the country becomes more affluent and indigenous demand for Chemicals increases. Add to it the comparatively lower labor costs, significant employment opportunities that it affords, a push in exports, and the Chemical industry could find its rightful place on the world stage. Right policies, investments and technology have enabled Indian steel and cement industry to be ranked second largest in the world; similar focus could boost Indian Chemical sector.

To realize its true potential of reaching USD 300 billion by 2025, India will not only have to learn from the growth journeys of other countries by adopting best practices, it will also have to bring in elements unique to India to leapfrog onto the global stage.

EXHIBIT 3 | Domestic Production has Potential to Reach ~\$300 Bn by 2025



Source: FICCI; IHS Markit, Oxford Economics, Annual Survey of Industries (2017-18), MSIP, National Skill Development Corporation, TradeMaps, CEFIC, National Accounts Statistics (2019).

REALIZING THE OPPORTUNITY: LEARNING FROM OTHER COUNTRIES

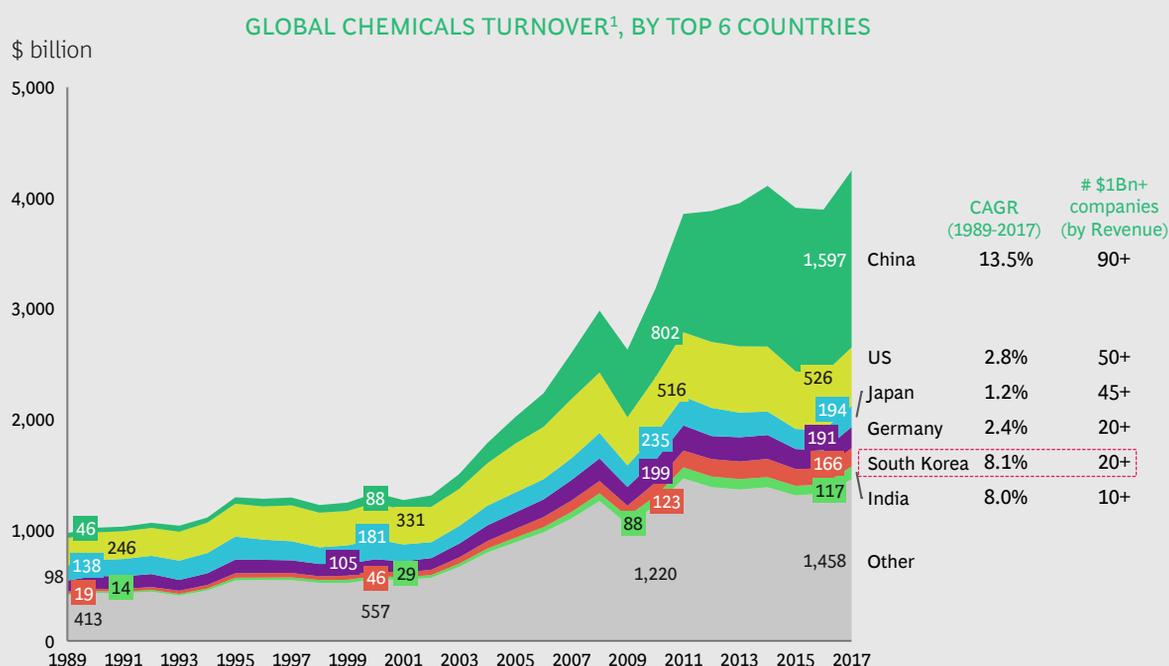
Looking Over The Fence

Through the period of the Chemical industry's evolution within the global economy, the Asia Pacific region has played a substantial role (Refer Exhibit 4). Several countries have rapidly advanced to become sizable sectoral players—with the growth of South Korea be-

ing particularly noteworthy. In 1989, the Chemical industry of South Korea was comparable to India. Within just three decades, South Korea created several billion-dollar Chemical companies.

In another significant outcome of this period,

EXHIBIT 4 | Asia has Witnessed Significant Growth Led by China and Korea; The 2 Economies have Together Produced 110+ Billion Dollars Chemical Companies



Source: ACC; CEFIC; BCG Analysis.

¹Refers to 'value of output' of chemicals (excluding pharmaceuticals).

established Chemical economies and global majors like US, Japan and Germany reported steady growth, and pivoted to competitive advantage by 'leveraging digital', among other areas.

There are vital learnings and best practices from these economies for India to examine and emulate to pave the path for its own Chemical sector's journey in the 2020s.

South Korea: Driving Growth Through Chem Cos of Scale

Since 1960, South Korea has taken remarkable strides in the Chemical sector, which broadly developed over three phases.

The period between the 1960s and 1990s was characterized by government-led economic nurturing and restructuring that enabled the formation of the industry. From the late 1990s onwards, the South Korean Chemical industry's development was primarily driven by the private sector alongside an influx of foreign investments. From 2010 onwards, the focus shifted towards technology-driven growth and an investment plan was launched to develop 100 core technologies. Backed by huge inward FDI flow and conducive government policies, the Korean Chemical industry witnessed significant growth and, by 2018, had created 20+ billion-dollar companies.

Three strategic levers played a crucial role in the rapid growth of South Korea's Chemical industry:

- Driving heavy investments to boost production
- Driving innovation & cutting edge research
- Driving ease & efficiency of doing business

DRIVING HEAVY INVESTMENTS TO BOOST PRODUCTION

South Korea provided a boost to FDI inflow by easing regulations and restrictions on investment by foreign companies. The strong government support to foreign investors resulted in South Korea's Chemical industry

becoming the second highest recipient of FDI among OECD countries, having received USD 16 billion in FDI since 2003.

The country has prioritized expansion of building block Chemical capacity and establishment of industrial complexes. With these efforts of creating integrated infrastructure, feedstock capacity has doubled between 2000 and 2018 from 20 Mtpa to 40 Mtpa.

There has also been a distinct shift to export-orientation through tariff structures and Free Trade Agreements with Singapore, EU, ASEAN, and US, among others. These measures have caused exports to more than triple from USD 15 billion in 2000 to USD 55 billion in 2018.

DRIVING INNOVATION & CUTTING EDGE RESEARCH

Korea counts among the top Chemicals R&D spenders globally (USD 2.2 billion in 2017) thanks mainly to favorable government policies which have been consistently focusing on stimulating R&D of high value materials. In 2019, R&D spend was at 1.6 percent of Chemical production. Tax incentives, access to global exports and encouragement of industry-academia-research center clusters are among the top initiatives of the Korean government.

In the last few years, there has been a shift from government-led to industry-led innovation, and several global majors like BASF and Solvay have set up R&D centers in the country. There is an equally strong focus on high performance specialty and downstream chemicals, with companies like Hanwha Chemicals and Honam Petrochemical developing materials for lithium-ion batteries, optical films, solar films etc.

DRIVING EASE & EFFICIENCY OF DOING BUSINESS

The government established K-REACH in 2015 to enhance trading efficiency and to align its policies with international standards. Moreover, a centralized repository of 40K+ chemicals, the Korea Existing Chemicals Inventory, was created and maintained to ensure transparency and compliance in distribution of these chemicals. To further ease operations, chemical companies began to foray into cutting-edge technologies such as Arti-

ficial Intelligence (AI) and Big Data across the value chain.

To summarize, Korea used a variety of lever- which boosted its production capacity as also gave a fillip to global investors to invest in the country’s Chemical sector. A favorable tariff structure, renewed focus on R&D, partner- ships with global Chemical corporations, trade agreements with countries, and the develop- ment of advanced core technologies have helped South Korea establish major Chemical corporations and, in turn, its share of the global Chemicals market. (Refer Exhibit 5)

EU / US: Digital To Build Advantage

Governmental support, in terms of favorable policies, is one of the primary factors in de-

termining the success of the chemical sector anywhere in the world. Once entered and es- tablished in the market, however, there is a new imperative that may determine the fu- ture success of the company. To thrive in later phases of growth, innovate and stay competi- tive, Chemical companies have begun explor- ing the potential of ‘going digital’.

The Chemical industry, unfortunately, has been a laggard compared to other sectors, in adopting digital technologies. However, devel- oped economies of the US and EU are begin- ning to adopt and to leverage its potential. Companies are implementing digital en- hancements to their regular business opera- tions—from R&D to marketing and sales. They are also applying sophisticated technol- ogies to develop new business models that will drive growth.

EXHIBIT 5 | Key Elements of An Ambitious Plan that Drove Korea to Become A Chemicals Production Giant



DRIVING HEAVY INVESTMENTS TO BOOST PRODUCTION

Significant focus to expand refinery/cracker capacity & build integrated complexes

Feedstock capacity has doubled between 2000 and 2018 from 20 Mtpa to 40 Mtpa

Boost in FDI inflow through favourable investment & IP protection policies

2nd highest FDI recipient among OECD countries; received \$16Bn FDI since 2003

Driving exports through fiscal incentives & tariff structures (incl. FTAs)

Exports increased by 3.5X from \$15Bn to \$55Bn between 2000 and 2018



DRIVING INNOVATION & CUTTING EDGE RESEARCH

Boosting industry R&D spend through strong fiscal incentives

R&D spend as a % of chemical production at 1.6% in 2019

Strong industry led innovation capability development & focus on speciality chemicals

Co's developing materials for Lithium-ion batteries, optical films, solar films

Collaboration between industry and government research institutions/universities

R&D centers set up by leading global chemical majors



DRIVING EASE & EFFICIENCY OF DOING BUSINESS

Alignment of policies with global benchmarks to enhance trading efficiency

K-Reach set up in 2015 along the lines of EU Reach

Leveraging digital platforms to improve operational efficiency

Chemical Co's foraying into cutting-edge technology like AI and Big Data

Built Chemicals Inventory (incl 40K+ chemicals)

Source: Nexant; News reports; government websites; World Bank; KOTRA.

Global players are using advanced analytics in manufacturing operations to optimize performance by improving yield and reducing raw materials. ‘Smart manufacturing solutions’ deployed by global Chemical companies, for example, have helped cut costs and improve efficiency. Advanced analytics are being deployed across the supply chain—including inbound and outbound logistics and warehousing—for accurate demand forecasting and to optimize planning. Other companies are focused on providing solutions to the Chemical industry to control air pollution and helping them meet prescribed environmental standards.

Digital technology can also change the way a market functions, by developing new service-oriented business models. For example, Bayer, John Deere and others, are using AI and Machine Learning (ML) to help farmers secure better harvests through improved seed selection, weather prediction, harvest analysis and prediction of threats to crops.

The Learnings for India

India’s potential for growth can be boosted by the strategic impetus that has propelled other Chemicals majors into the growth orbit. As evinced by the rapid sectoral growth in South Korea, countries that were similarly positioned as India just three decades ago, there are four key levers that India can use to its advantage:

- Accelerate India’s production capacity and boost foreign investments
- Streamline day-to-day operations by easing clearances and making it easier to do business
- Structurally upgrade technical capability by driving investments in R&D
- Enhance competitiveness of domestic players by leveraging digital across value chain

THE INDIA CHEMICALS AGENDA: PRIORITY FOCUS AREAS

The Blueprint For Success: Priority Focus Areas

The blueprint to become a Chemicals powerhouse has been laid out by Asian countries (e.g. South Korea) and the large developed economies (Germany and US, for instance). India is uniquely positioned now to pick and choose the best aspects from both sides as it accelerates in the 2020s. Specifically, there are four major areas of thrust:

- Accelerate production capacity
- Streamline day-to-day operations
- Structurally upgrade technical capability
- Enhance competitiveness of domestic players

ACCELERATE PRODUCTION CAPACITY

Achieving a 140 percent increase in domestic production capacity (from USD 125 billion (2018) to USD 300 billion (2020s)), will need a combination of enhanced FDI, higher cracker capacity and a customized tariff policy for the sector.

Boost Foreign Direct Investments.

The capex requirements for enhanced production capacity are significant—these investments, apart from domestic capital, will require ample infusion of foreign capital. Ideally, this should be primarily strategic invest-

tors, bringing in technology as well. There is significant opportunity: in the five years leading to 2018, the total Foreign Direct Investment (FDI) inflow into the India Chemical industry was ~USD 6 billion with 90 investing companies, and a median investment of USD 33 million. In the same period, China had 6.5x the FDI in Chemicals: USD 39 billion with 148 investing companies, and a median investment of USD 118 million (Refer Exhibit 6). Of the top 100 companies which invested in China during this period, 60+ companies did not make any investment in India, while the rest made only small investments in India.

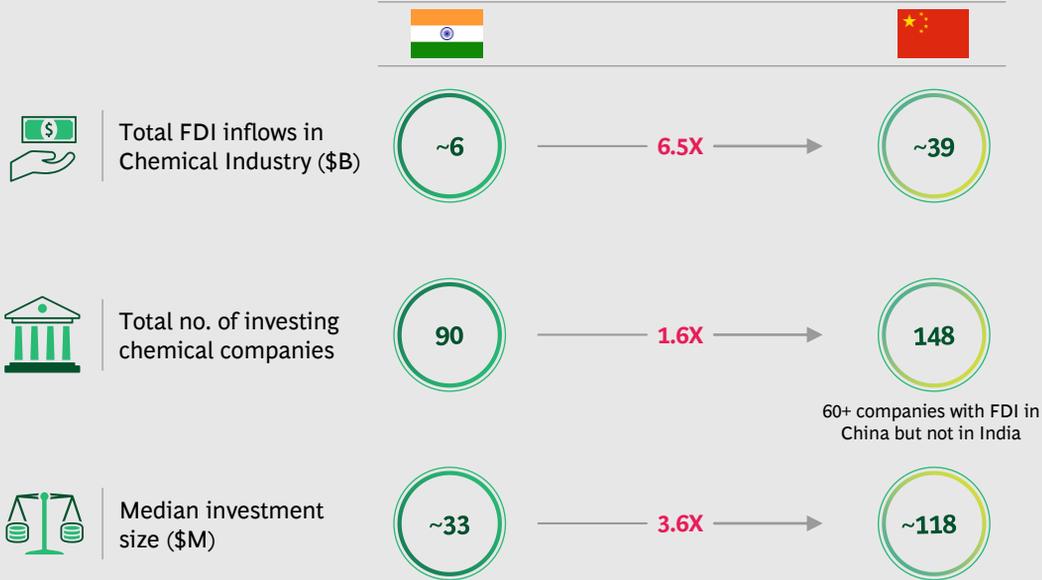
The timing is right: There are favorable tailwinds due to the US-China trade uncertainty and changing geopolitical scenario, which will encourage more global Chemical companies to diversify their sources of supply, with India being a potential beneficiary.

Additionally, there is increased policy focus on production in India—for instance, tax relief for new foreign companies that commence production in India (until 2023 currently, however government considering to extend timeline to 2024-25 given Covid-19 related delays this year).

And finally, the Indian Chemical market is expected to grow at a strong 8-10 percent CAGR as compared to its emerging market peers

EXHIBIT 6 | Significant Headroom Exists for FDI Growth in Chemical Industry in India

COMPARISON BETWEEN INDIA VS CHINA (2014-18)



Source: FDI Markets database; Cross border investments in new physical projects or expansions announced or opened by respective companies included in this database. Where size of capex is not given, same is estimated using a proprietary algorithm basis other projects in the same country/sector/activity; Hong Kong and Taiwan investments considered as FDI for China.

(Brazil, Russia, China), which are expected to grow at 3-5 percent CAGR. Thus, there is an inherent advantage in establishing production centers in India, as a healthy source of demand is expected to come from within the economy.

Actions to boost FDI in India

Concerted steps need to be taken to attract the right foreign investors to India and to communicate an attractive value proposition. Two key actions are proposed to attain this objective:

- Instituting a dedicated Indian Chemicals Council (ICC) FDI cell in potential partnership with Invest India (and/or other GoI institutions such as DPIIT, DCPC, Niti Aayog, etc.) and key FDI bodies: A dedicated chemical FDI cell is required to manage the full investment cycle—develop the right value proposition, articulate the investment opportunity, attract investors and provide adequate handholding and care during and post investment. This may be done in a potential partnership with Invest India, India’s investment

promotion agency. The dedicated ICC FDI cell can house certain key roles, such as an investment development lead, an outreach team, and chemical sector experts.

- Targeting select countries and companies through roadshows, campaigns etc.: Outreach programs in the form of roadshows and campaigns to promote India need to be undertaken across top priority markets such as the United States, Europe, Japan, Korea, and Taiwan, which are home to large Multi-National Corporations (MNCs) and potential investors. In addition to MNCs, industry associations (for example, the American Chemistry Council) and investment promotion agencies (for example, Jetro in Japan) are important stakeholders which will help achieve the objective.

Key elements of India’s outreach, as it seeks to expand its Chemical industry, would include:

- Value proposition development and preparation of factbooks

- Identification of priority investors and other relevant entities (for example, industry bodies, Investment Promotion Agencies) & targeted one-to-one meetings with identified entities—MNCs, industry associations and IPAs
- Close monitoring of sales funnel, quick decision-making, and facilitation of deal closure & focusing on building long-term partnerships

Build upstream cracker capacities to aid downstream industries

With India having a natural advantage in the form of excess Naphtha supply, it should focus on boosting investments in cracker facilities to expand domestic basic building block availability. India's surplus domestic Naphtha availability is estimated to be ~9 MMTPA by 2024. This lays out an opportunity for the Chemical Industry to tap into domestic feedstock and boost domestic supply of building blocks. Furthermore, policy interventions should be identified to boost production at the right parts of the value chain, where domestic products may be made more lucrative vis-à-vis exports.

However, there are challenges in setting up cracker facilities in India, for example, heavy capital investment to the tune of ~USD 3-4 billion which could be prohibitive for individual players; excess naphtha being available in scattered refineries across India's East and West coast, which could negate the advantag-

es; and limited downstream capacities in basic and intermediate industries resulting in low capital formation in upstream cracker facilities. These challenges need to be tackled to ensure that investors and companies have confidence in India.

India can look to several factors behind the successful setting up of cracker facilities across the globe. There is an emerging pattern of how global players help improve access to capital, ensure steady flow of supply and demand, and create a favorable policy environment for boosting upstream cracker investments.

To create access to capital, companies typically enter joint ventures and strategic partnerships, which helps them distribute the burden of heavy capex. Such crackers, when set up as a joint venture of two or more players, are known as 'condo crackers'. These kinds of partnerships offer several other strategic advantages—for instance, a foreign player can tap into local expertise by partnering with a local player, making it easier to navigate relationships with suppliers, government bodies and industry players; or an upstream refinery player and a downstream chemical producer can ensure steady supply and demand by partnering with each other.

The second factor is ensuring a steady flow of supply and demand. A steady flow of feedstock supply is a key consideration for companies setting up crackers in feedstock-deficient

SPOTLIGHT: VIETNAM

The case study of Vietnam, a developing nation seeking to boost its domestic petrochemical capacities, highlights how each of the three critical factors are synergistic for success. The Vietnamese government charted 'Chemical Industry Plan 2030' with the aim to leverage existing feedstock access via capacity building. It set a goal—to make domestic plastic production meet 26 percent of local demand by 2023, versus 11 percent in 2017. To attain this, the Vietnamese government offered several tax and non-tax

incentives for investments in petrochemical projects. As a result, the Long Son Petrochemicals cracker was set up as a joint venture between three companies: Thailand's Siam Cement Group, Vietnam's Petro Vietnam and Qatar's Qatar Petroleum. The project's location was selected keeping in mind a strong pipeline network and port access. Moreover, several downstream industries, belonging to the key industrial hub of Phu My, are near the project location.

nations. Typically, this is ensured by locating the cracking facility close to a port terminal, to ensure easy access to imported feedstock. Furthermore, a strong pipeline network is built, either by the government or by the private sector, to facilitate supply of domestic feedstock accumulated across the country's geography. On the other hand, a steady demand is created by locating the cracker in proximity to industrial hubs present in the region.

Lastly, a favorable policy environment is required, where governments typically step in to provide support and create a conducive environment for investments in crackers. Such incentives may range from corporate tax incentives such as tax exemption periods and investment-linked tax waivers, to other non-corporate tax incentives, such as price subsidies and duty exemptions on machinery and raw materials.

Actions India needs to set up cracker facilities

Learning from other countries, India should adopt a three-pronged strategy, with the aim being to execute within a significantly faster timeline.

- Focus on creating 6-8 consortiums of 2-3 players each with one "anchor" player. Make concerted efforts to attract different types of players—multinational corporations, downstream players, local companies etc.
- Provide government support in terms of adequate incentives (for example, feedstock allocation policies, investment linked tax holidays / waivers, Production Linked Incentive (PLI) scheme—as also rolled-out for pharmaceutical sector, input duty exemptions, price subsidies, etc.) to aid creation of cracker capacities and network of upstream and downstream ecosystem.

Customize tariff policy for the sector

To attain its aspiration, India needs to critically evaluate its industry tariffs. With the end objective of reducing import dependence, opportunities to rationalize tariffs should be identified along with key interventions to take advantage of them. There are several practical areas to keep in mind when rationalizing tariffs:

- Exporters tend to prefer importing material under advanced licenses rather than to buy locally under duty drawback schemes.
- Multiple downstream chemicals may be imported despite excess capacity or domestic availability of input raw material. For example, dependence on imports exists for Styrene-butadiene rubber (SBR) despite excess capacity—capacity of 290,000 MT versus production of ~220,000 MT
- Inverted duty structure in several chemical segments is a key concern going forward as domestic production capacity increases. For example, some agreements have a 0 percent duty on SBR and Polybutadiene rubber (PBR) end-products, while there is 2.5 percent duty on butadiene raw material.
- India's coverage and frequency of most non-tariff measures is lower versus other global economies leading to Indian Chemicals market heavily impacted by dumping of several chemical products vis-à-vis global benchmarks. Mandatory BIS standards as a potential Non-Trade Barrier to prevent dumping

Actions to rationalize tariffs in India

India can take advantage of several opportunities to rationalize tariffs:

- Rationalize duty structures (for example, ladder up duty for chemicals, increase duty drawback rates, etc.) and revisit India's stance on FTAs, addressing any duty inversions to provide boost to downstream capacity.
- Institutionalize trade remedies such as mandatory BIS standards to mitigate dumping of low quality products

STREAMLINING DAY-TO-DAY OPERATIONS

Environmental compliance is an integral part of building a sustainable Chemical industry. The global Chemical producing economies have demonstrated the importance of focusing on two key areas pertaining to day to day Chemical operations and thereby preventing potential environmental harm.

Streamline environmental clearance processes, while ensuring continued high standards

Due to environment being on the concurrent list, there are multiple approving agencies involved, including central and state pollution control boards. There is potential to streamline the framework and approval mechanism, resulting in higher speed while maintaining standards.

Actions for streamlining environmental clearances

- Single unified pollution control board: Concurrent policies (CPCBs / SPCBs), procedures and guidelines could potentially be unified, to streamline and fast track clearances.
- Additionally, a set of 18 policy recommendations have been identified by ICC to accelerate environmental clearances (including "product agnostic" clearances). These policy measures are primarily bucketed into three key areas of operations—i.e., recommendations that can be evaluated 'while setting up the plant', 'during emissions management', and 'while undergoing expansions'

One specific area to highlight here is ICC has also been working with international agencies to bring globally acclaimed standards into India. "Responsible Care" (one of the key initiatives from ICCA) is aimed to improve 'health, safety and environmental' performance, while 'Nicer Globe' (another key initiative) drives 'safe and secure transportation.

Standardize Chemicals logistics policy across supply chain

Chemical logistics presents a unique and complex operational challenge. With chemical production hubs concentrated near the coastal regions and downstream consumers fragmented across the nation, transportation of chemical goods is a vital requirement for managing the growing demands of the end-use industries. A comparison of the present status of Chemical logistics in India against global best practices shows headroom for improvement.

India has been developing the overall logistics infrastructure, with various infrastructure

upgrades underway, such as the development of dedicated freight corridors and expansion of port capacities. The following points focus on unique complexities and challenges which need to be addressed to ease the movement of Chemical goods in India.

- Complex product portfolio and strict hazard compliance: There are ~80,000 different chemical products used across various end use industries. Each chemical is unique with its own set of physical and chemical properties (corrosive nature, toxicity etc.). Due to the varying degrees of physical and environmental risk associated with handling these chemicals, strict compliance of safety and hazard norms is crucial. This highlights the importance of having a comprehensive national repository of information for all chemicals which could simplify information retrieval and boost flow of chemical goods.
- Indigenous hazard labelling and classification standards: Communication of hazard information, through labelling and classification of Chemicals, is a crucial element of chemical logistics. Safety Data Sheets (SDS) and chemical container labels are examples of conveying hazard information to relevant stakeholders. The current methods of hazard communication in India varies from other nations—for example, India currently follows a 9-section SDS format for communicating the health and safety standards for each Chemical. This format is different from the globally prevalent and accepted 16-section Globally Harmonized System (GHS) standard. The differences in communication methods often lead to reworking of labels and re-classification of chemical containers during export or import leading to inefficiencies in international trade.
- Presence of multiple regulatory acts: Chemicals are transported in India primarily through three modes of transport—roadways, railways, and waterways. As a result, stakeholders from multiple ministries and regulatory bodies get involved in the process. Each authority has its unique set of rules and acts with

respect to the safe transportation of chemical goods. The absence of a unified regulatory act and fragmented state of safety regulations potentially leads to confusions and adds to complexity of goods movement.

Actions for Chemicals logistics and supply chain
Three specific areas would help streamline chemicals logistics:

- **Build a digital centralized repository of all Chemicals:** India should create a centralized digital library of all chemicals being produced or imported into the country. This repository would contain information pertaining to safe chemical transportation, precautionary measures, potential risks of toxicity etc., thus improving information retrieval for stakeholders involved in chemical logistics.

SPOTLIGHT: GLOBAL BEST PRACTICES FOR CHEMICAL GOODS TRANSPORTATION

Development of national digital Chemical registers

In order to improve hazard communication to all the stakeholders involved in logistics, many European nations – Italy, Poland, Sweden, etc. – have developed or are in the process of developing centralized digital “National chemical registers and inventories”. These repositories contain relevant information such as physical and chemical properties, potential risks and hazards, safe handling guidelines, emergency procedures in the event of accidents, etc., and provide access to all individuals handling and transporting any kind of chemical.

These registers provide multiple benefits – a one-point access to information for new and existing chemicals, expedited movement of goods facilitated by efficient retrieval of information, effective safety compliance and quicker response times in case of accidents.

Standardization of labels and use of digital technology

Chemical manufacturing nations are adopting standard chemical labelling and classification norms, with as many as 72 countries, like USA, China, Africa etc., having already adopted or in the process of adopting the UN recommended “Globally Harmonized System” (GHS) standards.

The GHS constitute a set of standardized guidelines and format for classification of chemicals hazard labels and SDS. This system has become a global standard for

hazard communication and replaces the various domestic standards which were followed historically. Using the GHS standardized labelling format across multiple nations has further facilitated international chemical trade.

GHS saves time by eliminating the conversion of safety label formats across borders; OSHA estimates state savings of \$ 32 million every year in the US driven by GHS. It has also enabled productivity improvements and additional cost savings through simplified hazard training for personnel and enabled better safety compliance in the workplace. OSHA estimates as many as 43 fatalities and 585 injuries are prevented annually due to GHS implementation.

Nations, like China and USA, have started replacing conventional physical GHS labels with digital labels, further adding to the benefits of GHS. The digital labels use both online (RFID, QR Codes etc.) and offline technology (call and text-based information retrieval systems). These labels simplify the complex and congested current physical labels by categorizing information into specific buckets relevant for different stakeholders. For example, potential environmental hazard for regulatory personnel, specific physical handling hazards for workers, emergency protocols for first-aid workers etc. Digital label information could also be stored in multiple languages to aid comprehension and compliance across borders.

- Align Chemical labelling and classification to GHS and use smart labels: India should adopt global classification standards with GHS and in parallel explore the development & commercialization of digital smart labels for use in Chemical freight containers. This could potentially enhance international chemical trade.
- Unify Chemical rules and regulations into a single framework: India should unify the various rules and regulations across multiple ministries into a unified “REACH-like” framework. This would simplify regulations around domestic flow of goods and ensure strict safety compliance.

STRUCTURALLY UPGRADE TECHNICAL CAPABILITY

Research and Development (R&D) plays a vital role in the growth of all science and technology-based companies and the Chemicals industry is no exception. A variety of end-use industries, each demanding unique Chemicals, can only be served with multi-disciplinary technical knowledge and an army of capable individuals with the requisite industry knowledge. Best practices across leading nations provide additional insights on key imperatives that could be explored to boost R&D in India.

India currently spends a total of USD ~1.7 billion on Chemical R&D activities, amounting to around 1.6 percent of the country’s total Chemical production. This places India seventh in the global rankings, trailing behind nations like China, Japan, and Germany, in terms of absolute Chemical R&D spends, pointing to a significant scope for growth in the Indian Chemicals R&D.

Nations with higher scale Chemical industries understand the role of R&D and have undertaken proactive measures to augment their R&D environment. To strengthen domestic R&D capabilities, many nations have created an ecosystem to develop highly skilled and talented individuals. Setting up of dedicated research institutes, multi-disciplinary research units and promoting industry-academia partnerships are critical elements in this regard. Germany is the leading example of such a cohesive ecosystem. Chemical re-

search in Germany is conducted across all sections of academia ranging from dedicated research programs for doctorate students to professional researchers in non-university clusters of excellence. Research is carried across varying degrees of specialization and innovation, ranging from research in mono-thematic traditional areas to multi-disciplinary research in explorative fields performed in partnership with multiple institutions.

Industry-University Collaborations (IUCs) have also been a major driver to boost R&D output across the world, with some estimates stating that up to 10 percent of the new industrial products and processes are a result of IUCs. The widespread prevalence of IUCs across nations is attributed to the mutual benefits to both Industries (which gain access to highly qualified researchers and dedicated research infrastructure) and universities (receiving additional source of funding and access to industrial equipment). The Chemical industry has witnessed many Chemical giants collaborating with leading Chemical universities across the globe for research partnerships. Germany, again, stands as an exceptional example in the context of IUCs, with some estimates stating that almost a third of ~2,000 Chemical companies in Germany have active collaborations with academia. Germany has a cohesive network of IUCs at both domestic and international levels and it has helped industries and universities develop long lasting and widespread relationships, and advance innovation portfolio and scientific expertise of the German Chemical industry (Refer Exhibit 7).

Furthermore, fiscal incentives play an important role in encouraging industries to invest in R&D. Governments in major Chemical producing nations such as China, Japan and Singapore have actively created a robust system of fiscal incentives, in the form of tax benefits, accelerated depreciation of R&D assets and cash grants for companies investing in qualifying R&D activities.

Actions to boost R&D in India

To be competitive in the Chemical R&D space, India should explore the development of a comprehensive R&D ecosystem enabling

EXHIBIT 7 | Germany: Robust Government Funded Research Ecosystem to Drive R&D & Build Talent Pool

RESEARCH ECOSYSTEM LARGELY FUNDED BY GOVERNMENT



- Research training groups
- Integrated research training groups
- Integrated training groups in Collaborative research centers/Transregions
- Clusters of Excellence
- Collaborative research centers/Transregions
- Non-university research centers
- Graduate training at Non-university research centers

MULTIPLE DFG¹ FUNDED INITIATIVES EXIST WITH VARYING OBJECTIVES TO BOOST R&D

Research initiative	State of implementation ²	Structure/Purpose of initiative
Clusters of excellence	5 CoEs	Collaborative research b/w universities & institutions
Collaborative Research centers	18 CRCs	Multi disciplinary collaborations b/w universities
Research Units	13 units	Research program with 1 primary and many subprojects
Non-university research centers	52 Institutions	Cluster of dedicated research centers after graduation
Research training groups	11 RTGs	Specialized doctorate training program
International research training groups	4 partner countries	Collaborations with intl. universities for doctorates
Integrated training research groups	11 training groups in 8 universities	Integration of graduates & post graduates with CRCs/TRRs

Source: BCG analysis.

¹ DFG: German Research Foundation ² Considering initiatives in the field of chemistry only.

collaboration between research institutions, industry associations and government departments.

Additionally, the government should consider setting up of “Indian Chemical Collaborative Research Centers” (ICCRs), which could act as dedicated centers for advanced exploratory research across the chemicals value chain, for example, Coal-To-Olefin (CTO) or Crude-oil-to-chemicals (COTC) technology in the upstream sector and mobile battery technology for electric vehicles (EVs) in the downstream sector.

These ICCRCs could also act as collaborative research hubs for leading researchers and experts from industrial and academic backgrounds. To be effective, ICCRCs would require the following enablers:

- Strategic locations: ICCRCs should be established near major chemical hubs in India either as independent institutions or in partnership with institutes of eminence in the field of chemical research, such as the IITs, IISERs, planned CICETs, etc.

- Dedicated R&D council: An “R&D Steering Council” should be set up to act as the governing body to oversee and facilitate the setup of ICCRCs through regulatory and operational assistance (such as nominating the ICCRC chairman basis technical and administrative experience from existing IITs). The council would also help steer collaborative R&D efforts. ICCRCs should partner with domestic and international bodies—Industries, Universities and Research units—to gain access to world-class researchers, equipment, and infrastructure.
- Government incentive support: The government could promote industry funding through fiscal incentives, such as tax super deductions on qualified CSR spending, for the establishment and operations of ICCRCs. Additionally, on line of PLI scheme, government could potentially announce a “First in India” scheme to accelerate innovation of new products.

ENHANCING COMPETITIVENESS OF DOMESTIC PLAYERS

In the ever-changing landscape of industrial

practices, the recent digital technology trends have been the most revolutionary. In manufacturing, 'Industry 4.0' marks the shift to next-gen adoption of digital technologies such as IoT, AI and ML across value chains. Digital is fast becoming the 'secret sauce' for maintaining a competitive edge with productivity improvements in operations—for instance, through automation of production processes and digitally integrated supply chains.

The global Chemical industry has ramped up in terms of digital maturity—assessed using BCG's proprietary "Digital Acceleration Index" (DAI)—and has gone from being a "Digital starter" to "Digital literate." Global Chemical corporations have realized the criticality of adopting digital technology and have deployed numerous AI, ML, IoT-based technologies and integrated them across their respective value chains. This has generated a plethora of tangible benefits ranging from enhanced business operations (driven by smart supply chain planning and manufacturing) to faster development of new businesses (through digitally advanced R&D and conception of novel products). Insights from these top players prove the need for other companies to develop digital competence to maintain global competitiveness.

Benchmarking against other industries, however, shows that the Chemical industry is in a relatively early phase of digitization with minimal adoption of advanced technology across most companies.

Actions for India going digital

To promote the adoption of 'Industry 4.0' in the India Chemical industry, India should set up an 'Innovation Center for Chemical Operations' (ICCO) and enable the chemicals industry to realize the untapped potential of digitization.

The ICCO would be a representative model of a chemical supply chain with actual Industry 4.0 technology integrated across different segments of the model. Various representatives from the Chemical industry, including large corporations and MSMEs, should be taken through a journey across the model to:

- Identify pain points present across their respective supply chains through expert presentations and live demonstrations
- Digitize opportunities across the supply chain through the various Industry 4.0 technologies on display
- Brainstorm implementation road maps with expert discussions and guidance

The ICCO should be operated in collaboration with industrial and academic partners which specialize in Industry 4.0 technology specific to individual sections of the Chemical industry supply chain. For example, digital logistic experts could showcase sensor integrated freight containers which monitor chemical health to improve logistics. Within the model, experts could assist companies to choose relevant Industry 4.0 technology and help estimate its financial and operational impact. ICCO could also partner with technology implementation experts to assist organizations in creating Industry 4.0 adoption roadmaps catering to the needs and capabilities of each organization.

A 15-point agenda has been identified to drive the industry forward. With many fundamental advantages the 2020s could well be the decade in which the India Chemical industry accelerates and achieves its full potential to become a global Chemicals powerhouse.

The Call To Action: 15-Point Agenda To Make India A Global Chemicals Powerhouse In The 2020s

 <p>ACCELERATE INDIA PRODUCTION CAPACITY</p>	<p>Boost Foreign Direct Investments</p>	<ol style="list-style-type: none"> 1 Set-up a dedicated ICC- FDI cell to bolster India value propositions 2 Run targeted outreach program across US/Europe/Japan/South Korea/Taiwan
 <p>STREAMLINE DAY TO DAY OPERATIONS</p>	<p>Streamline Environmental Clearances</p>	<ol style="list-style-type: none"> 7 Set-up unified governance with representation from CPCBs & SPCBs to streamline policy guidelines & PMS 8 Accelerate environmental clearances through 18-point policy measures including faster clearances for Responsible Care & Nicer Globe certified companies
 <p>STRUCTURALLY UPGRADE TECHNICAL CAPABILITY</p>	<p>Ease movement of chemicals across the supply chain</p>	<ol style="list-style-type: none"> 9 Build a digital centralized repository of all chemicals to drive distribution ease & higher compliance 10 Align chemical labeling standards to GHS along with RFID based digital labeling 11 Develop REACH like unified framework consolidating multiple regulations
 <p>FOCUS ON ENHANCING COMPETITIVENESS</p>	<p>Accelerate R&D journey and talent pool</p>	<ol style="list-style-type: none"> 12 Set up Indian Chemical Collaborative Research Centers ('ICCRCs') in India's chemical hubs sponsored via govt. 13 Set up dedicated R&D steering council to fast track set-up of ICCRCs and drive industry-institution collaboration 14 Provide fiscal support through "First in India" scheme, tax super deductions, etc. 15 Government of India to collaboratively setup "Innovation Center for Chemical Operations (ICCO)" to show case and foster adoption of Industry 4.0 practices across the value chain

NOTE TO THE READER

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