INDIAN CHEMICAL INDUSTRY

Five Year Plan – 2012-2017

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I. Preface

The planning commission had set up a working group on Chemicals for formulation of the XIIth Five Year Plan. The following sub-groups were set-up for the various chemical industry sub-segments and were headed by a group of industry leaders.

1. Sub-group on Petrochemicals and Organic Chemicals
2. Sub-group on Chlor-Alkali & Inorganic chemicals
3. Sub-group on Specialty chemicals
    a. Dyestuffs and Dye intermediates
    b. Others
4. Sub-group on Pesticides and Agrochemicals
5. Sub-group on Pharmaceuticals Intermediates
6. Sub-group on Small and Medium Enterprises (SMEs)

This report is based on the inputs received from these sub-groups.

II. Executive Summary

The chemical industry is critical for the economic development of any country, providing products and enabling technical solutions in virtually all sectors of the economy.

Global chemical production growth slowed down from 4.4% p.a. in 1999-2004 to 3.6% p.a. in 2004-2009, with global chemical sales in FY10 valued at $3.4 trillion. The industry is increasingly moving eastwards in line with the shift of its key consumer industries (e.g. automotive, electronics, etc.) to leverage greater manufacturing competitiveness of emerging Asian economies and to serve the increasing local demand. This has led to share of Asia in the global chemical industry increasing from 31% in 1999 to 45% in 2009.

With Asia's growing contribution to the global chemical industry, India emerges as one of the focus destinations for chemical companies worldwide. With the current size of approximately $108 billion[1], the Indian chemical industry accounts for ~3% of the global chemical industry. Two distinct scenarios for the future emerge, based on how effectively the industry leverages its strengths and manages challenges. In the base case scenario, with current initiatives of industry & government, the Indian chemical industry could grow at 11% p.a. to reach size of $224 billion by 2017. However, the industry could aspire to grow much more and its growth potential is limited only by its aspirations. In such an optimistic scenario, high end–use demand based on increasing per capita consumption, improved export competitiveness and resultant growth impact for each sub-sector of the chemical industry could lead to an overall growth rate of over 15% p.a. and a size of $290 billion by 2017 (~6% of global industry). This has a potential for further upside in the future considering India's increasing competitiveness in manufacturing.

The draft manufacturing policy recently approved by the Cabinet targets increasing the share of manufacturing in GDP to at least 25% by 2025 (from current 16%). It aims to create 100 million additional jobs through creation of National Investment and Manufacturing Zones (NIMZs) as mega investment regions, equipped with world class infrastructure. These zones will enjoy fast track clearances from the environment ministry and state pollution boards, special policy regimes, tax concessions and more favourable labour laws. Investments in manufacturing in the chemical sector are absolutely essential to ensure growth of the Indian chemical industry.

Notes: 1) Chemical industry size as per CMIE 2010

Focussed growth and planning for the chemical sector would enhance our global competitiveness further, increase domestic value addition, provide technological depth and promote sustained economic growth. In order to realize the growth envisaged above and leverage the India opportunity effectively, the chemical industry would require significant investments in capacity creation, technology development, access to feedstock and a larger pool of skilled human resources. This could translate into additional investment of $110-150 billion[2]. Pro-active action by the Government and nodal agencies of PCPIR zones through encouraging anchor tenants to establish facilities, making feedstock available for downstream plants and creating a favorable ecosystem in terms of infrastructure and other facilities will help them become true chemical manufacturing competence centers and also send a positive message to the global investing community. The chemical industry's R&D spends would need to go up significantly from current levels of less than 0.5% of sales to reach closer to global benchmarks of 4% of sales (implying R&D spends of ~$12 billion by 2017[3]). On the human resources front, adequate educational infrastructure would be required to impart vocational training to develop additional 4.5 to 5 million skilled workers by 2017[2]. Over 15 years, employment potential could range between 8-9 million jobs.

The Indian chemical industry can deliver on an accelerated growth phase, provided a clearly defined vision along with a strategic roadmap is developed to enable it. If this is not done, we may see the growing market increasingly being served through manufacturing done outside India. The various segments of the chemical industry (such as organic chemicals, specialty chemicals, chlor-alkali, pesticides, colorants and alcohol based chemicals) have their own unique set of challenges. The industry can grow only if these individual segments overcome their challenges and move swiftly along the growth path. The performance of these segments has been studied in the subsequent chapters and targets/ goals have been set for the XIIth five year plan along with concrete action plans consisting of levers that will help overcome challenges and drive growth.

The industry and government will have to work in tandem to achieve the ambitious targets set for the chemical industry.

Notes: 1) Chemical industry size as per CMIE 2010 2) Estimates for capital expenditure and manpower required by 2017 are based on benchmarks of current capital invested and employment generated as a % of current industry size 3) R&D expenditure as 4% of 2017 sales ($290 billion) is $11.6 billion

ACTIONS TO BE TAKEN BY GOVERNMENT

Detailed key initiatives that the government must undertake in order to ensure the growth of the chemical industry on the outlined path are as follows:

1. **Improve infrastructure**

   There is an urgent need to build better infrastructure and provide adequate power/ water to support industrial growth of chemicals. Infrastructure is inadequate with respect to safe transportation of products as well as proper goods storage and exports. Significant investments are needed in roads, railways, waterways, ports, warehouses etc. to support the overall industrial growth in India. Various levers could be explored to provide adequate infrastructure to the chemical industry

   a. PPP model for building necessary infrastructure, especially for ports and roads

   b. Availability of finance to improve infrastructural facilities for SMEs.

   c. large scale infrastructure projects, especially those involving multiple states

      i. Making the Petroleum, Chemicals and Petrochemicals Investment Regions (PCPIRs) more effective and encouraging additional investments in already planned PCPIRs such as development of roads and ports near the SEZs/ PCPIRs. Anchor companies could undertake responsibility to make raw material available for downstream units in the cluster, thereby facilitating integration of the entire value chain

   d. Pooling of common infrastructure at existing clusters

      i. Industry can benefit from common production and distribution infrastructure for industries with similar characteristics and complementary requirements

      ii. Government could encourage development of clusters around the large existing plants by extending benefits similar to those provided to PCPIRs.

2. **Ensure feedstock availability**

   a. Encourage “Consortium Cracker” project: Every PCPIR must have a cracker which produces all the building blocks. Government could endorse a consortium cracker project

b. Government could facilitate industry to participate in securing feedstock and mining rights (for coal) from gas and oil rich countries, such as in Middle East and Russia and coal rich countries, like Indonesia, South Africa, and Australia, respectively. Similar approach could also be adopted for inorganic feedstocks such as Sulfur, Rock Phosphate and Potassium Chloride. Initiation of Govt. to Govt. agreements for long term supply of basic minerals at competitive prices could be considered

c. Certain technologies which are capital intensive require support from the government by way of long term steady policies and fund support, such as Coal gasification (simultaneously production of power and fertilizer based on coal gasification) and Coal to Methanol/ Olefins/ Acetic Acid

d. Government and industry could develop strategies for allocation of feedstocks to best suited products (Gas for fertilizers, Coal for power, Naphtha for petrochemicals)

3. Provide support for new technologies and establish technology up-gradation fund (TUF)

a. To promote investments in R&D and green technologies, fiscal incentives such as accelerated depreciation, tax benefits, subsidies etc. could be provided

b. A technology up-gradation fund (similar to textiles) should be set up for chemicals. A fund size of Rs. 500 Crore for the XIIth plan period is proposed.

4. Implement the 6-point plan for strengthening R&D

a. Establish chemical sector council for innovation having representatives from the government, chemical companies, industry associations and reputed research/ educational institutes (e.g., NCL, ICT)

b. Establish an autonomous USD 100 million chemical innovation fund by securing 10% of the total inclusive national innovation fund set up by the National Innovation Council to encourage commercialization efforts for innovations generating inclusive growth

c. Develop three regional clusters and two innovation centers in universities dedicated to chemical industry

d. Sign international collaboration agreements with Germany and Singapore which could be good partners for India to learn and develop capabilities in

chemical product and process innovation. Both of these countries have world class examples of large scale chemical parks (e.g., Ludwigshafen in Germany, Jurong in Singapore) with integrated infrastructure, knowledge management and R&D facilities; India can benefit significantly from their experience while establishing PCPIRs

e. Launch an outreach program with the target of building a chemical innovation eco-system between several constituents like innovators, venture capitalists, research institutes, companies and industry associations.

f. Chemical Innovation Council shall recommend and help government in creation of dedicated fast track court to handle IP issues and enable stricter enforcement of IP rights, which will significantly reduce the time required for judicial dispositions

5. Set-up talent development infrastructure

a. India will need over 14,000 highly skilled, chemical engineers within the next decade to join the specialty chemical industry alone. A potential short fall of 8,000 to 10,000 chemical engineers is indicated driven by limited talent from Tier 1 universities and lack of attractiveness of the chemical sector for employment. To resolve this shortfall, the industry must improve the value proposition for chemical engineers while the Government should work in collaboration with industries to upgrade the current chemical departments in Tier 2 universities to become state-of-the-art departments (in terms of infrastructure, faculty qualifications, industry interaction, and administration)

b. To meet the future demand, 1,000 new ITIs, vocational training institutes and diploma institutes should be set up

c. Government could set up specialized universities, vocational training institutes and develop skill base. Institutes could be set up closer to clusters and government could provide rebate on training & development as given for R&D. Corporates could be incentivized to engage trainees/ students from these institutes on projects to provide industry exposure. This could lead to a closer bonding between industry and academia which has been observed as a best practice followed by China and lead to the development of indigenous technology and intellectual property.

6. **Improve image of the industry**

   a. Government could provide incentives for bio-based raw materials to reduce dependence on crude oil, encourage companies to seek “Responsible Care Certification” and facilitate priority loans to those who meet environment norms

   b. Providing greater autonomy to Pollution Control Boards (PCBs) for stricter enforcement could be considered.

   c. A fund of Rs 25 Crore is proposed for promotional activities for the Chemical Promotion and Development Scheme which includes holding of various events such as India Chem and holding international and national conferences etc. for development and promotion of chemical industry

7. **Consolidate acts into an Integrated Chemical Legislation, simplify regulatory structure and strengthen regulations**

   a. It will be expedient in the interest of development of chemical industry to consolidate multiple legislations governing the chemical industry into one Integrated Chemical Legislation. This legislation should cover the entire life cycle of chemicals. This will act as REACH like legislation for safe use of chemicals for protection of human health & environment.

   b. Government should expedite swift implementation of GST to lower transaction costs and avoid cascading of taxes; involvement of states in policy formulation should be encouraged, e.g. Central government constituted empowered committee of state finance ministers led to smoother and faster VAT implementation

   c. Government should also focus on removing redundancy associated with multiple regulatory bodies (e.g. crop protection comes under Dept. of Chemicals, Ministry of Agriculture & Health Ministry) and simplifying registration approval procedures, especially for pharmaceuticals and agrochemicals.

8. **Rationalize taxes and duties**

   a. Feedstocks and basic building blocks for the downstream chemical products should be preferably at zero duty. This should be followed by slightly higher duty for primary chemicals, still higher for secondary chemicals and still higher for final products/ chemicals, to provide an opportunity for value addition and also provide adequate competitive protection. Example, Naphtha which is a basic feedstock,

should have zero duty, followed by slightly higher duty for primary products like Ethylene, Propylene, Butadiene etc. and still higher duty for secondary products like Polyethylene, Polypropylene etc.

b. Chemical industry could be granted tax and duty reductions for specific identified products such as import duty reduction on inputs like coal, furnace oil, naphtha, etc., inclusion of a wider range of inputs under CENVAT credit, making power cost VATable and encouraging companies to set up captive power plants etc.

c. CENVAT and MODVAT returns process should be rationalized and made smooth; processing of refund claims should be faster

9. Develop India's chemical inventory

A chemical inventory is a listing of industrial chemicals manufactured in, or imported by, a country created from information submitted to government authorities by manufacturers, processors, users, and/or importers. Such an inventory can allow authorities to maintain an updated overview of chemicals marketed in their country, reveal whether substance manufactured is used within a country or exported therefore the applicability of new research knowledge to the country and identify risk zones to facilitate the setting of risk reduction priorities. A dedicated cell of 5 to 10 competent scientists and chemical engineers may be set up to lead the development of India's chemical inventory alongwith establishing the relevant funding mechanism. It is proposed that the government may allocate a budget of Rs 50 Crore for the establishment of the Indian chemical inventory during the XIIth plan period.

ACTIONS TO BE TAKEN BY INDUSTRY

Similarly, the industry must also strive to ensure strong industry growth by acting on the following imperatives

1. Invest locally with scale and size matching global norms and adopt cutting edge technology (developed or acquired)

Fragmented nature of industry makes it difficult for the companies to optimize operational costs, realize economies of scale and adopt latest technologies, making them uncompetitive globally. The industry should actively move towards investing in new capacities with scale and size matching global standards to achieve world scale of plants and reap economies of scale and adopting cutting edge technologies

2. **Secure feedstock and technology - pursue international JVs/ alliances/ acquisitions**

   Apart from domestic consolidation, Indian companies could acquire resources in resource-rich countries to ensure feedstock supply. Similarly, JVs/ alliances with companies in advanced countries could be pursued for technical and technological collaborations and ensuring access to technology and support for R&D

3. **Become a coveted employer - Attract and retain talent**

   Industry should implement steps to attract talent, such as offering R&D/ marketing oriented job profiles, providing attractive career paths with global exposure, offering compensation comparable to other industries and developing strong in-house training programs. Industry should form a close collaboration with academia through joint projects to source talent and participate in curriculum formation

4. **Establish a targeted innovation platform, invest more in R&D**

   Product innovations for meeting local needs rely heavily on the chemical industry for inputs and support. Chemical industry must work in close collaboration with end-use industries to help innovate products suited to Indian conditions. The areas for strengthening R&D in chemical industry include improvements in catalysis, manufacturing process, reduction in cost of production, application development and design of new products relevant to the Indian market needs e.g. water management, low cost vehicles, biofuels etc.

5. **Create a positive, consumer & environment friendly image**

   The industry could work towards establishing a positive image by strengthening its safety practices, complying with environmental regulations and reducing its carbon footprint. The industry should promote a green image by focusing on green products and processes (bio-feedstock, bio-degradable products, eco-friendly processes). Leading the green change successfully will require innovative approaches to deliver economic, environmental and social benefits. Companies should voluntarily seek “Responsible Care Certification”.

6. **Interact with regulatory/ industry bodies**

   The industry must engage constructively with regulatory bodies for jointly developing effective approaches for addressing the challenges and needs of the industry. Companies should also co-operate with the regulators by adopting requisite standards and following industry rules and regulations:

Budget Projections for 2012-2017

To undertake the initiatives recommended, a provision of Rs 575 Crore has been proposed for XIIth Plan Period. Out of Rs. 575 crore, Rs. 50 Crore is proposed for the establishment of the Indian chemicals inventory. Rs. 25 crore is for Chemical Promotion and Development Scheme which includes holding of various events such as India Chem, holding international and national conferences etc. for development and promotion of chemical industry. Balance Rs. 500 crore is for establishment of Technology Upgradation which implies that annual outlay of Rs. 100 crores. The size of the chemical industry covering organic, inorganic, dyes and pesticides is US $ 22 billion. An yearly outlay of Rs. 100 crores for technology upgradation is 0.1% of the size of this sector. Fund sought to be established for incentivizing the industry to develop use innovative technology replacing obsolete inefficient technology.

III. Introduction

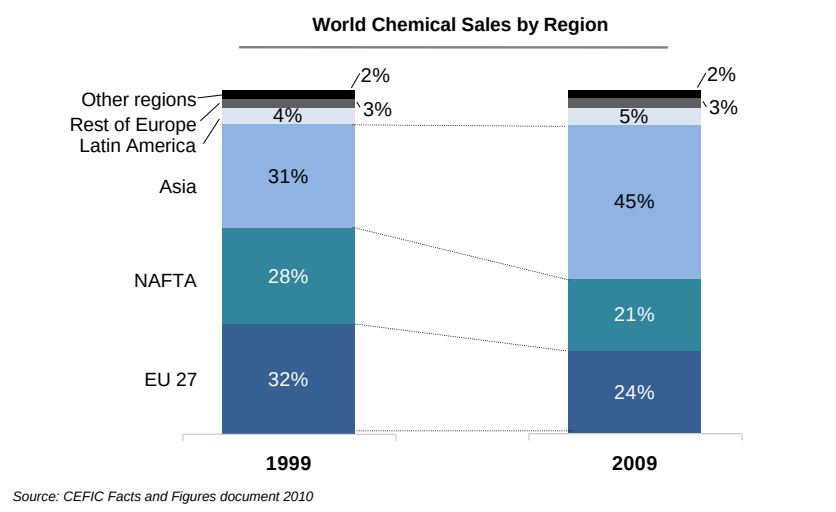
Chemicals are a part of every aspect of human life, right from the food we eat to the clothes we wear to the cars we drive. Chemical industry contributes significantly to improving the quality of life through breakthrough innovations enabling pure drinking water, faster medical treatment, stronger homes and greener fuels. The chemical industry is critical for the economic development of any country, providing products and enabling technical solutions in virtually all sectors of the economy.

Ensuring development of sustainable, green solutions in the fields of water treatment, food production and healthcare are the key challenges for the future. Fueled by an increasing focus of industry on improving its image, these trends are shaping the priorities for R&D in the field of chemistry. In order to emphasize the importance of the chemical industry in meeting the key challenges for the future, the United Nations Organization has proclaimed 2011 as the 'International Year of Chemistry'

IV. Overview of Indian and global chemical industry

The chemical industry is central to the modern world economy having a typical sales-to-GDP ratio of 5-6%. Global chemical production growth slowed down from 4.4% p.a. in 1999-2004 to 3.6% p.a. in 2004-2009, with global chemical sales in FY10 valued at $3.4 trillion.

The global chemicals industry is witnessing a gradual eastward shift. The industry is increasingly moving eastwards in line with the shift of its key consumer industries (e.g.



automotive, electronics, etc.) to leverage greater manufacturing competitiveness of emerging Asian economies and to serve the increasing local demand. Over the last 10 years, the share of Asia in global chemical sales has increased by ~14% points rising from 31% in 1999 to 45% in 2009. With rising concerns around climate change and depleting natural resources, focus on sustainability is another key trend impacting the global chemical industry. Chemical companies are increasingly working towards reducing energy intensity of their operations, minimizing effluent discharge and pollution, increasing the share of recyclable products in their portfolio and diversifying their raw material base to include bio-feedstock.

With Asia's growing contribution to the global chemical industry, India emerges as one of the focus destinations for chemical companies worldwide. With the current size of $108 billion[1], the Indian chemical industry accounts for approximately 7% of Indian GDP. The chemicals sector accounts for about 14% in overall index of industrial production (IIP). Share of industry in national exports is around 11%. In terms of volume, India is the third-largest producer of chemicals in Asia, after China and Japan. Despite its large size and significant GDP contribution, India chemicals industry represents only around 3% of global chemicals.

Notes: 1) Chemical industry size as per CMIE

Two distinct scenarios for the future of the Indian chemical industry emerge, based on how effectively the industry leverages its strengths and manages challenges. In the base case scenario, with current initiatives of industry & government, the Indian chemical industry could grow at 11% p.a. to reach size of $224 billion by 2017. However, the industry could aspire to grow much more and its growth potential is limited only by its aspirations. In an optimistic scenario, high end–use demand based on increasing per capita consumption, improved export competitiveness and resultant growth impact for each sub-sector of the chemical industry could lead to an overall growth rate greater than 15% p.a. and a size of $ 290 billion by 2017.

V. Chemical industry sub-segments

A. Basic Organic Chemicals

1. Introduction

Organic chemicals industry is one of the most significant sectors of the chemical industry. It plays a vital developmental role by providing chemicals and intermediates as inputs to other sectors of the industry like paints, adhesives, pharmaceuticals, dye stuffs and intermediates, leather chemicals, pesticides etc. Methanol, acetic acid, formaldehyde, pyridines, phenol, alkyl amines, ethyl acetate and acetic anhydride are the major organic chemicals produced in India. Formaldehyde and acetic acid are important methanol derivatives and are used in numerous industrial applications. Phenol is an aromatic compound and derived from cumene, benzene and propylene derivatives. Alkyl amines are used in the manufacture of surfactants. Pyridine derivatives are used in the manufacture of pharmaceuticals. Ethyl acetate is the ester of ethanol and acetic acid and is manufactured for use as a solvent. Acetic anhydride is widely used as a reagent. Natural gas/ naphtha are mainly used as feedstock for the manufacture of these organic chemicals. Alcohol is also an important feedstock for the industry, with sizable production of acetic acid and entire production of ethyl acetate being based on alcohol.

2. Global Scenario

Global production of organic chemicals was around 400 million tonnes during 2010-11. Major producers of organic chemicals are USA, Germany, U.K, Japan, China and India. Few Latin American countries, for example Brazil and Chile are increasing their presence in global organic chemicals market.

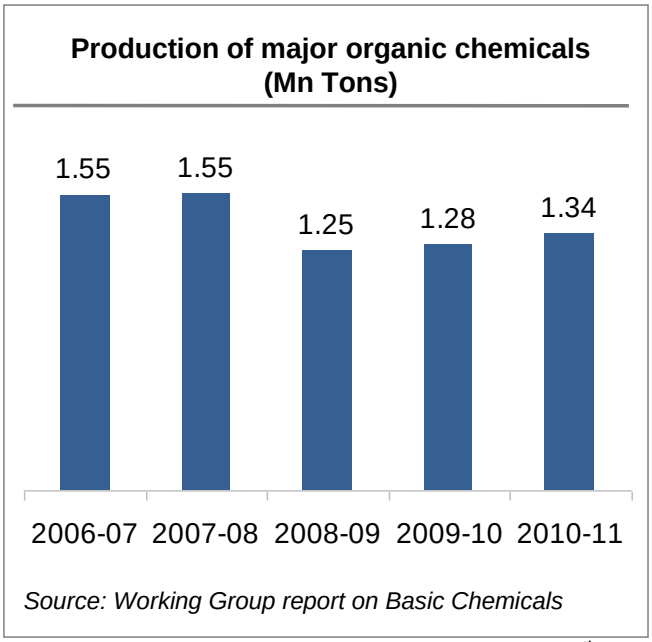
3. Indian Scenario

Six major chemicals produced in India are Methanol, Aniline, Alkyle Amines and its derivatives like Formaldehyde, Acetic Acid and Phenol, contributing to nearly 2/3rd of Indian basic organic chemical industry. The balance 1/3rd of the organic chemical consumption in the country is accounted for by other wide variety of chemicals.

- **Demand & supply**

  During the XIth Five Year Plan period, production of major organic chemicals has shown a significant decline due to large volume imports taking place from countries like China, resulting in low operating ratios of ~ 60%.

  The demand for organic chemicals in India has been increasing at nearly 6.5% during this period and has reached the level of 2.8 million tonnes. The domestic supply has however grown at a slower pace resulting in gradual widening of demand supply gap which was primarily bridged through imports. Domestic production declined at ~ 6%



Source: Working Group report on Basic Chemicals

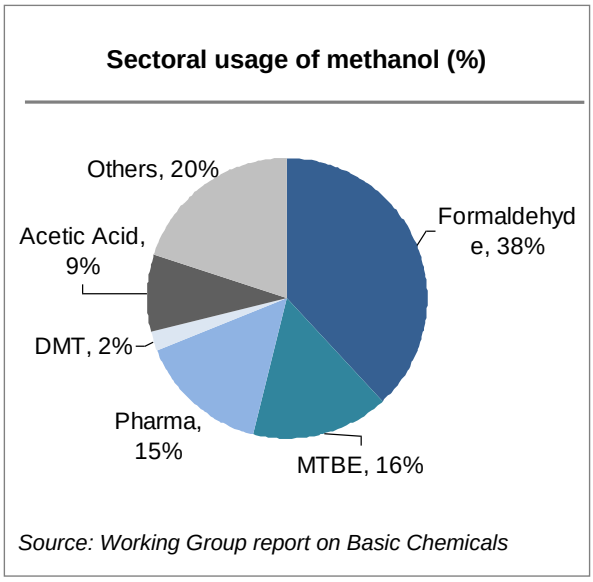
  p.a. and imports grew at a rate of 17-19% p.a. during the XIth plan period.

  The key segments of the industry are methanol, formaldehyde, acetic acid, phenol, ethyl acetate and acetic anhydride.

  Methanol

  Methanol is a very versatile chemical primarily produced in India from natural gas and naphtha. Alternative routes for production of methanol are coal and petcoke. Coal and petcoke route is however not yet commercialized. Current methanol consumption is 1.5 million tonnes. The demand is growing at 10% and is expected to continue to be met through imports. The two major end-use segments for methanol are chemical and energy. In the chemical segment, methanol is used for production of formaldehyde, acetic acid, di-methyl terephthalate (DMT) and a range of solvents. The consumption

of methanol in the energy segment is substantial as blending component for petrol and methyl tertiary butyl ether (MTBE), tertiary amyl methyl ether (TAME) and di-methyl ether (DME). In India, the usage pattern for methanol has remained unchanged over a period of time with formaldehyde sector accounting for bulk of the consumption. Considering the diverse uses of methanol and its potential for use in the energy sector, the industry estimates that current demand growth of 10% would be sustained with relatively higher growth in the energy segment. It is estimated that by end of XIIth Five Year Plan period, demand of methanol would reach 2.5 million tonnes thus providing



Source: Working Group report on Basic Chemicals

substantial opportunities for domestic industry in this sector. The current production capacity in the country is 0.385 million tonnes thereby creating gap of 2.115 million tonnes which would primarily met through imports from Middle East and China. Investment opportunity exists for a world scale capacity of over 2 million tonnes.

Acetic Acid

Acetic Acid is primarily used for production of purified terephthalic acid (PTA), vinyl acetate monomer (VAM), acetic anhydride and acetate esters. In India, production of acetic acid is primarily based on alcohol and its demand has grown at 10% during XIth Five Year Plan period. At present the consumption is estimated to be 0.6 million tonnes which would reach nearly 1.0 million tonnes by end of XIIth Five Year Plan period. The demand growth is primarily driven by end use demand from PTA which is basic raw material for polyester and fiber. There is substantial incremental capacity of PTA, driving demand for acetic acid in this segment.

Acetic acid is primarily produced through alcohol or methanol route. Alcohol route in Indian context is gradually becoming unviable due to high prices and limited availability of this feedstock. At present bulk of acetic acid is imported with domestic production accounting for less than 30% of demand.

Formaldehyde and Phenol

Domestic demand for formaldehyde and phenol is estimated to be 0.25 million tonnes each. Both these segments have been growing at a moderate pace with formaldehyde showing growth rate of 3% with primary outlet in the form of phenol. Formaldehyde is used largely in the laminate sector. Phenol is also used for production of caprolactam and bisphenol-A which have wider application base. Phenol demand is expected to grow at 8% during XIIth Five Year Plan period to reach 0.4 million tonnes by end of the plan period while demand for formaldehyde is expected to reach 0.3 million tonnes.

Ethyle acetate and Acetic anhydride

Ethyl acetate demand is around 0.23 million tonnes which is met through domestic production. Ethyle acetate demand is driven by use as solvent for printing inks, paints and in pharmaceuticals as well as exports. India also exports significant volumes of ethyle acetate. Acetic anhydride demand is estimated to be 0.08 million tonnes. India is self sufficient in acetic anhydride production with little trade.

Alkyl Amines

Alkyl Amines include ethylamines, methylamine, isopropylamines, butylamines, ethyl hexyl amines. The total capacity of these products is 125,000 tonnes. The capacity utilization in India is to the extent of around 80% and to a large extent, Indian industry is self-sufficient in these amines. These amines are mainly used in the manufacture of pharmaceuticals, agro-chemicals, paints, rubber chemicals etc. The growth of these amines is to the tune of 8% per annum.

- **Trade**

Methanol, acetic acid and phenol have significant import volumes, highlighting a deficit

Import volumes ('000 tonnes)	FY07	FY08	FY09	FY10	FY11*
Methanol	527.3	788.8	1,058.9	822.2	575
Formaldehyde	0.4	0.4	0.5	0.7	0.5
Acetic Acid	124.5	136.4	285	389.7	340.5
Phenol	68.8	102.9	92.9	103.1	85.5
Ethyl Acetate	3.724	0.404	6.721	14.929	1.978
Acetic Anhydride	0.280	0.421	0.37	0.895	0.6

* - Imports from April – Dec 2011

Source: DGFT

in domestic capacity. Significant investment potential exists to set up additional domestic capacities and serve demand through local production. This will also require focus on ensuring feedstock availability for the sector including naphtha, natural gas and alcohol.

Export volumes ('000 tonnes)	FY07	FY08	FY09	FY10	FY11*
Methanol	1.2	31.7	3.3	45.9	29.1
Formaldehyde	2.2	5.7	3.3	4.0	2.9
Acetic Acid	14.8	15.0	12.6	13.0	7.1
Phenol	2.6	2.1	3.2	2.7	0.8
Ethyl Acetate	14.8	33.1	30.8	47.1	107.0
Acetic Anhydride	1.3	0.9	4.2	1.3	1.5

* - Exports from April – Dec 2011

Source: DGFT

Methanol

India is a large importer of methanol. Due to insufficient domestic production, in FY09 the net import of methanol was 1.06 million tonnes i.e. more than 4 times the domestic production of 0.24 million tonnes. Imports have grown from 0.5 million tonnes in FY07 to 0.8 million tonnes in FY10.

Acetic Acid

Most of the demand for acetic acid was met through domestic production earlier. However, due to oversupply of acetic acid in global markets and depressed prices, imports of acetic acid have grown from 0.12 million tonnes in FY07 to 0.39 in FY10. Cheap imports have led the domestic manufacturers to reduce their plant capacity utilization.

Formaldehyde and Phenol

Unlike methanol, production of its derivative formaldehyde in India is sufficient to meet the domestic demand. However, over 70% of demand of phenol is met through imports with no fresh supply addition in last few years. Phenol imports have grown from 0.068 million tonnes in FY07 to 0.1 million tonnes in FY10

Ethyle acetate and Acetic anhydride

Indian is a net exporter of ethyl acetate with export volumes rising from 0.014 million tonnes in FY07 to 0.107 million tonnes in FY11 (April – Dec) leading to a growth rate of over 50% p.a. Acetic anhydride trade is minimal with low export and import volumes.

- **Opportunities**
  - **Consolidation:** Since most of the Indian manufacturers operate on a small scale compared to global peers, there is a room for consolidation in Indian organic chemicals industry. Domestic players can take advantage of economies of scale arising from consolidation and become more competitive thereby preventing cheaper global imports.
  - **Improved feedstock supply:** Domestic organic chemicals players don't have the advantages of backward integration and hence, they lack pricing flexibility. However, given the new finds of natural gas reserves in the country, domestic manufacturers will be able to get supply of feedstock at stable prices.
  - **Wider product portfolio:** Commodity chemicals companies can improve their product portfolio by adding specialty chemicals such as polymers additives, water treatment chemicals, lubricating additives, etc. This will help in improving their margins but requires significant R&D efforts.
  - **Forward integration:** Petrochemical companies producing benzene and propylene can look for forward integration opportunity given the demand-supply

deficit in phenol market. Similarly, an opportunity exists for companies with better access to natural gas supply to venture into the methanol market facing continuous supply deficit.

- **Outbound approach:** Even successful companies from west are shifting their base to resource rich nations like Saudi Arabia, Qatar, Russia, etc. Indian organic chemical companies may also explore opportunities outside the country either through green-field or brown-field projects.

- **Challenges**

  - **Lack of world class infrastructure:** Given the poor infrastructure with lack of adequate facilities at ports and railway terminals and poor pipeline connectivity, domestic manufacturers will continue facing difficulty in procuring raw materials at a cost competitive with the global peers.

  - **Lack of cheaper raw material availability:** Feedstock (naphtha and natural gas) and power are critical inputs for organic chemicals industry. Costs of these raw materials are high in India compared to countries like China, Middle East and other South East Asian countries such as Thailand and Indonesia.

  - **Large global capacity addition:** Apart from the oversupply in the global markets, there is another cause of concern for domestic manufacturers, with further large capacity additions happening in global markets. For example, globally, methanol industry is expected to witness excess capacity in the future due to a spate of capacity additions in gas rich countries such as Middle East and Russia.

4. Action plan 2012-2017

Demand for basic organic chemicals has a potential to grow at 10% p.a. to reach 5 million tonnes by end of the XIIth plan period. To cater to this demand and move towards self-sufficiency, the organic chemical industry must target a growth of 10-12% p.a. during the XIIth plan period.

To cater to this demand the industry may target increasing its acetic acid capacity by 450,000 (current capacity 351,000 tonnes) tonnes to bring down the demand-capacity deficit from 41% to 20%. Methanol presents an opportunity of over 2 million tonnes of capacity requiring an investment of approximately $0.9 billion (Rs. 4,000 Crore). Phenol capacity target for the end of the XIIth plan period could be a total of 200,000

tonnes (from current capacity of 74,000 tonnes) to bring down the demand-capacity gap from 68% to 40%. However, this would require policy initiatives enumerated below:

- **Ensuring feedstock availability:** Feedstock availability continues to be major concern for Indian chemical industry. Availability as well as pricing of natural gas and naphtha at competitive prices are major constraints. The poor quality of Indian coal makes production of methanol through this route uncompetitive at prevailing pricing for coal in India. As a result of this, the industry is primarily dependent on import of methanol, the basic building block, from Middle East and China
- **Fiscal and regulatory support against cheap imports:** Large production capacity of methanol established in Middle East and China will continue to put pressure on Indian industry. Viability of local production in the absence of any fiscal and regulatory support from the Government will continue to be of concern. Methanol production from petcoke and coal may be incentivised to make the production economically viable.
- **Support for world scale plants in PCPIRs:** The industry currently is operating plants which are much below global scale and hence need for consolidation and establishment of world scale plant. This can be achieved with creation of favourable investment climate in the country. Putting up world scale anchor tenant namely oil refinery and cracker plant at PCPIR needs to be explored. It is also imperative that such mega scale plants are integrated with down stream facilities for production of acetic acid and phenol, where substantial gap exists in domestic demand and supply.

B. Specialty Chemicals

1. Introduction

Specialty chemicals are defined as a “group of relatively high value, low volume chemicals known for their end use applications and/ or performance enhancing properties.” In contrast to base or commodity chemicals, specialty chemicals are recognized for ‘what they do’ and not ‘what they are’. Specialty chemicals provide the required ‘solution’ to meet the customer application needs. It is a highly knowledge driven industry with raw materials cost (measured as percentage of net sales) much

lower than for commodity chemicals. The critical success factors for the industry include understanding of customer needs and product/ application development to meet the same at a favorable price-performance ratio

2. Global Scenario

Global specialty chemicals industry is estimated to be ~$ 740 billion accounting for ~ 22% of the global chemical industry.

3. Indian Scenario

The specialty chemicals segment has grown at 11-13% p.a. over the XIth plan period (FY07 to FY11). Indian specialty chemical industry (excluding agrochemicals and dyes & pigments) is currently valued at $17.7 billion and is an important growth driver for Indian economy. This segment has the potential to reach $38 billion by the end of XIIth Five Year Plan period growing at a rate of 13-14% p.a.

Segment	FY11 Size ($ bn)
Paints and coatings	3.6
Specialty polymers	2.3
Plastics additives	0.9
Construction chemicals	0.6
Home care surfactants	1.1
Textile chemicals	0.8
Flavors and fragrances	0.4
Water chemicals	0.6
Cosmetic chemicals	0.5
Paper chemicals	0.4
Printing inks	0.4
I&I cleaners	0.2
Rubber chemicals	0.2
Other segments	5.7
Total	**18**

Growth in the Indian specialty chemicals industry is driven by three factors:

1. More end use demand

With increasing GDP, the Indian middle-class could grow from 31 million households in 2008 to 148 million households by 2030, with quadrupled consumption. Furthermore, India's urban population is expected to increase by 275 million people by 2030. This will result in consumption-led double-digit growth in

key end markets over the next decade and an increased need for better products and services

Specialty chemical industry growth typically follows the growth of these key end markets. For example, an increasingly urbanized India (cities are likely to comprise 40% of the population by 2030) will double the requirement for clean municipal water by 2020, and therefore significantly increase municipalities' usage of water treatment chemicals to treat/ recycle waste water. Similarly, increased infrastructure spending by the government (The XIIth Plan recommends USD 1 trillion investment in development of roads, ports, power and telecom) accompanied by growth in the real-estate industry, could result in over 15 % p.a. growth in the construction chemicals and coatings segment.

2. Increased intensity of consumption

Compared to the developed world (the US, Europe) or China, the current penetration of specialty chemicals within India's end markets is low. With an increased focus on improving products, usage intensity of specialty chemicals within these end markets will rise in India over the next decade.

For example, concrete admixtures improve the fluidity of concrete, provide a smoother, more even finish, and help avoid cracks. Consequently, concrete admixtures can help reduce maintenance and repair costs, and therefore, the total cost of ownership of construction projects in India. India's current expenditure on admixtures is only \$ 1/ m^3 of concrete, compared to \$ 2/ m^3 in China and \$ 4.5/ m^3 in US. This is primarily due to the lack of awareness of admixtures in the Indian construction industry. With increasing demand for higher quality construction and increasing awareness of concrete admixture benefits, the industry could double the intensity of admixture consumption in India.

Similarly, the usage of pesticides in India is 0.58 kg/ ha compared to 2 kg/ ha in China. To meet India's food requirements – spurred by increasing population, rising income, and limited availability of arable land – the yield per hectare will need to be increased considerably (e.g., crop productivity in India is at 2 MT/ ha compared to China at 5 MT/ ha). This can be achieved through multiple means (e.g., larger fields, better automation, improved irrigation infrastructure), along with increased use of agrochemicals.

3. Improved consumption standards

Consumption standards are policies implemented by the government to promote the safe use of products. These standards are necessary for both improving society's standard of living and enhancing consumer safety. Most developed countries (e.g. the US, Germany) have implemented stringent consumption standards across various end-use markets. As the economy develops, India will need to regulate products more stringently, and strengthen consumption standards, which in turn will promote increased usage of specialty chemicals. For instance, the US and Germany are very strict on the usage of solvents in paints and limit the volatile organic compound (VOC) content. India still uses enamel paints with high VOC content. Mandating the usage of water-based paints (that contain 5-15% petrochemicals) will help ensure health and safety of consumers, and encourage the consumption of higher cost, water based paints (increasing the segment's value). The chart below describes 10 potential standards that India could implement in line with other developing and developed countries.

INDUSTRY	Potential customer standards in India	Comparable standards in other countries
Automotive	• Nationwide implementation of stricter emission norms (Bharat IV/ V) • Fuel efficiency standards to improve average fuel economy of vehicles	• Entire EU has specific targets for CO2 emissions for cars (120 g/ km by 2012) • US CAFÉ standards specify minimum fuel efficiency at 36 MPG by 2016
Construction	• Mandating energy conservation and building code (2007) guidelines • Banning mixing and production of concrete at sites in urban areas	• Germany's EnEV is one of the most stringent energy conservation codes • China has banned site mixing of concrete in 240 major states
Water treatment	• Re-usability norms for all types of waste water • Shifting to pollution load-based norms from concentration-based norms	• Industries are incentivised to use Singapore's NEWater (recycled water) • US EPA sets effluent emission guidelines for each industry
Paints and coatings	• Tighter emission norms for VOCs in line with the developed world • Mandatory use of lead-free pigments and coatings in all applications	• US has set 250 g/ litre as the limit for VOC in paints • US has a norm of maximum 90 ppm of lead in paints
Flavours and fragrances	• Moving from a negative list (of banned chemicals) to a positive list of (acceptable chemicals) in flavors • Mandating the usage norms by IFRA (International Fragrance Association)	• EU has "E numbers" for food additives that have been assessed for use (positive list) • Majority of the developed world (US, UK, EU) follow IFRA guidelines

The nature of growth in different markets would reflect the growth potential of Indian economy in that segment. Government needs to play a key facilitating role in supporting this growth.

Key driving industries for growth of Specialty Chemicals

(i) Automotive Sector

Automotive sector in India is growing in excess of 10% and is likely to produce 25 million vehicles from current level of 14 million. The focus would be on affordable cars driving the demand for automotive components made out of plastics and use of paints and coatings in this sector. There are over 10 large producers of cars and vehicles in the country and most of the global majors have presence in this segment.

(ii) Construction Chemicals

Construction industry in India is growing in excess of 16% p.a. and is likely to reach $ 100 billion by the end of the XIIth Five Year Plan period. The construction chemical industry in India accounts for only 0.4% of the total construction spend and has a potential of reaching 1% which is the norm in developed economies. The key products for this sector would be in the areas of painting and coating materials, reinforcing fibers, admixtures and other construction chemicals. The key success factor for construction chemical industry would be developing products and adopting advanced coating, ceiling and reinforcing material like polyurethane base coating, silicone base and polymer base re-enforcing material.

(iii) Water Chemicals

The next major segment in India would be the water chemicals segment with potential for a range of chemicals for conserving this critical resource. The demand for water is likely to grow substantially, putting pressure on supply of water for irrigation, drinking and industrial usage. The need to augment supply of water requires both conservation efforts to minimize wastage as well as greater amount of recycling. This is where water chemicals will play a vital role. Water treatment chemicals are used for a wide range of industrial and in-process applications such as reducing effluent toxicity, controlling Biological Oxygen Demand (BOD) & Chemical Oxygen Demand (COD) and disinfecting water for potable purpose. Apart from use in potable water, the customer base is widespread across diverse industries ranging from large power plants,

refineries and fertilizer factories to pharmaceuticals, food and beverages, electronic and automobile companies.

(iv) Textile Chemicals

The growing demand for textiles and apparel will drive the demand for textile chemicals in India. A range of processing aids, dyes & pigments cater to this segment and with increasing demand from both for domestic as well as for export market, demand for textile chemicals is expected to rise.

(v) Personal Care

With growing affluence, Indian consumers are able to spend more on hygiene and personal care products. Increasing consumption is driving demand for wide range of cosmetic chemicals, health care products as well as hygiene products using specialty chemicals, polymers and oleo chemicals. India is also becoming major arm for oleo chemicals derived from organic sources and is participating in the global market. This segment is expected to grow at a rapid pace surpassing the growth of other segments in this sector.

- **Strengths & Opportunities**
  - Specialty chemicals segment has immense growth potential driven by high growing end-use industries
  - Technology & innovation will play vital role in growth of this sector where India has natural advantage of large pool of technical man-power as well as scientists and researchers
- **Challenges & Weaknesses**
  - While chemical industry addresses growing need for materials required by different sectors, the industry employs highly complex manufacturing processes that involve handling of often toxic and hazardous chemicals. The process being energy intensive, the importance of safety, security and environmental protection can not be underestimated
  - The export performance of specialty chemicals so far has been good. However, regulations like REACH may impact export performance

4. Action plan 2012-2017

Based on the above assessment of future demand of specialty chemicals, this industry will reach value of $38 billion by the end of XIIth Five Year Plan. Specialty chemical segment in India is poised for substantial growth and offers immense potential for investment as well as employment generation. It is estimated that additional investment of $ 7-10 billion is feasible in this segment over the XIIth plan period which could generate additional direct employment of quarter of a million people and much more indirect employment.

Segment	FY11 size ($ bn)	End of 12th five year plan
Paints and coatings	3.6	8.2
Specialty polymers	2.3	5.3
Plastics additives	0.9	1.7
Construction chemicals	0.6	1.4
Home care surfactants	1.1	1.7
Textile chemicals	0.8	1.5
Flavors and fragrances	0.4	0.8
Water chemicals	0.6	1.1
Cosmetic chemicals	0.5	0.9
Paper chemicals	0.4	0.9
Printing inks	0.4	0.8
I&I cleaners	0.2	0.5
Rubber chemicals	0.2	0.4
Other segments	5.7	13.2
Total	**18**	38

Given the potential to grow to a $ 38 billion sector in India by 2017, providing a significant boost to the specialty chemicals industry should be one of the most important economic priorities of the government. Following 10 key enablers must be successfully implemented to enable this growth.

1. **Encourage specialty chemical companies to set up plants in the PCPIRs by ensuring land and key feedstock availability**

The Petroleum, Chemicals, and Petrochemicals Investment Regions (PCPIRs) policy is aimed at setting up five industrial parks across India for chemicals and petrochemicals to promote investments in the chemicals sector in India.

- **Demarcate a special zone of 2,500 hectares** (10% of the proposed 250 sq.km area of each PCPIR) to aggregate the feedstock demand in one place.
- **Provide access to Ethylene oxide and mandate stringent manufacturing standards for EO**: The anchor petrochemical tenant in the PCPIR should put up an EO plant to cater to the aggregated demand (25 to 50 per cent of a typical EO plant capacity). The additional EO requirement by the specialty chemical industry by 2020 will be around 260,000 TPA, which could comfortably support 1 to 2 EO plants and/or multiple EOD plants within the PCPIRs. Further, the government should implement stringent manufacturing standards (e.g., BS 5500, ASME VIII, Division 1 and 2, Indian Factories Act, The Static and Mobile Pressure Vessels (Unfired) Rules 1981, etc) to ensure safe usage of EO.

2. **Fund the upfront investment for relevant chemical infrastructure for Greenfield PCPIRs**

   The government should float a Special Purpose Vehicle (SPV) to fund and maintain common infrastructure (e.g., power generation and distribution, effluent treatment) for Greenfield PCPIRs centrally through a public private partnership. The fund size could range from $ 25 million to $ 35 million dollars for each PCPIR, depending on specific infrastructure needed (e.g., size of the central effluent treatment plant needed, utilities, roads). This SPV should also setup and operate R&D parks which can work on exploratory research, process development, optimization, and problem solving, as well as the running pilot-scale projects.

3. **Establish a site operator, with the right functional expertise, to market and manage each PCPIR**

   The site operator will be responsible for establishing comprehensive services and marketing of the site to potential manufacturers to ensure timely participation from companies in the PCPIR. Non-core activities of manufacturers are outsourced to the site operator who becomes the single point of contact for all the

manufacturers' requirements. The site operator could be a joint venture with any of the top 10 EPC players in India and/or any of the experienced global chemical infrastructure service providers (e.g., Infraserv, Currenta, Infracor) who bring relevant functional expertise with them.

4. **Upgrade current chemical universities to cater to the talent shortfall**

   India will need over 14,000 highly skilled, chemical engineers within the next decade to join the specialty chemical industry. A potential short fall of 8,000 to 10,000 chemical engineers is indicated driven by limited talent from Tier 1 universities and lack of attractiveness of the chemical sector to place the talent. To resolve this shortfall, the industry must improve the value proposition for chemical engineers while the Government should work in collaboration with industries to upgrade the current chemical departments in Tier 2 universities to become state-of-the-art departments (in terms of infrastructure, faculty qualifications, industry interaction, and administration).

5. **Upgrade the ITIs to ensure availability of requisite skilled manpower**

   The quality of candidates from chemical ITIs is not satisfactory. The ITIs need to upgrade their infrastructure and industry needs to support ITI students and provide practical job training in these institutes.

6. **Set up a technology up-gradation fund**

   The government should establish a technology up-gradation fund (TUF) that will address specific technology issues faced by the industry (e.g., manufacturing lead-free paints; developing alternatives for phthalate based plasticisers). This fund could be particularly useful for the SME sector to facilitate access to the latest technologies. This will ensure that the Indian specialty chemical industry can be globally competitive and also meet consumer standards.

7. **Launch a 'certification' programme on environmental protection**

   The Central Pollution Control Board (CPCB), the State Pollution Control Board (SPCB), and industry need to put in place the right incentives and disincentives to promote environmental protection within the chemical industry. One approach is to institutionalize a program jointly owned and administered by the industry and the Ministry of Environment and Forests (MoEF), to enable voluntary certification of

units that are environment compliant. To encourage adoption of the program, the government should create the right incentives such as a fast track clearance process (e.g., approvals for expansion) for certified units only.

8. **Establish a specialty chemicals forum to frame relevant consumer standards**

   This forum should have a high-level representation from industry, customer, and government. For example, given India is going to be a small car hub, a "small car forum" could assess use of polymers and recommend consumer standards, incentives to drive innovation, and product safety standards. The forum can also be a means of dialogue to highlight and resolve the primary bottlenecks to growth. This forum should study other countries' regulations and develop consumer standards, define a stable regulatory regime, put in place a strong tracking mechanism, and support technology transfer to existing companies.

9. **Establish India's chemical inventory**

   A chemical inventory is a listing of industrial chemicals manufactured in, or imported by, a country created from information submitted to government authorities by manufacturers, processors, users, and/or importers. The content of the inventory can range from just the CAS numbers and/or names of chemicals, to the amount produced and imported by specific location, to the amounts being used for different purposes. A number of inventories have been compiled by countries including the US, the European Union, Canada, Japan, South Korea, Australia and the Philippines. Such an inventory can allow authorities to maintain an updated overview of chemicals marketed in their country, reveal whether substance manufactured is used within a country or exported therefore the applicability of new research knowledge to the country and identify risk zones to facilitate the setting of risk reduction priorities. Further the inventory can help highlight production trends and increase awareness information transparency on chemicals among the general public and other stakeholders.

   The government should setup a dedicated cell of 5 to 10 competent scientists and chemical engineers to lead this effort along with establishing the relevant funding mechanism, infrastructure (e.g., research laboratories), and a state-wise administrative support (e.g., the US required $2 million to set up their chemical inventory database and $9 million to implement it). To keep the database current,

the government will need to allocate an annual budget (e.g., the US spends $400,000 annually to maintain their database).

10. Set up a steering committee to lead the execution of this agenda

The steering committee should comprise of 5 to 6 members representing the government, industry, and academia. Possible members are the Minister of Chemicals & Petrochemicals, the Secretary of Chemicals & Petrochemicals, members from the planning commission, managing directors from large-scale and small-scale specialty chemical companies, and directors of chemical universities (like Institute of Chemical Technology or any Indian Institute of Technology). The committee should work on a clear agenda to frame the right policy interventions and lead the execution of an agenda which will ensure that the Indian specialty chemical industry reaches global scale by 2020.

Specialty chemicals – Target for XIIth Five Year Plan

The specialty chemical segment has grown at about 11% p.a. over the XIth plan period (FY07 to FY11). The industry is currently valued at $18 billion and is an important growth driver for Indian economy. This segment has the potential to reach $38 billion end of XIIth five year plan period growing at a rate of 13-14%.

C. Chlor Alkali

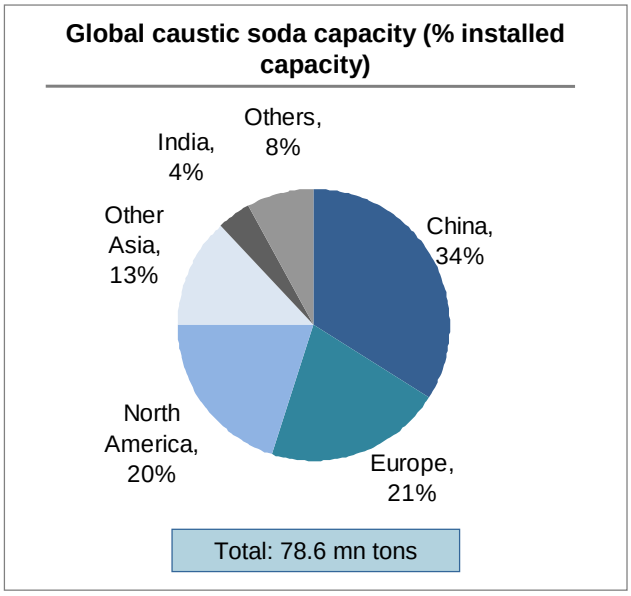
1. Introduction

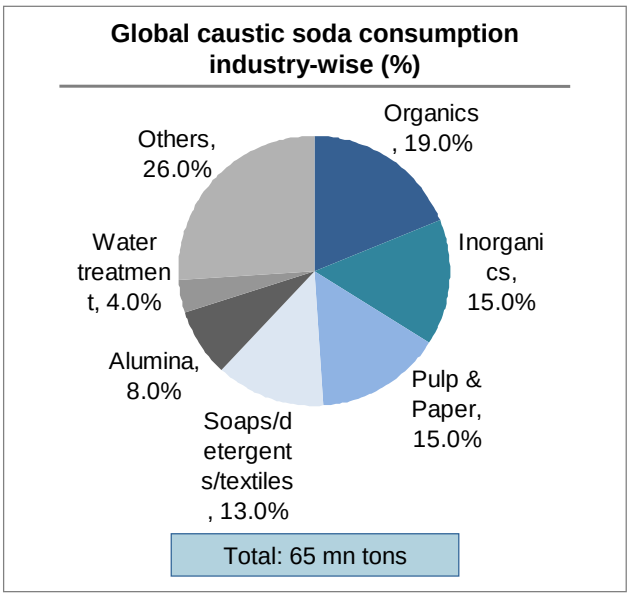
Globally the size of the chlor-alkali industry is 170 million tonnes ($70 billion). The size of the Indian chlor-alkali sector at 7 million tonnes is 4% of world market. The chlor-alkali industry is the oldest and largest segment of the inorganic chemical industry. It comprises of caustic soda, liquid chlorine and soda ash. Caustic soda is used in various applications such as finishing operations in textiles, manufacture of soaps and detergents, alumina, paper and pulp, control of pH (softening) of water, general cleansing and bleaching. The aluminium industry is the biggest demand driver for caustic soda. Chlorine is used in multiple sectors such as manufacture of polymers like PVC, bleaching applications, paper and pulp and textile industry. Soda ash is used as a raw material for a vast number of key downstream industries such as soaps & detergents, glass, silicates, specialty chemicals, etc

2. Caustic soda industry

Global scenario:

China has the highest caustic soda capacity at 27 million tonnes, accounting for 34% of world capacity. North America has a capacity of 15 million tonnes China and Middle East are fast emerging as key production hubs for caustic soda. It is expected that there would not be any significant capacity additions in developed countries like North America and Western Europe, primarily due to unattractive cost structures and flat



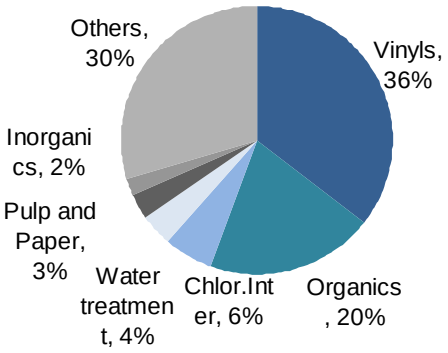


demand.

Current global consumption of caustic soda is estimated at 65 million tonnes. Asia is the largest consumer of caustic soda and is expected to remain the same in near future. Majority of caustic soda is exported from North America, the Middle East and Asia. Australia and Latin America are the leading importers.

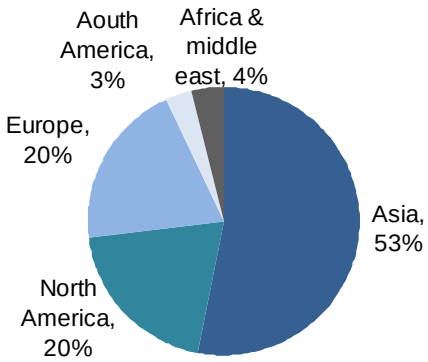
Global consumption of chlorine in 2009 is estimated at 55.4 million tonnes. Chlorine is used in manufacture of paper and pulp, ethylene dichloride (EDC), which is used for producing polyvinyl chloride (PVC), manufacture of chlorinated paraffin wax, fertilizers and pesticides.

Global chlorine consumption industry-wise (%)



Total: 55.4 mn tons

Global chlorine consumption region-wise (%)



Total: 55.4 mn tons

India scenario:

There are 37 manufacturers of caustic soda, having aggregate installed capacity to the extent of 3.246 million tonnes. These plants co-produce chlorine in the ratio of 1:0.89. Today 95% plants are running on state of the art energy efficient membrane cell technology. Rest 5% operating on mercury cell process will also switch over to technology based on membrane cell by 2012. Gujarat is the largest caustic soda producing state with 1.6 million tonnes capacities. Caustic soda manufacturing is highly energy consuming process & consumes 2.5 MW per MT of caustic soda.

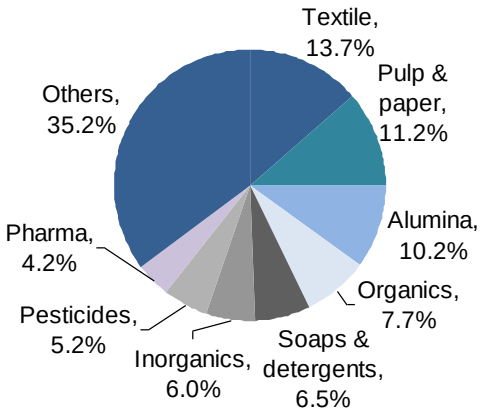
Existing capacity of caustic soda is 3,246 thousand MT and chlorine is 2,876 thousand tonnes. The production of caustic soda and chlorine for the last five years is as under

Thousand tonnes

Year	Installed capacity	Production of Caustic soda	Production of Chlorine
2006-07	2,547.8	1,993.1	1,765.9
2007-08	2,741.8	2,160.3	1,914.0
2008-09	2,923.0	2,198.8	1,948.1
2009-10	3,202.4	2,326.0	2,060.8
2010-11	3,246.3	2,457.6	2,177.4

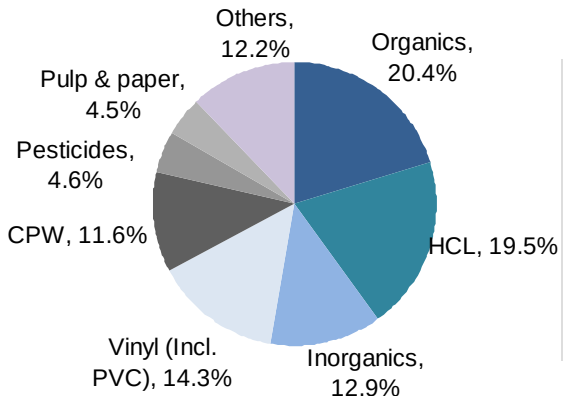
Consumption pattern of caustic soda and chlorine in the country is as follows:

India caustic soda consumption: Industry-wise



- ***Demand from alumina, paper and textiles drives caustic soda industry; these 3 industries alone constitute ~ 60% of total demand***
- ***Indian alumina industry is growing at 10-11% (gearing up to become a world leader), textiles at 12% and paper at 4-5%***

India chlorine consumption: Industry-wise



- ***Major consuming sectors are vinyl, CPW, pulp & paper and chemicals constituting over 80% of demand***
- ***Chlorine use for water treatment needs to be promoted in India to ensure clean, safe drinking water***

Trade:

Imports have increased from 0.14 million tonnes in 2006-07 to 0.186 million tonnes in 2010-11. About 0.27 million tonnes of caustic soda was imported in 2009-10. Exports increased from 52,000 tons to 84,000 tonnes during the same period.

Thousand tonnes

Year	Import	Exports
2006-2007	140	52
2007-2008	172	56
2008-2009	185	66
2009-2010	270	36
2010-2011	186	84

Strengths & opportunities:

- With the shift in emphasis on product innovation, brand building and environmental friendliness, this industry is increasingly moving towards greater customization and customer orientation.
- The key raw material for the industry is salt and India has adequate volumes of this resource.
- Indian industry is mature and developed with over 93% capacity based on latest energy efficient, environment friendly membrane cell technology with a target of having 100% capacity on membrane cell by the year 2012; next only to Japan.
- India has more than adequate capacity to meet domestic demand of both caustic soda & chlorine.
- The trading of energy saving certificates (ESC) under national mission for enhanced energy efficiency (NMEEE) will facilitate the chlorine alkali sector to be more competitive in the domestic as well as in the global market.

Challenges & weaknesses:

- China, with higher scale of production and lower power tariff makes has globally competitive production cost compared to India and poses threat to the Indian business

- The industry needs to significantly strengthen its technical capabilities and marketing acumen to be globally competitive.
- Chlorine is produced as a co-product of caustic soda. Unlike global market chlorine demand is not yet developed in India. Chlorine usage in India for PVC is limited by lack of production/ availability of merchant ethylene. Since chlorine is hazardous, storing, disposing and transporting excess chlorine creates an issue.
- Industry was rendered uncompetitive recently due to sudden surge in imports as interim safeguard duty, imposed by Government from 04.12.09 to 03.03.10 (for 3 months) has not been extended.
- Grid power cost in India is one of the highest, ranging from Rs. 3.85 to Rs. 6.0 as compared to Rs. 0.8 in Middle East, Rs. 2.25 in USA and Rs. 1.98 in Europe.
    - Though most plants (~80%) have installed captive power plants, heavy investment in captive power capacity was rendered futile due to high taxation (electricity duty & cess) on captive power (as high as Rs. 0.4 per kwh) which are non-VATable

3. Soda ash

Introduction

Soda Ash is an important inorganic chemical and constitutes one of the vital industry segments of the Indian Chemical industry. It is used as a raw material for a vast number of key downstream industries such as soaps, detergents, glass, silicate, specialty chemicals. Increasingly it is being applied for climate change mitigation and environmental management applications such as flue-gas desulphurization and mitigating the impact of acid rain on inland water bodies.

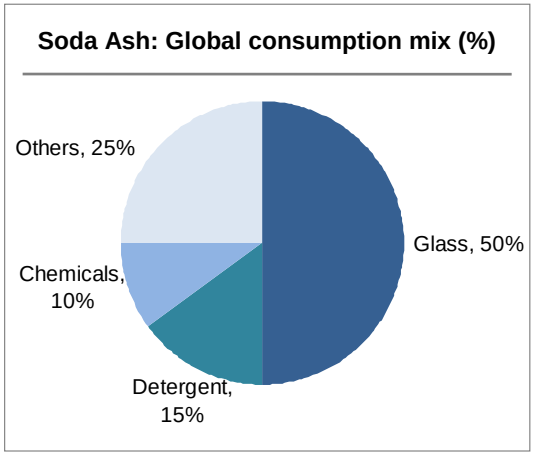
Global scenario

Worldwide consumption of soda ash is estimated at 48 million tonnes. Soda ash is produced through Solvey Process and also available naturally in mines. Natural and synthetic are two methods of soda ash production. Of the total production, natural soda ash accounted for 11.7 million tonnes.

The US accounts for over 92.3% of global natural soda ash production of 11.7 million tonnes. The country has world's largest trona deposit in the Green River basin.

The global soda ash capacity is estimated to be 60 million tonnes in FY11. China and US are the biggest soda ash producing countries accounting for 40% and 20% of the total global soda ash capacity respectively. With a capacity of 3.16 million tonnes, India accounts for 5.3% of the total global capacity.

Globally, majority of soda ash is used in the glass industry which accounts for 50% of the global soda ash consumption. Chemicals and detergents are other major end uses, accounting for 10% and 15% of global soda ash consumption respectively. Soda ash can also replace caustic soda in certain industries like pulp and paper, water treatment and certain sectors in chemicals.

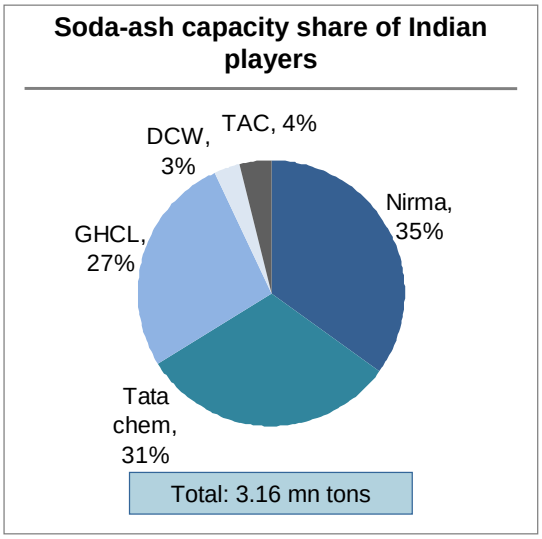


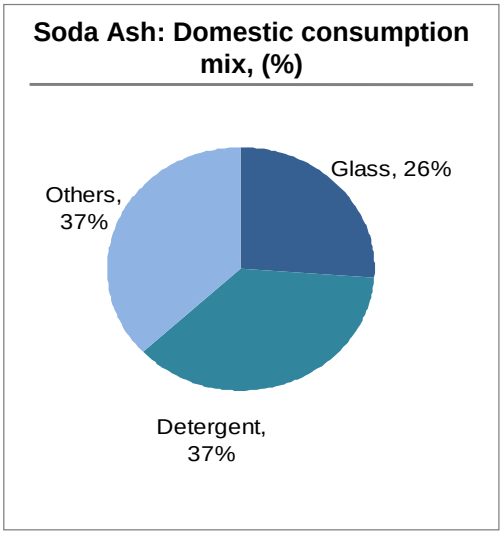
Indian scenario

Demand & supply

There are five manufacturers of soda ash in India, having installed capacity to the extent of 3.16 million tonnes. Of these, four are located in the Saurashtra region of Gujarat. Only Tuticorin Alkalis and Chemicals (TAC) is located at Tuticorin in Tamil Nadu. The main reason for concentration of soda ash facilities in Gujarat is the availability of key raw materials: salt and limestone. Two varieties of soda ash are produced in India; light soda ash (used mainly by the detergent industry) and dense soda ash (used mainly in the glass industry).

Domestic soda ash capacity and consumption is as under.



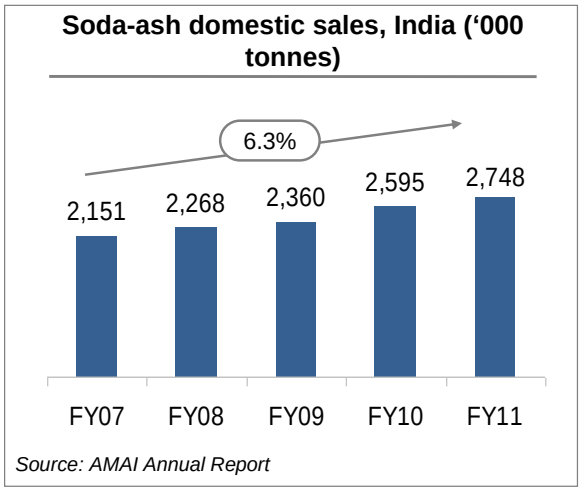


The production of soda ash achieved by these units is as follows:

Thousand tonnes

Year	Installed capacity	Production of Soda ash
2006-07	2,993.7	2,046.9
2007-08	3,078.7	2,024.7
2008-09	3,078.7	2,129.0
2009-10	3,078.7	2,147.2
2010-11	3,161.0	2,424.6

Over the period 2006-07 to 2010-11, demand for soda ash in India has grown at a CAGR of about 6.3%. Rising urbanization, increase in per capita income and increased levels of middle class prosperity has fueled the growth of the detergents and glass sectors. This demand growth is projected to continue through the XIIth Plan period.



Soda ash demand in India is dominated by the detergent and glass industries. While detergents represent the largest end-user segment glass and especially float glass is the fastest growing segment.

Trade

During the XIth Plan period, India witnessed a sharp increase in imports of soda ash.

Thousand tonnes

Year	Import	Exports
2006-2007	284.00	185.94
2007-2008	394.87	144.85
2008-2009	420.26	158.98
2009-2010	662.64	251.63
2010-2011	560.86	186.23

About 560,000 tons were imported in 2010-11 compared to about 284,000 tons in 2006-07. During 2008-09, India was the third largest destination for Chinese soda ash exports. Till April 19, 2011, the Government of India had imposed safeguard duty on import of Chinese soda ash. While soda ash demand increased at 6.3% per annum during the period 2006-07 to 2010-11, imports increased at ~ 18% p.a. As a result, the domestic players lost significant market share.

Strengths & opportunities

- Indian soda ash Industry includes world leaders like Tata Chemicals - world's 2nd largest producer with 5.5 million tons of capacity spread across India, USA, Kenya & U.K.

- Industry has more than adequate capacity to meet entire domestic demand & has been consistently exporting.
- Outlook for industry remains strong with end user industries continuing to grow (glass: 10-12%, detergents: 5%, picture tubes: 10%, bulbs & tubes: 7%). These four sectors account for almost 74% of demand.

Challenges & weaknesses

- China, with higher scale of production and lower power tariff, poses a threat to the Indian manufacturing units
- Recently, the industry was badly hit by a sudden surge in imports at dumping prices from China, EU, Turkey, Pakistan etc making Government support through safeguard/ ADD imposition necessary.
- Production is concentrated in Gujarat due to proximity to raw material i.e. salt & limestone. Most end use industry of soda ash is located in southern or eastern region. This leads to high logistics costs

4. Employment

Chlor-alkali sector provides direct & indirect employment to about 1.5 lakh people. Nearly 50,000 people including contract labour work in the units manufacturing caustic soda and soda ash plants. In the XIIth Five Year Plan, the industry envisages employment increase to the extent of 5%.

5. Action plan 2012-2017

Indian soda ash demand is expected to reach ~3.6 million tonnes by FY17. Accordingly, the industry can target a capacity of ~3.6 million tonnes (from current capacity of 3.161 million tonnes) by the end of the XIIth five year plan to ensure self sufficiency. Similarly Caustic soda demand is expected to reach ~ 4 million tonnes. A domestic caustic soda capacity of ~4 million tonnes (from current capacity of 3.246 million tonnes) should be targeted for the XIIth plan period. To facilitate the accomplishment of this aspirational capacity, the government and industry will have to collaboratively work towards implementing the following action items

- Government policy to encourage crackers/ petrochemical complexes to produce ethylene can help boost/ double chlorine consumption.

- Central government could develop a policy guideline on level of cess on electricity and captive power generation & also VAT for such duties and taxes.
- Government support/policy of allocation of coal blocks on priority basis & long term lease for limestone essential to ensure raw-material availability. Also as per Coal Distribution Policy released in October 2007, CPPs should be grouped with IPPs for coal prices
- Controlled coastal shipping leads to higher shipping costs from Gujarat. Government should promote coastal shipping, inland waterways as an alternatives
- Govt. support is required in enhanced allocation of railway rakes to soda ash industry on a priority basis
- Government should explore removal of sea-water cess, which is used only for cooling
- Government could relook at pricing/ export ban to ensure naphtha is available locally at international prices
- Govt. to give fillip to chlorine molecule – promote development of value added Chlorine based chemicals. If India has sufficient chlorine demand, caustic would be cheaper. Plastics, PVC sector has to be looked afresh with focus on chlorine molecule. Govt. support is required for promoting usage of Chlorine for water treatment as is accepted in other countries based on WHO recommendations
- R&D for hydrogen cell to be encouraged to promote hydrogen usage
- Facilitate open-access & inter-state wheeling of power; especially for power intensive industry such as chlor-alkali
- Facilitate R&D towards development & commercialization of non-conventional and renewable energy sources
- Reward innovations in all areas across energy management, waste minimization, recycling, reuse & reduction in the overall energy footprint of industries
- Government should retain safeguards/ anti dumping duty on soda ash and caustic soda
- Government should reduce import duty to NIL on inputs used in producing power such as coal, furnace oil, naphtha, gas and allow 100% CENVAT credit on all

inputs entering factory gates (currently confined to only those inputs used directly in manufacturing)

- Cement industry is given mining rights for limestone but not soda ash industry. Government should allot chemical grade limestone mining rights for soda ash industry
- Govt. should allow long term leased lands for salt fields & measures for increasing yield of salt & producing quality salt for chlor-alkali industry should be taken. Rationalization of ground rent for salt works & quantitative restrictions on export of salt required
- The industry is dependent on imported membranes. It may carry out R&D and develop electrolytic membrane locally in order to substitute these imports and reduce cost of production. Import duty can be reduced to 2.5% on spares required for existing membrane cell plants, at par with the duty on membranes
- Indian ports need to be improved on PPP model to facilitate cost effective and safe coastal movements to transport raw materials & feedstock

Target for XIIth Five Year Plan

Chlor alkali is the oldest and largest segment of the chemical industry. The production of caustic soda and chlorine grew at a rate of 5.4% over the XIth five year plan period. Production is targeted to grow at 8.1% p.a. over the XIIth plan period to keep up with demand growth. The growth in production of soda ash was 4.3% during the XIth five year plan and is expected to grow at 7% during XIIth five year plan period. Overall, chlor-alkali production is targeted to grow at 8% p.a. over the next five years.

India's soda ash demand is expected to reach 3.6 million tonnes by FY17. Accordingly, the industry can target a capacity of 3.6 million tonnes (from current capacity of 3.161 million tonnes) by the end of the XIIth five year plan to ensure self-sufficiency. Similarly caustic soda demand is expected to reach 4.0 million tonnes. A domestic caustic soda capacity of 4.0 million tonnes (from current capacity of 3.246 million tonnes) should be targeted for the XIIth plan period. This implies a capacity growth of 3% p.a. over the XIIth five year plan to meet the targets.

D. Pesticides

1. Introduction

Agriculture is an important sector of the Indian economy and vital for the food and nutritional security of the nation. Ensuring food security for more than 1 billion Indians with diminishing cultivable land resources is a herculean task. This necessitates use of high yielding variety of seeds, balanced use of fertilizers, judicious use of quality pesticides along with education of farmers and use of modern farming techniques. In order to meet the needs of a growing population, agricultural production and protection technology have to play a crucial role. Substantial food production is lost due to insect pests, plant pathogens, weeds, rodents, birds, nematodes and during storage.

Pesticides industry has developed substantially and has contributed significantly towards India's agriculture and public health. In value terms the size of the Indian pesticide industry is $3.8 billion in the year 2011. India is a predominant exporter of pesticides to USA, Europe and African countries.

Today, the domestic industry is characterized by over-capacity, low capacity utilization and unsustainable levels of production from many units and low investments in R&D. Besides, the formulation market is highly fragmented with large number of small formulators. Globally, there is a growing trend towards low dosage, high potency molecules and as such, market for usage of high volume pesticides is declining.

With the advent of the integrated pest management (IPM) technique, the use of bio pesticides and genetically modified (GM) seeds has increased globally.

2. Global Scenario

Global generic market of pesticides was $45 billion. Export opportunities for Indian companies are immense with key markets being USA, France, Netherlands, South Africa, Bangladesh.

3. Indian Scenario

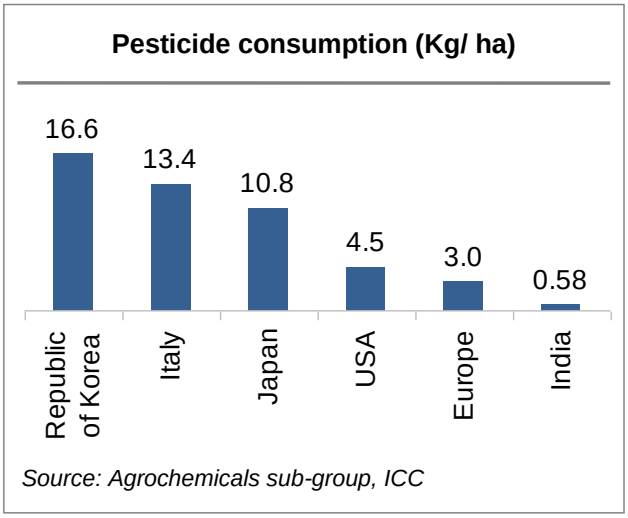
India is the 4th largest producer of pesticides after USA, Japan and China. India is the second largest producer of pesticides in Asia. The Indian pesticides industry has been growing at 8-9% p.a. over the past five years (FY07-FY11). Industry size is estimated to be $3.8 billion in FY11 with exports accounting for 50% of the market. Over the XIIth

plan period, the segment is expected to grow at 12-13% p.a. with domestic demand growing at 8-9% p.a. and export demand at 15-16% p.a. Three broad categories of companies are present in the industry - Multi-National, Indian including the public sector companies and small sector units. There are about 125 technical grade pesticides manufacturers in the country of which about 60 are in the organized sector, and 10 are, multinationals. There are about 800 pesticides formulators in the country. Most Indian technical manufacturers are focused on off-patent pesticides.

- **Demand and supply**

The Indian pesticides industry is characterized by low capacity utilization. The present total installed capacity is 146,000 tonnes and has a low capacity utilization of <60%. The industry suffers from high inventory owing to seasonal and irregular demand on account of monsoons. The consumption of pesticides in India is low in comparison to other countries. There is a marked difference in the consumption pattern of pesticides in India vis-à-vis the rest of the world. Insecticides account for 76% of the total domestic market. On the other hand, herbicides and fungicides have a significantly higher share in the global market. Crops like cotton, wheat and rice together account for 70% of total agrochemical consumption.

The consumption of pesticides in India is low in comparison to other countries. The consumption pattern of pesticides, as available from Agrochemicals Sub-Group of Indian Chemical Council, is as under.



Source: Agrochemicals sub-group, ICC

- **Employment**

  Pesticides manufacturing sector provides direct and indirect employment to approximately 60,000 people, nearly 10,000 of these working in pesticides manufacturing units. In the XIIth five year plan, the industry envisages employment increase to the extent of 7%.

- **Trade**

  India is a net exporter of pesticides. Exports account for ~50% of the pesticides market. Indian exports of pesticides grew at ~ 15% p.a. during the XIth plan period and will continue to grow at the same rate during the XIIth 5 year plan period. The key export destination markets are USA, France, Netherlands, Belgium, Spain, South Africa, Bangladesh, Malaysia and Singapore. Some of the agro-chemicals exported over the years include Isoproturon, Endosulphan, Aluminium Phosphide, Mancozeb, Cypermethrin, Thiomethaxam, Imidacloprid etc.

- **Strengths & Opportunities**

  - **Cost competitiveness:** But for taxes and levies, Indian producers can make available the product at the cheapest price available in the world. Low cost manufacturing base leads to competitive cost of production of pesticides especially Pyrethroids, Organo Phosphorous (OP) Ester etc.
  - **Huge export potential:** The excess production capacity is a perfect opportunity to increase exports by utilizing India's low cost producer status
  - **Growth in demand for food grains:** India has 16% of the world's population and less than 2% of the total landmass. Increasing population and high emphasis on achieving food grain self sufficiency is expected to increase growth of pesticides industry
  - **Limited farmland availability:** India has more than 190 million hectares of gross cultivated area and scope of bringing new areas under cultivation is severely limited. Available agriculture land per capita has been reducing globally and is expected to reduce further. The pressure is therefore to increase yield per hectare which can be achieved through increased usage of pesticides
  - **Growth of horticulture & floriculture:** Growing horticulture and floriculture industries will result in increasing demand for pesticides especially fungicides

- **Increasing awareness:** There is loss of crops due to non-use of pesticides. Companies are increasingly training farmers regarding right use of pesticides in terms of quantity to be used, the right application methodology and appropriate chemicals to be used for identified pest problems. With increasing awareness, the use of pesticides is expected to increase.
- **Patent expiry:** In the year 2014, many molecules are likely to go off patent throwing the market open for generic players. Pesticides industry in India can exploit this opportunity
- **Product portfolio expansion:** Threats like genetically modified seeds, integrated pest management (IPM), organic farming etc can be turned into opportunities if the industry re-orients itself to better address the needs of its consumers and broadens its product offering to include a range of agri-inputs instead of only pesticides
- **Environment friendly pesticides:** The issue of monitoring of pesticide residues in food and agricultural commodities will occupy an important position both in domestic sale and export of agro based products. There will be a gradual shift towards pesticides that are user and environmental friendly.
- **R&D in pesticides:** Prior to 2005, i.e. in the process patent regime, Indian companies concentrated on marketing generic and off patent products. Due to this, the R&D expenditure by Indian companies was lower at approximately 1% of turnover. Global companies focused on high end specialty products and dominated the market for patent new molecules and globally, pesticides companies spend 8-10% of their turn over on R&D. However, with the onset of the product patent regime in India, the Indian companies will need to increase R&D expenditure to meet competition from global market. Alternatively Indian companies can also be competitive in the area of Contract Research and Manufacturing Services (CRAMS).

- **Challenges & Weaknesses**
  - **High cost of power & finance:** Very high cost of power, unreliability of supply and frequent interruption with high transmission and distribution losses. Chemical industry is highly capital-intensive and high cost of finance in India is a challenge (interest rate 14%-15% p.a. as compared to 2% to 6% prevailing in developed countries)

- **Infrastructure:** Poor transport and communications infrastructure, resulting in delays and slow movement of goods
- **Scale of production:** The plant sizes are not comparable to world-scale operations effecting to cost of production.
- **Labour laws:** Labour laws at present do not allow flexibility in deployment of labour. This discourages modernization and investment in technological changes and eventually leads to industrial sickness, thus adversely affecting workers as well
- Cumbersome and complicated product development process from inception to registration to manufacture, formulation and sale
- Luke warm response of Centre and State Governments in strengthening quality control enforcement
- In comparison to other agriculture inputs like fertilizers (50% subsidy) and seeds (no excise duty and taxes), **pesticides are excisable and multipoint taxable**
- **R&D costs:** R&D to develop a new agrochemical molecule takes an average of 9 years and high cost on research. Indian companies have to focus on developing newer molecules and will face challenges in building these capabilities.
- **Threat from Genetically Modified (GM) seeds:** Genetically modified seeds possess self immunity towards natural adversaries which have the impact on the business of pesticides
- **Need for efficient distribution systems:** Since the number of end users is large and widespread, effective distribution via retailers is essential to ensure product availability. Lately companies have been directly dealing with retailers by cutting the distributor from the value chain thereby reducing distribution costs, educating retailers on product usage and offering competitive price to farmers
- **Support for Integrated Pest Management (IPM) & rising demand for Organic farming:** Promotion of IPM and usage of bio-pesticides is gaining momentum. With increasing demand for organic food, farmers have reduced chemical usage and have adopted organic farming. Agrochemical companies will have to tackle the rising environment awareness and address concerns on negative impact of pesticide usage

- **Counterfeit products:** The spurious pesticides market has a negative impact on the organized sector revenues and farmers

4. Action plan 2012-2017

Based on the export potential and potential for increased penetration in the domestic market, the Indian agrochemical industry can target a size of $7.7 billion by FY17 (up from existing $3.8 billion). However, achieving this target will require governmental support and the industry initiative with regard to the following aspects:

1. **Registration of pesticides:** Delay in getting product registrations leads to delay in exports, hampering India's exports. The procedure should be simplified and time bound registration and issue of registration certificate for export within 30 days from receipt of request from exporter/ manufacturer should be ensured. Efficiency of Central Insecticides Board & Registration Committee should be increased by bringing more transparency, implementing robust and secured online data submission
2. **Multiple governing authorities for crop protection**, e.g. pesticides comes under Dept. of Chemicals and Petrochemicals, Ministry of Agriculture and Ministry of Health & Family Welfare. These activities falling under different ministries should be merged. Government could explore setting up a separate division under Dept. of Chemicals & Petrochemicals which could deal with all the issues such as pesticide registration, its use, fixation of standards for residue in food chain etc.
3. **Environmental clearance should be speed up** through single window clearance for setting up pesticides manufacturing plants. Once a factory is cleared from the environment point of view, any product changes (within selected parameters) could be allowed without seeking additional clearances.
4. **Ambivalence prevails about the use of pesticides.** There is need to pro-actively educate farmers for the safe, appropriate and judicious use of pesticides. A clear national policy directive is needed to increase pesticide usage, as at present the coverage is only about 20% of cultivated areas resulting 10 to 30% crop loss due to pests and weeds
5. **Spurious pesticides:** The presence of spurious pesticides in the market is major problem. The problem can be tackled by adopting the following approach:

a. Improve the method of sampling, and make the inspectors accountable
b. Pesticide testing labs need to be upgraded and should be mandated to seek accreditation from NABL (National Accreditation Board for Laboratories) i.e. ISO 17025 certification
c. Industry members or independent quasi-government agencies should be allowed to undertake surprise visits to these labs
d. A joint analysis of samples through an independent laboratory which is accredited by NABL should be considered
e. Insecticides Act, 1968 should be reviewed and amended for any loopholes that can be exploited to support spurious pesticide manufacturers

6. **Recognize pesticides as a knowledge based industry:** The pesticides industry is to be provided the same support as pharmaceuticals. This would support investment in R&D
7. **Budgetary support to pesticides industry:** Considering crop losses due to pests, weeds and diseases, there is urgent need for the following budgetary support:
    a. The pesticide industry is to be treated equal to fertilizer industry and the government to reduce central excise duty from the present 10% to 4%. This will reduce costs, resulting in increased usage of plant protection chemicals to reduce crop losses
    b. Section 35(2AB) of the Income Tax Act should be amended to provide weighted deduction of expenses for the following:
        i. Agriculture extension work such as undertaking demonstration and training to farmer and all expenses connected thereto
        ii. Development, upkeep and use of agricultural web sites
        iii. Undertaking of R&D work in-house or through agricultural universities or reputed research organizations
        iv. Farmer meetings for sharing best practices and their familiarization tours for education and training
        v. Fees & expenses paid to experts for dissemination of information and best practices to farmers/ users
        vi. Knowledge dissemination through media or otherwise

c. All agricultural inputs should be treated as far as taxes, levies and subsidies are concerned, at par.
d. Government should consider and allocate funds for educating end users/ farmers for the benefit of pest control and also safe and judicious use of pesticides
e. Government should encourage latest technology adoption measures among farmers and create farmer panels for key crops across India

8. To ensure better adherence to Safety Health & Environment (SHE) and Good Manufacturing Practices (GMP) norms for crop protection, Government should make efforts to guide SMEs

Target for XIIth Five Year Plan

The Indian pesticides industry grew at a rate of 8-9% over the past five years (FY07-FY11). Industry size is estimated to be $3.8 billion in FY11 with exports accounting for ~50% of the market. Over the XIIth plan period, the segment is expected to grow at 12-13% p.a. with domestic demand growing at 8-9% p.a. and export demand growing at 15-16% p.a. Based on the export potential and potential for increased penetration in the domestic market, the Indian agrochemical industry target a size of US $7.7 billion by FY17.

E. Dyestuffs

1. Introduction

Colors are an integral part of human perception and life. Much before the invention of synthetic dyestuffs, natural and vegetable colors were in use in India for centuries. Perkin's development of the 1st synthetic dye in 1856 led to the birth of European dyestuffs industry and use of synthetic dyes widely extended to all textile substrates. The well-developed textile industry in India soon started use of synthetic dyes and depended on imported organic dyestuffs till 40's. The start up of Arlabs Ltd. (the 1st dyestuffs company) in 1940, followed by other dyestuffs companies in 50's and 60's led to the establishment of the indigenous industry. In the development phase that followed subsequently, India slowly emerged as the supplier of dyestuffs and

intermediates, particularly in reactive, acid, direct and VAT dyes and some key intermediates.

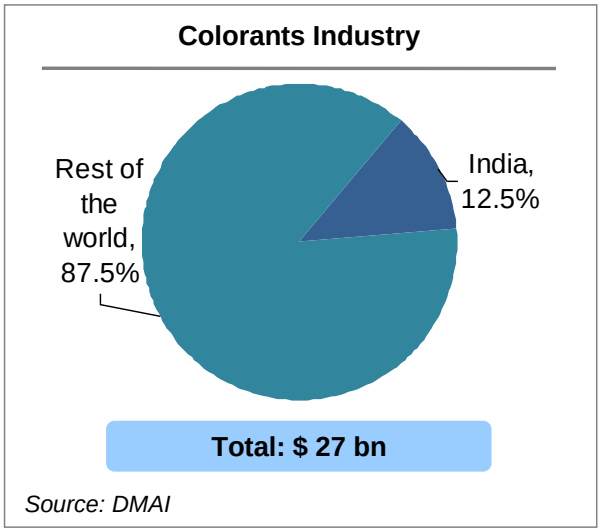
Color adds to the very existence and intrinsic value of human tribe. Synthetic dyes contribute heavily for the use of color. Color has an inherent element of value addition to a wide variety of products like textiles, leather, paper, food products, cosmetics, plastics, paints, inks and high-tech applications like optical data storage (CDs, DVDs), solar cells, medical diagnostics (CT Scan, angiography), security inks, lasers, photo dynamics etc.

The basic raw materials used for the manufacture of dyestuffs are benzene, toluene, xylene and naphthalene (BTXN). The technology employed by the dyes sector has been well received in the international market. Some of the units have established joint ventures abroad using their indigenous technology. The per capita consumption of dyes in India is 50 gms as compared to 400 gms in Europe, 300 gms in Japan which shows that there is tremendous potential for the Indian market to absorb additional production.

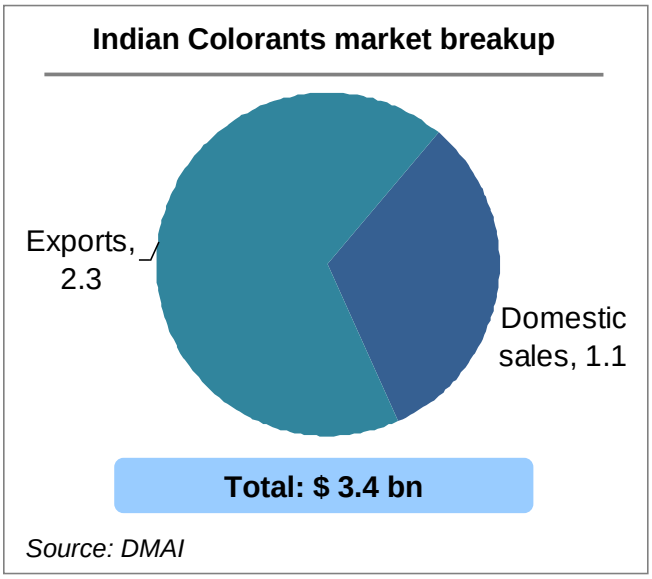
2. Global Scenario

Considerable efforts have been put in by industry and academia on a continuous basis to deliver colorants with green environment. The need for high performance products has been to a great extent crystallized. There is also a noticeable trend in the world market with regard to colour solution approach to counter commoditization with the advent of technological innovations.

The world market for colorants comprising dyes, pigments and intermediates is presently estimated at approximate value of $27 billion. During the last decade, the industry was growing at an average growth of 2-3% per annum. Whereas other countries in the world market contribute nearly 87.5% of the global share, India accounts for 12.5%. Size of the Indian colorants industry is $3.4 billion in FY10 with exports accounting for ~68%.



There has been a notable transition in the global arena during the last 2-3 decades in the manufacturing base of colorants, with a shift in production from Europe, USA and Japan to Asia viz. China, India, Taiwan, Thailand and Indonesia etc. With decline in production in



most of the traditional centers, non-traditional centers like India and China are now preferred sources for supply of colorants to the global market.

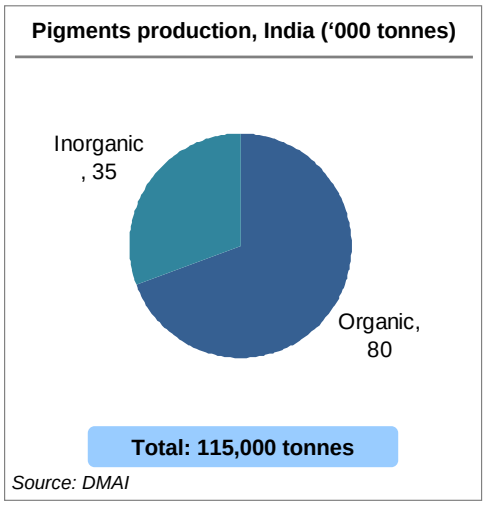
Preference for eco-friendly products has additionally cast responsibility on the industry to be more selective and improve the product range with greater focus on R&D. This would ensure quality and performance colorants to suit the market expectations.

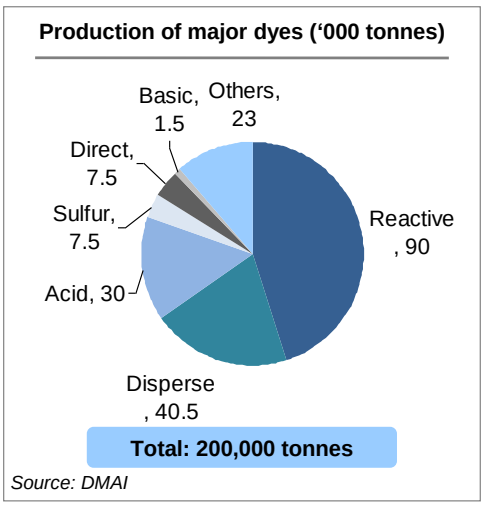
3. Indian Scenario

Today, Indian dyestuffs industry comprises about 950 units (50 in large and organized sector and 900 units under Small & Medium Enterprises (SME) Sector). The industry has grown at ~10% p.a. between FY06 and FY10 with exports growth at 14.5% p.a.

- **Demand and supply**

The overall production capacity of dyestuffs is 200,000 tonnes per annum. With the ever increasing standards of quality and reliability, Indian dyestuffs industry meets





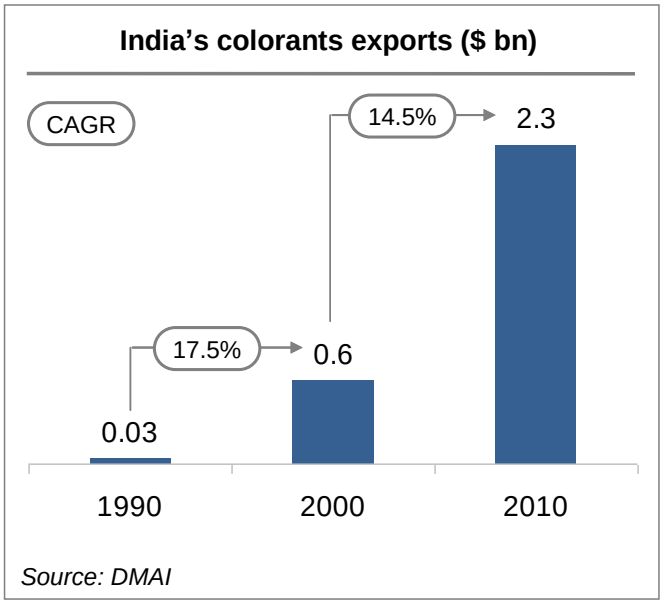
more than 95% of the domestic requirement, out of which textile industry consumes nearly 60% and the remaining is shared by paper, leather & other consumer industries. As far as pigments are concerned, the market size is 115,000 tonnes. The main consumer industries are printing inks, paints, plastics, rubber, etc., accounting for 70% of the end use.

Whereas many of the plants all over the world are very large size, there are many SME units in India, which are capable of producing quality colorants. Gujarat and Maharashtra account for nearly 95% of the colorant production in the country.

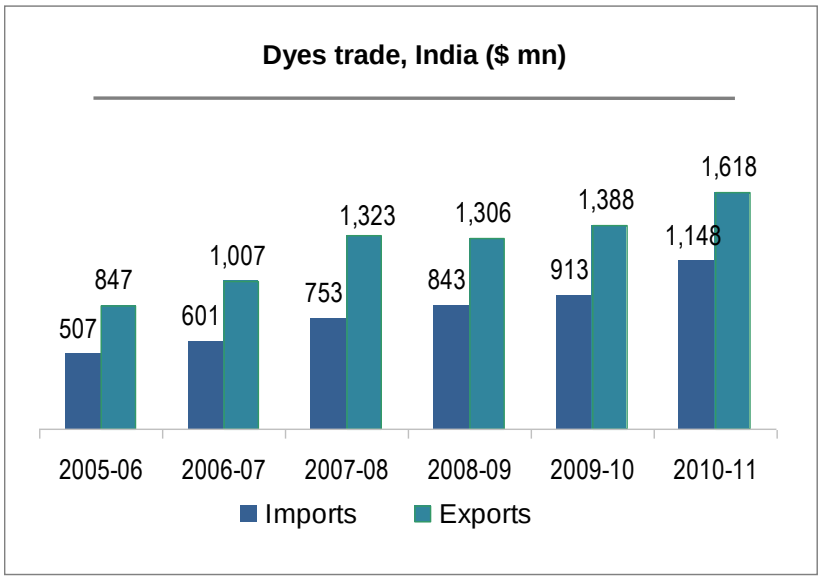
- **Employment**

The industry provides employment to ~ 100,000 people. During the XIIth five year plan, the industry will require 15,000 additional chemistry graduates to join the workforce.

- **Trade**



There has been remarkable growth in the exports of colorants during the last 2 decades. From a mere $0.03 billion in 1990, exports reached $2.3 billion in 2009-2010, having surpassed the estimates envisaged in the ten year strategic action plans submitted in 1991 and 2001. During the last decade, the industry achieved a growth of 14.5% p.a. Exports are estimated to grow to $4.9 billion by 2017. Import & export of



dyes for the past five years is shown in the chart.

- **Strengths & Opportunities**
  - Some consolidated units are world class capacity plants

- Ready availability of main feedstock except naphthalene and toluene
- High degree of entrepreneurship
- Rich market potential
- Matured chemical industry
- Proven chemical process and technologies
- Potential for technology up-gradation to provide value added products
- Developed countries are looking at outsourcing dye production to developing countries, as production facilities shift base to Asian countries like India and China

- **Challenges & Weaknesses**
  - **Low per capita consumption:** Per capita consumption of colorants is only a meager 50 gm vis-à-vis the world average of 250 gm
  - **Infrastructural challenges**
    - **Land:** There is a lack of ideal, dedicated and adequate availability of land at suitable locations. Dyes clusters need to be allocated specific land in PCPIRs
    - **Water:** Inadequate availability of water is a limiting factor as water is an important component in the manufacturing of colorants
    - **Power & Fuel:** Availability of power is inadequate and cost is very high. Various Government duties and levies add to the cost substantially
    - **Logistics:** Unavailability of good quality roads with excellent connectivity is a severe constraint. Port facilities and long turnaround time affect efficiency and competitiveness of the colorant industry
  - **Lack of innovation:** Spending on research & development (R&D) is the lowest by India's colorant industry. For a nation aspiring to be a major manufacturing centre for colorants, there is an urgent need to increase R&D activities.
  - **Availability of feedstock:** Availability of feedstock like naphthalene and toluene is very poor. The industry is import dependent for many dye-intermediates
  - **Availability of human resources:** There is a shortage of skilled manpower for the colorants industry

- **Environmental concerns:** Though there are other industries, which are equally or more polluting, colorant industry is considered to be the most polluting due to visibility of color. Poor image due to wrong public perception is affecting the industry. The existing effluent discharge norms need to be re-evaluated
- **Cost of finance:** To have a competitive edge, colorant industry should be provided with adequate working capital and term finance for supplementing machinery & modernization etc., at low rate of interest by banks and financial institutions. Export finance should be made available at concessional rates. There is also an urgent need for review for reduction in the service charges levied by the banks
- **REACH:** The registration cost is exorbitantly high thereby hampering in the process of acceleration of exports of chemicals from India to EU countries and is acting as a non-tariff barrier
- There is also the challenge of several small and medium sized units with outdated technology

4. Action plan 2012-2017

1. **Market development:** To promote exports, efforts need to be made to improve contacts with trading centers in Asia, Europe, South Africa and Latin America as they are a vital link between the supplier and the local consumers. Both the industry and govt. can play a vital role in promoting Indian products as a brand 'Made in India' by conducting events for increasing awareness among foreign buyers. Exhibitions and buyer-seller meets promote world trade to a great extent. India Chem, Chemspec and China Interdye, which are organized regularly, are helping bring the global trading community under one roof, substantially improving business possibilities. The Dyestuffs Manufacturers' Association of India has joined hands with China Dyestuffs Industry Association to organize Interdye Asia in India and other Southeast Asian countries, the first exhibition taking place in Ahmedabad in December 2011. Trade delegations are an integral part of global trade. It is of paramount importance to send delegations abroad to get better understanding of the markets and assess export potential. Continuous support from the Govt. in these market development activities is essential to realize exports targets

2. **Low emphasis on colorants industry:** Govt. could declare dyes industry as a "focus" industry & make financial allocation under MDI scheme of Department of Commerce
3. **Infrastructure**
    a. **Land:** There is a lack of ideal, dedicated and adequate availability of land. The estimated additional land required to meet aspirational target is about 4,000 hectares. Land is also required for setting up effluent treatment plants. State Governments should develop "Dyes Parks" with specified land & infrastructure.
    b. **Water:** On an average about 50,000 litres of water is required to process 1 ton of colorant. The estimated water requirement to meet aspirational target is about 150 mn litres per day. Alternate source of water availability needs to be explored
    c. **Power & fuel:** All the levies and duties on power supply should be CENVATABLE since power is part of manufacturing cost. Fuel prices for furnace oil, LDO are very high. Supply of gas should be augmented for the industry
    d. **Manpower:** Industry is already facing scarcity of skilled and trained manpower. Colorant industry will require about 15,000 additional chemistry graduates by the end of XIIth Five Year Plan period. Besides, thousands of operators and other skilled personnel will also be required. Additional institutes like Institute of Chemical Technology (ICT), Mumbai, M.S. University, Baroda and Institutes like ITIs should be set up in Gujarat and Maharashtra. B.Sc. in color chemistry course can be offered in the existing colleges/ universities
    e. **Facilitate ease of doing business:** There are several bottle necks in customs formalities, various permissions, income tax, sales tax, service tax and central excise formalities and assessments. These hurdles have to be removed to save time and cost.
4. **Technical up-gradation:** Technology up-gradation is the need of the hour for improving existing products, invent new products and for better technology for treatment of effluents. Concern for Safety, Health and Environment is ever increasing. Besides, customer requirement in terms of various quality parameters is rising. There is also a need to conserve and make optimum use

of natural resources, adopt energy saving measures etc. The need for Research & Development (R&D) in these fields is of paramount importance. Government support is required in the form of setting up dedicated fund to incentivise R&D activities by the industry and educational institutes. Availability of UNIDO funds should be explored. Further, 200% depreciation on investments in R&D, allowing duty free import of laboratory equipments, sponsoring international and national seminars on exchange of information on latest technology developments etc. are other areas of Government support

5. **Labour laws:** Govt. should look at the labour laws of developed countries with hire and fire policy, but with very high wages and very low rate of unemployment. The present labour laws de-motivate the labour from improving efficiency and getting adequately trained, at the cost of productivity. Besides, they hinder industrial growth and thereby employment growth, since employers are reluctant to employ more labour. Reforming and introducing liberal labour laws will fasten the industrial growth and improve corporate earnings leading to more revenues to the Government and more income in the hands of labour. At the same time, a balanced adequate social security scheme should be put in place.
6. **Environment Policy:** The dyestuffs, pigments and intermediates industry in India is committed to protect the environment from the hazards of pollution and it is unanimous in its approach to manufacture products responsibly in an effort to safeguard the environment for the future generations. The industry however feels that the norms imposed are arbitrary, unreasonably stringent and without adopting a scientific method to arrive at the compliance limits. Even world class cities like Tokyo, Japan allow for more relaxed norms for effluent discharge within their city limits.

   The most immediate and urgent attention of the government is required in the granting of permission for product change-over and to expand capacity. Provisions for change of product range do exist in the current law but it is an extremely complicated and lengthy process. The process needs to be made more conducive for the industry. An independent study be conducted by the Government to study the achievable norms taking into consideration the norms adopted by other countries in the world

7. **Finance:** Exporters dealing with leading banks are getting export credit at 11.25%. Some of the status holders are getting foreign currency funds at LIBOR +2%. Most SMEs are, however, deprived of getting this facility. It is, therefore, suggested that the same rate should be made available to all the SMEs for exports.
8. **Availability of feedstock:** There is an urgent need to modernize and expand to world scale capacities by the large Govt. owned chemical companies such as HOC, NCPL, GACL, GNFC and RCF. Indian dyes industry is importing most of the dye intermediates from China. There is urgent need to create dyes intermediates manufacturing facilities in the country have world class capacity to meet demand domestically. In this context, PSU's may consider the manufacture/ expansion of existing capacity of dye intermediates like cyanuric chloride, aniline, ethylene oxide, diketene, beta naphthol, naphthalene intermediates, aniline intermediate and phthalic anhydride.
9. **Image Building:** Colorant industry is regarded as one of the most polluting ones in the minds of general public. Govt. authorities have therefore extended low priority for its expansion. There is thus no opening, neither for expansion nor addition to product range. Industry does not have any maneuverability with regard to product improvisation. Industry in collaboration with Government may actively create awareness in changing this perception
10. Government should explore extending similar benefits to EOU as currently available to SEZ for the benefit of existing plants as shifting a chemical plant is not possible. New plants could be set up in SEZs
11. Ethylene oxide could be allocated for downstream industry (from Dahej PCPIR)

Target for XIIth Five Year Plan

Indian colorants industry is estimated to be $3.4 billion in FY10 with exports accounting for 68%. In the XIth Five Year Plan, the dyes industry has witnessed growth of 9.5%. The overall production capacity of dyestuffs is 200,000 tonnes per annum and that of pigments in 150,000 tonnes per annum. There has been remarkable growth in the exports of colorants during the last 2 decades with a growth of 14.5% p.a. between 2000 and 2010

The exports are projected to grow to $4.9 billion by 2017. Driven by robust exports growth, the Indian colorants industry has set a target to grow from the present $3.4 billion to $7.5 billion by 2017. The targets imply that the industry must grow at a rate of 12% p.a. over the XIIth plan period.

F. Alcohol based chemicals

1. Introduction

Alcohol is a key feedstock for the manufacture of basic chemicals. Alcohol based chemical industry occupies an important place in the Indian chemical industry and is a key contributor to the growth of the sector. The current size of alcohol based chemical industry is $1.1 billion (Rs. 4,850 crores).

Industrial alcohol in India is produced from sugarcane molasses. Molasses is the by-product of the manufacture of sugar from sugarcane juice. Thus, alcohol production in India is heavily dependent on production of sugar and sugarcane. The major sugarcane producing states in the country are Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Tamil Nadu, Uttar Pradesh, and Uttaranchal.

Alcohol has two major uses - potable use by diluting and blending etc. and industrial use for production of various chemicals. Alcohol is now also used for blending with petrol.

A large number of alcohol based products are manufactured in India. Some of the important alcohol based chemicals are acetic acid, acetic anhydride, acetaldehyde, ethylene glycol, glyoxal, pyridine/ picoline, pentaerythritol, ethylene oxide derivatives etc. The major user industries of these chemicals include synthetic fibres and synthetic yarn, drugs & pharmaceuticals, agrochemicals, personal care products, dyestuffs, pigments, flavours & fragrances etc. There are about 20 major units engaged in the manufacture of alcohol based chemicals. Some of the largest users of alcohol are Jubilant Organosys Ltd., India Glycols Ltd., Laxmi Organics Ltd. and Somaiya Organics Alcohol Ltd. for the manufacture of alcohol based chemicals.

2. Global Scenario

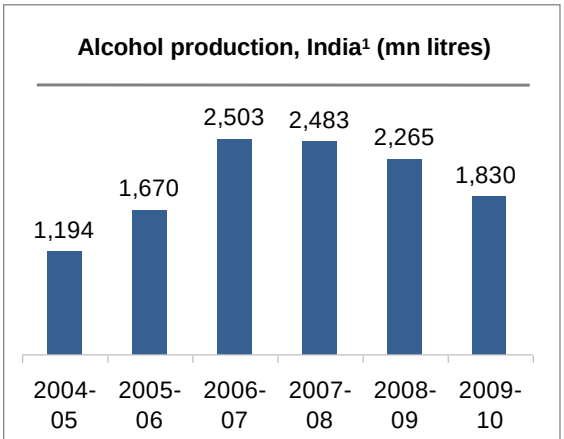
Two countries leading ethanol production globally are United States and Brazil, and account for 70% of world production. They are followed by EU, China and India.

3. Indian Scenario

- **Demand & supply**

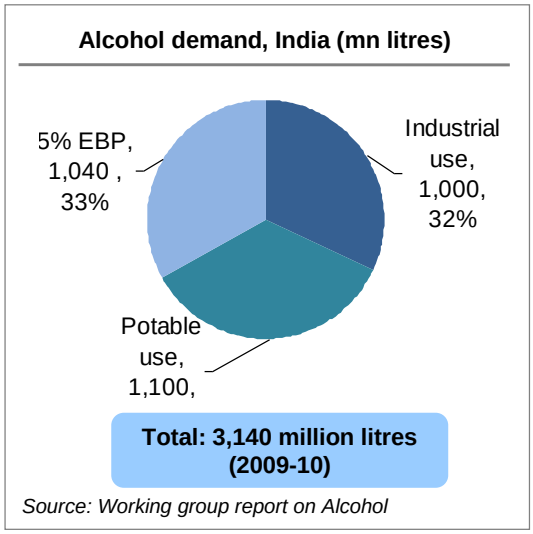
There are about 340 distilleries in the country with capacity of approximately 3,500 million litres. However, the capacity utilization is low mainly due to non-availability of sufficient molasses. The past production of alcohol from the ten major producing states viz. Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Tamil Nadu, Uttar Pradesh and Uttaranchal, Bihar, Haryana and Punjab is shown in the chart.

Production has been steadily decreasing from 2,500 million litres in FY07 to 1,830 million litres in FY10 registering a negative growth of 10% p.a.



Note 1) Production from seven major states: Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Tamil Nadu, Uttar Pradesh and Uttaranchal

Source: Working group report on Alcohol



Source: Working group report on Alcohol

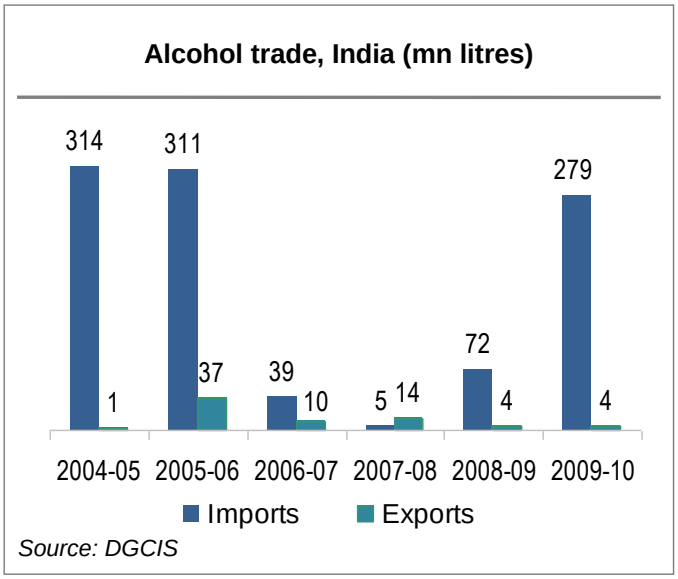
Though the demand of alcohol is increasing in industrial as well as potable sectors and now even for blending under Ethanol Blending Programme (EBP), the production of alcohol in has been showing a negative growth mainly due to adverse climatic conditions. The demand of alcohol is higher than domestic availability and the gap is met through imports. The present demand of alcohol in the country is about 3,140 million litres.

- **Employment**

Alcohol based chemical based chemical industry provides direct employment to about 7,500 people. In XIIth five year plan, the industry envisages employment increase of about 5%, subject to favourable availability of molasses in the country.

- **Trade**

  Import of industrial alcohol has increased considerably in the recent years (39 million litres in FY07 to 270 million litres in FY10). This necessitates the need for exploring alternate sources/ feedstocks for manufacture of alcohol. Export of alcohol has shown



Source: DGCIS

  significant negative growth over the years (10 million litres in FY07 to 4 million litres in FY10) due to decreasing domestic production and increasing demand.

- **Strengths & Opportunities**

  The alcohol based chemical industry contributes to green chemistry by manufacturing chemicals through a renewable feedstock viz. ethanol rather than opting for the petrochemical route. This has been one of its competitive advantages. The alcohol based chemical industry also contributes to the foreign exchange reserves of the country by way of direct exports and by preventing imports of products manufactured indigenously (saves or earns $595 million in foreign exchange for the country). Alcohol based chemical industry, by manufacturing green chemicals with the help of renewable resources, is reducing GHG emissions as compared to manufacturing through petro-route. Alcohol when used for manufacture of green chemicals has 70% more GHG savings as compared to usage of mineral oil for the same purpose. Carbon footprint of alcohol based chemicals is more favourable as compared to fossil fuel based chemicals.

- **Challenges & Weaknesses**
    - Sugar production is cyclical in nature; hence there is volatility in the prices of molasses and alcohol. This leads to severe fluctuations in prices of feedstock
    - There is a shortage of industrial alcohol and the new demand for blending with petrol has widened the gap
    - States prefer the movement of molasses/ alcohol for potable sector. Most states do not permit free inter-state movement of industrial alcohol, forcing the industry to purchase at higher prices locally. Import and movement is not allowed freely by state governments
    - High export/ import duty for inter-state transfer. Besides, fees are charged under various heads viz. transport fee, purchase tax, vend fee, de-naturalization fee etc.
    - State government policies lead to uncertainty about the availability of alcohol as a raw material for the industrial sector
    - Taxation under the central excise act and cascading taxation under the state VAT/ sales tax laws leads to high prices. The states levy taxes on molasses and ethyl alcohol at different rates and restrict VAT credit when used as input. Consequently, such taxes levied by the states get embedded in the cost and are not neutralized even when the final product is exported out of the country. The multiple state levies impact the competitiveness of the industry

3. Action plan 2012-2017

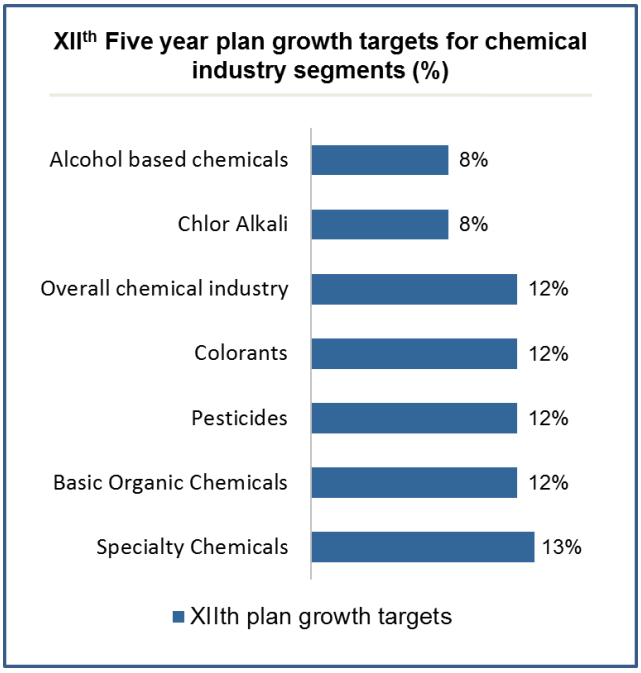
- **Changes in regulation of molasses and ethyl alcohol:** To avoid the difference in taxation applied by different states, Central Govt. should regulate the movement of molasses and ethyl alcohol used for industrial purposes
- **Coverage of alcohol under GST to avoid cascading duties:** Molasses, rectified spirit, extra neutral alcohol & other similar alcohols and denatured alcohol are not covered by entry 8 or entry 51 of list II of the seventh schedule to the constitution of India, which covers intoxicating liquors. Therefore, molasses and all types of ethyl alcohol should be under the purview of proposed GST regime so as to ensure their uniform taxation in different states, with facility of input tax credit when used for manufacture of chemicals

- **Priority allocation of alcohol to the green chemistry industry:** In order to protect alcohol based green chemical industry and make it more competitive, the Government may prioritize allocation of ethanol as feedstock for green chemicals which will save foreign exchange, increase employment in the country, add capital investment opportunities and also utilize existing capacities
- Review of the ethanol blending program (EBP) to ensure availability of a precious feedstock for a well established sector

Target for XIIth Five Year Plan

The size of alcohol based chemicals industry is $1.1 billion (Rs. 4,850 crores). Production in seven major alcohol producing states has been steadily decreasing from 2,500 million litres in FY07 to 1,800 million litres in FY10, registering a negative growth of 10% p.a. during the XIth plan period due to non-availability of sufficient molasses. However, demand for alcohol is increasing in industrial as well as potable sectors and alcohol is now also being used in blending with petrol. This necessitates the need of exploring the alternate sources (apart from molasses) for manufacture of alcohol. Given the right regulatory support, the alcohol industry could aim to grow at 7-8% to reach $1.7 billion (Rs 7,500 Crore) by the end of the XIIth five year plan.

To summarize, the following growth targets have been set for the various segments of the chemicals industry



Indian chemical industry – XIIth five year plan

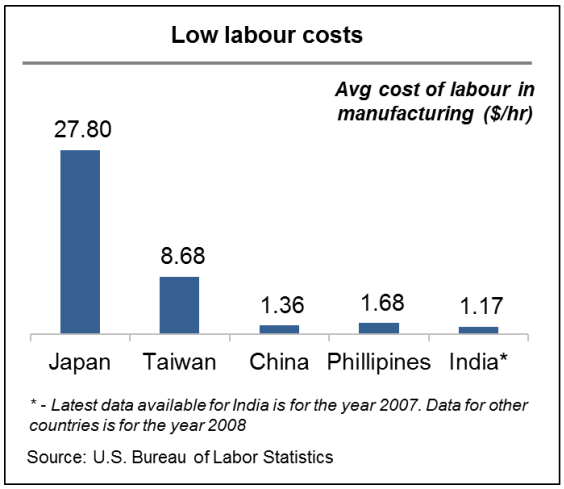
VI. Competitiveness of Indian industry

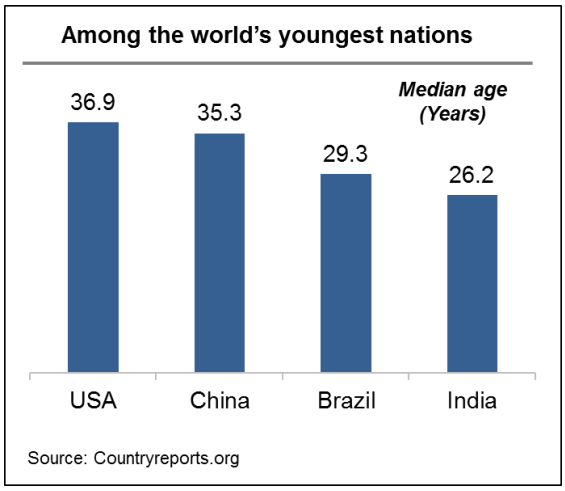
A. Export competitiveness

There is a global demand for Indian chemical products due to their high quality and competitive pricing. India's expertise in developing low cost yet high end chemical products is the key growth driver for Indian chemical exports. India exports significant volumes of generic agrochemicals and pharmaceuticals. 40% of India's agrochemicals sales as well as 60% of pharmaceuticals sales are through exports. This is primarily due to Indian strengths in contract manufacturing leveraging its low operational costs.

The introduction of the Indian Patent Act, 1970 (which provided patents based on manufacturing process of the product rather than based on new product as was the global norm) enabled Indian drug manufacturers to develop existing bulk drugs through varying production processes. After creating a niche for themselves in the domestic market, several Indian players turned their sights on exports. Consequently, the share of exports in total bulk drug production soared and India became a major exporter of pharmaceuticals. However, the government, as a member of the World Trade Organisation (WTO), agreed in 1995 to adhere to the product patent regime from 2005. This led to increasing interest of MNCs in India which was viewed as a potential low cost manufacturing base. Thus, while the process patent era helped Indian companies to gain supremacy in generics, the product patent era encouraged new drug-discoveries over the long term. Dyes and Pesticides exports are nearly 50% of the production achieved mainly because of technological improvements and skilled manpower.

B. Versatile skilled human capital





An unparalleled resource of educated, hard-working, skilled and ambitious workforce is the hallmark of India's human capital. India has the world's largest population in the 0-24 years age group with an employed workforce in the organized sector of ~ 37 million in FY07. Number of new jobs created in the organized sector every year range between 4-5 million. With over 380 universities, 11,200 colleges and 1,500 research institutions, India has the second largest pool of scientists and engineers in the world. Over 2.5 million graduates are added to the workforce every year including 300,000 engineers. Around 170 institutes, including IITs, NITs and University Chemical Engineering Departments offering programmes in chemical engineering churn out approximately 11,000 chemical engineers every year. As of 2010, each year, Indian universities churn out ~150,000 chemistry post graduates.

Labour costs in manufacturing are lower in India than most other developing countries. The available skilled, highly productive and English speaking resource pool is a major source of competitive advantage for India.

C. R&D strengths

Indian industry has certain inherent strengths as far as R&D is concerned. Drug discovery costs USD 100 – 200 million in the west whereas it costs only USD 10 million in India. There is also a large pool of less expensive, English-speaking, scientific and engineering workers. In spite of this, the market size of patented drugs in India is currently very small. Industry reports suggest only about 1-2% of the Indian pharmaceutical market is accounted by patented drugs. However, the introduction of

The Patent Act (2005) has increased the confidence of domestic and global pharmaceutical companies. The share of patented drugs increased to ~14-15% in Brazil after 10 years of the start of patent protection and increased to ~5% in China after 5 years of patent protection. Given these indicators, India has the potential to have 15% of pharmaceuticals market from patented products by 2020.

India has a strong base for innovation through its network of 200 national laboratories and 1,300 R&D units, However, India is lagging in terms of R&D compared to other nations. Currently, overall number of patents filed by India (overall industry level patents including chemical industry) is 1/10th of the number of patents filed by China and 1/15th of those filed by USA. Firms with R&D centers in India are ~25% whereas in China and USA the number is ~40% and ~60% respectively. Though India is increasingly becoming a centre of R&D for foreign companies, domestic companies also need to increase their focus towards R&D for meeting the evolving needs of the Indian consumers. The Indian market is characterized by predominant rural population with low annual income. The projected needs of this segment are centered around food & nutrition, water, energy, healthcare, transport, education and communication & entertainment. Affordable products and services meeting the needs of this large segment of the income pyramid will be critical for winners in next decade. Low cost innovation/ frugal engineering could help create these products and services for Indian markets at acceptable price points. Product innovations for meeting these needs will be enabled by several major technologies like bio-technology, renewable energy & clean technologies including bio-fuels, water management technologies, technologies to enable low cost vehicles, wireless connectivity etc. Indian chemical industry will be required to contribute in a significant way to support such technological innovations. Development of a small car like Nano or a low cost water purifier like Swach are quintessential examples of frugal innovation to meet the needs of the masses. Such product innovations require close collaboration with the specialty chemicals industry for development of light weight plastics, durable paints, nano filtering materials etc.

VII. Performance during XIth plan

Target for chemicals industry growth for XIth five year plan was 7-8%. The performance of the various industry segments during the XIth plan is as follows:

Production of **major organic chemicals** has shown a significant decline due to large volume imports taking place from countries like China, resulting in low operating rates. Besides cheaper imports, low availability of feedstock was another reason for the de-growth of the Indian organic chemicals industry. Lack of availability of natural gas is a constraint for methanol manufacturers in India. Acetic acid competes with the potable alcohol industry and ethanol blending program for its feedstock (alcohol), which is also in insufficient supply in the country. Owing to poor feedstock availability and cheap imports, production of major inorganic chemicals witnessed a negative growth of 6% vis-à-vis the XIth plan target of 7-8% growth, thus failing to achieve the growth envisaged for the sector in the XIth plan period.

Specialty chemicals segment in India has been growing at a rapid pace owing to growing key end use markets such as automobiles, infrastructure, electronics, textiles etc. The segment witnessed a growth rate of 11-13% p.a. over the XIth plan period surpassing the target of 7-8% growth.

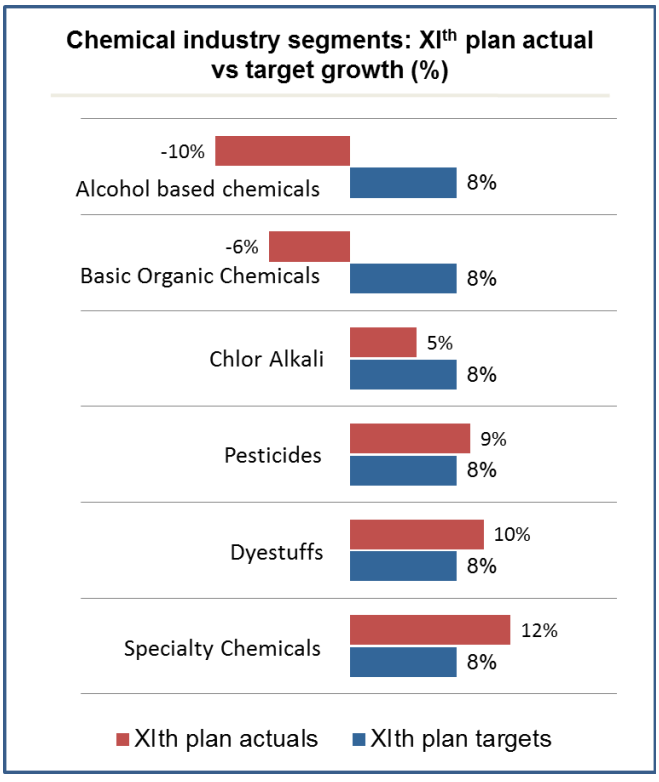
Indian **chlor-alkali** industry grew at 5% over the XIth five year plan period to keep pace with the demand. The industry fell slightly short of the growth target of 7-8% for the XIth plan period. Production of caustic soda grew from 1.993 mn tons in FY07 to 2.457 mn tons in FY11. Production of chlorine grew from 1.765 mn tons to 2.177 mn tons over the same period. Overall caustic soda and chlorine production grew at 5.4%. Production of soda ash grew from 2.046 mn tons in FY07 to 2.424 mn tons in FY11 leading to a production growth of 4.3%. Production was impacted by imports from China. During 2008-09, India was the third largest destination for Chinese soda ash exports. This led to the Government of India imposing safeguard duty on import of Chinese soda ash.

India is the 4th largest producer of pesticides after USA, Japan and China. India is the second largest producer of pesticides in Asia. The Indian **pesticides** industry has been growing at 8-9% p.a. over the past five years (FY07-FY11) driven by exports. Industry size is estimated to be $3.8 billion in FY11 with exports accounting for 50% of the market. India is a predominant exporter of pesticides to USA, Europe and African countries. The pesticides segment has thus met the growth target set for the XIth plan period.

The Indian **dyestuffs** industry has grown at ~10% p.a. between FY06 and FY10 with exports growth at 14.5% p.a. There has been remarkable growth in the exports of colorants during the last 2 decades. From a mere $0.03 billion in 1990, exports reached $2.3 billion in 2009-2010, having surpassed the estimates envisaged in the ten year strategic action plans submitted in 1991 and 2001 with a growth of 14.5% p.a. over the last decade.

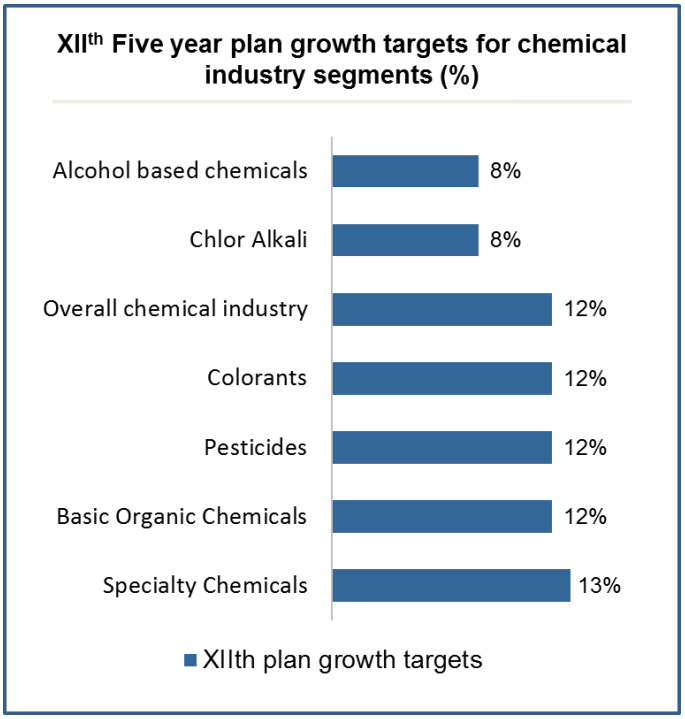
Alcohol production has been steadily decreasing from 2,500 million litres in FY07 to 1,824 million litres in FY10 registering a negative growth of 10% p.a. There are about 340 distilleries in the country with capacity of approximately 3,500 million litres. However, the capacity utilization is low mainly due to non-availability of sufficient molasses. Though the demand of alcohol is increasing in industrial as well as potable sectors and now even for blending under Ethanol Blending Programme (EBP), the production of alcohol in has been showing a negative growth mainly due to adverse climatic conditions.

The performance of the key segments of the Indian chemical industry vis-à-vis the growth target for the XIth plan has been summarized in the chart below



VIII. Targets and Policy initiatives for XIIth Plan

The following growth targets have been set for the various segments of the chemical industry. Policy initiatives required in various industry related aspects are as follows:



A. Sustainability

One of the key issues facing the chemical industry is “Sustainability”. From being an economic and an environmental issue, it has also acquired strong socio-political overtones, which already have deep impact on the industry, and this impact will only deepen in coming years.

The main issues the industry will have to grapple with and address actively, for the next 2 decades are:

1. Water
2. Environmental impact
3. Raw materials
4. Safety over lifecycle and
5. Energy use

Unless the industry, government and technical & research institutes address all these proactively and collaboratively, the industry will not grow.

A summary of the key problems and some potential solutions is given below-

1. **Water**

   This is already a scarce resource in all parts of India. Intense competition with human needs makes this a very sensitive social factor, and there is no question that industry will be a third priority in any allocation, after community and farming needs. Supply of water for Indian chemical industry still has not been a subject of sustained or planned effort.

2. **Environment**

   The levels of pollution of ground water and air pollution have reached alarming proportions in most of the chemical industry clusters. While there are sterling examples of many Indian chemical companies which are in the forefront of environmental, water and safety performance, the non-compliant attitude of many companies and ineffective enforcement efforts in some clusters, have led to large scale damage to environment.

   To address these inter-related issues, it is recommended that:

   - At least 20 reputable and active educational/ research institutes be identified and supported by GOI, to set up initiatives with industry, to develop green processes, that are less water intensive, environmentally compliant, and safe; and to train specialists, process developers and managers.
   - These institutes, like the IITs, CSIR labs, and university departments, can each focus on sectors and areas of key interest, tasked to develop within 5 years into centers of excellence and consultancy; and industry experts may be asked to join these institutes as advisors/ research panel members.
   - These institutes and others must be encouraged and assisted to partner with specialist labs and educational/ research institutes of repute in Europe, Japan, US, where there is a long history of successful work in these areas.
   - Credible Environmental Audit and Certification, viz Responsible Care Certification (Sales: over 250 cr) and ISO 14000 Compliance (Sales: 10-

250 cr), should be made mandatory and reportable, for all chemical companies. Reputable auditors must be empanelled.

- Government of India agencies (Ministry of Environment and Forest, Central Pollution Control Board, Department of Chemicals and Petrochemicals) must work with state governments to ensure more rigorous and transparent enforcement of pollution and environment related regulations in chemical units.
- There has to be a system of positive incentives for compliant industries. The star rating system used by commerce ministry to encourage exports has worked wonders over the last 20 years. The best way could be to use the internationally recognized measures of excellence for chemical company performance in environment, safety, health, community perception: viz “Responsible Care Certification”; and encourage companies with such certification through star rating and fast track clearance for expansions, product diversification etc.
- These key non-fiscal incentives will encourage the growth of compliant companies and will act as a catalyst to motivate non-compliant companies towards better environmental compliance.

3. Raw Materials

India is seriously deficient in hydrocarbon resources. At the same time India has a huge wealth of renewable agricultural and agro-waste resources.

Key recommendations are as under:

- Industry needs to develop and upgrade technologies and processes to produce chemicals starting from agro-wastes and non-edible agricultural products such as ethanol, glycerin, cellulosic materials, non edible oils, etc. to surfactants, polymers, specialty and fine chemicals, through fermentation, genetic engineering and bio-tech based processes and intermediates. A great amount of work has already been done worldwide in this direction.

- To put in place a national policy and action plan to develop the necessary plantation industry on waste land along with consuming industry segments with a focus on low resource agriculture.
- Identify and inventorize all agro-wastes and their utility as raw materials and bring in the processes for necessary commercial utilization.
- Set up at least 4 regional 'Centers of Excellence' who will partner with international technology organizations and institutes and develop and upgrade processes for the above processes and products.
- Treat renewable resources/ agro-waste based chemical industry as an industry of strategic national importance.

4. Energy

The Indian chemical industry is a major consumer of energy. There are numerous fragmented capacity plants existing in the country, many of these are energy inefficient. A few dozen companies of scale have, however, become examples of high energy efficiency over the years, through process intensification, energy efficiency improvement, energy capture and recycle. These measures need to be strongly encouraged, while at the same time helping the broad spectrum of aspiring companies to emulate and improve.

Recommendations:

- Create a database benchmarking energy standards of companies sector-wise. Publish these benchmarks for companies to work towards achieving, including the methodology and technologies that have been employed in each of these products/ industries for energy efficiency. Provide soft loans and tax credits for such investments (eg waste heat recovery systems, energy audits etc.)
- Require all chemical manufacturing companies with sales revenue above Rs. 50 crores, to publish audited energy consumption figures in comparison to the benchmarks. The very requirement of evaluation, comparison, and

dissemination will persuade a large number of companies to work towards energy improvement.

- Create at least one centre for energy excellence which will be tasked with acquiring and sublicensing energy efficiency technologies.

5. Safety over Lifecycle

There has been increasing international and local concern over the impact of chemicals on human and plant, animals and aquatic life; and on key resources like water and atmosphere. This green movement is a very positive feature and has resulted in legislations like REACH in the EU and similar regulations in Japan and North America. It is important that India emulate these countries, and design and adopt a sensible and practicable system of controls to regulate and ensure safety over the entire chemicals life cycle: from manufacture to distribution to end-use, to recycle, destruction or disposal. There is now sufficient experience, for example, from REACH in the EU, and from the US and Canada, for Indian industry and government to jointly develop a workable and much less "expensive" set of regulations covering the entire lifecycle of chemicals.

B. Strategy for strengthening R&D

Innovation is important for chemical industry fortunes. In the past, product innovations have helped in developing products with multi billion dollar sales (e.g., glyphosate, industrial enzymes) and process technology innovations have helped in reducing operating cost by greater than 20% (e.g., direct oxidation of propylene).

However India's performance on innovation has been rather unsatisfactory. According to World Intellectual Property Organization statistics (2009) India was granted just 7,539 patents as compared to 67,948 of China and 157,283 of USA. Recently published global innovation index by INSEAD ranks India at 56th position: much below other developing countries like Malaysia, UAE and China.

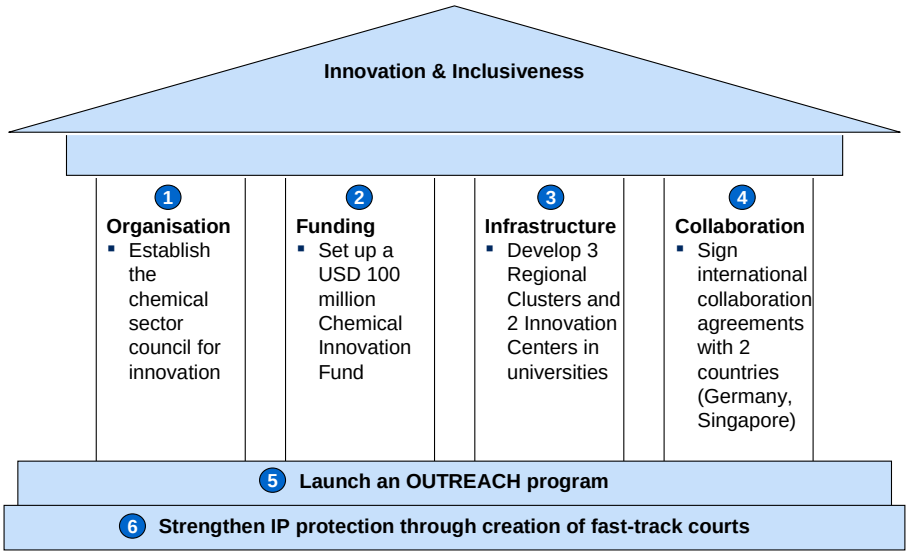
Realizing that innovation is the engine for the growth of prosperity and national competitiveness in the 21st century, the Government had declared 2010 as the 'Decade of Innovation'. To take this agenda forward, Prime Minister has approved the setting up of a National Innovation Council (NIC) to develop a national strategy on

innovation with a focus on an Indian model of inclusive growth. The idea is to create an indigenous model of development suited to Indian needs and challenges and develop product and services that are affordable by a low income household, without compromising quality.

After studying the experience of other countries (US, UK and China) and understanding of Indian context, NIC recently crafted out Indian innovation strategy for the next decade with focus on “inclusive innovation”.

The Chemical ministry should undertake six specific initiatives in line with National Innovation Strategy to support innovation specific to chemical industry.

Six initiatives derived from India’s National Innovation Strategy can promote innovation and inclusiveness in the chemical industry



Source: National Innovation Strategy

1. Establish chemical sector council for innovation

- NIC has proposed setting up State and Sector innovation councils to help in formulating the ‘Roadmap for Innovation 2020’ and implement it in respective States and Sectors.
- In line with this, a Chemical sector council should be setup which should have representatives from the government, chemical companies, industry associations and reputed research/ educational institutes (e.g., NCL, ICT)

- Within first six months, the Chemical sector council should develop an integrated view of R&D/innovation requirements of the chemical industry by working with all key stakeholders like government, companies and various industry associations (e.g. ICC, FICCI, CII)
- The council should then incorporate the innovation roadmap for the chemical sector into national innovation strategy

2. Establish an autonomous USD 100 million chemical innovation fund

- NIC has proposed establishment of USD 1 billion inclusive innovation fund for India to encourage commercialization efforts for innovations generating inclusive growth; it also recommended use of the PPP model to increase quantum of investment by 10 to 20 times its seed capital.
- The chemical sector needs to secure at least 10% of total national inclusive innovation fund to invest in ventures/ innovations for the chemical industry.
- The chemical sector council should short-list three areas (e.g. food, energy, water) to deploy these funds where chemical innovations can significantly contribute in developing solutions which promote inclusiveness.

3. Develop three regional clusters and two innovation centers in universities dedicated to chemical industry

- Driving the innovation agenda nationally would require strengthening regional capacity for innovation and strong industry-academia linkages. NIC has proposed to identify 20 innovation clusters across the country and 20 innovation hubs at different universities in India.
- Three dedicated clusters for chemical industry should be created in regions with large share of chemical industries (e.g. Gujarat, Maharashtra, Tamil Nadu, Andhra Pradesh) and similarly two universities focused on chemical engineering (e.g. ICT, IIT Mumbai) should be short listed to develop innovation hubs for chemical industry.

4. Sign international collaboration agreements with Germany and Singapore

- NIC is already developing a platform for collaboration and engagement with other countries to understand their views and strategies for strengthening the innovation eco-system.

- Germany and Singapore, with presence of large scale chemical industry and world scale research facilities, can be good partners for India to learn and develop capabilities in chemical product and process innovation.
- Both of these countries have world class examples of large scale chemical parks (e.g., Ludwigshafen in Germany, Jurong in Singapore) with integrated infrastructure, knowledge management and R&D facilities; India can benefit significantly from their experience while establishing PCPIRs.
- These collaborations could be in the form of bilateral exchange forums, linkages between relevant industry association and research institutes.

5. Launch an OUTREACH program

- NIC has defined outreach as one important pillar of the National Innovation Strategy. They have also proposed a National Innovation Portal which will provide all information related to the innovations and the innovators in a single repository and will also act as an outreach medium.
- The Indian chemical industry generally suffers from a bad perception in the eyes of the public and needs to improve its image through more university, college, business interactions. This program will play crucial role in building the chemical sector's capability of attracting and retaining high quality talent in the chemical field.
- The OUTREACH program should also have the target of building a chemical innovation eco-system between several constituents like innovators, venture capitalists, research institutes, companies and industry associations.

6. Recommend creation of dedicated fast track court to enable enforcement of IP rights

- Effective IPR (Intellectual Property Rights) systems are critical to promote investment in innovation.
- India has already reformed IPR substantially in last decade by becoming a signatory of TRIPs (Trade-Related Aspects of Intellectual Property) in the Uruguay round agreement of 1995 making protection of intellectual property an enforceable obligation; It has also amended patents act three times in last

twelve years where the third amendment (2005) has introduced product patent protection for food, pharmaceutical and chemical inventions.

- However enforcement of IPR in India still remains a concern; US Special 301 report has put India on priority watch list for weak IPR enforcement with special mention of need for expeditious judicial dispositions for IPR infringement related issues.
- Chemical innovation council shall recommend and help government in creation of dedicated fast track court to handle IP issues which will significantly reduce the time required for judicial dispositions.

Success of these initiatives will be dependant on complex interplay of dynamics among various players (e.g. government, companies, venture capitalists, individual innovators, end user, educational and research institutes) within innovation eco system.

The Chemical sector council is expected to bring all the key stakeholders together to develop an innovation roadmap for chemical sector. Regional clusters and university centers will provide a support system and relevant infrastructure for innovators. The fund will provide resources and incentives for innovation in the right areas. The outreach initiative and innovation portal will provide a platform for collaboration and sharing. Simultaneous implementation of these initiatives will be important for overall success.

C. Strategy for ensuring feedstock availability

Important feed stocks for chemical sector are coal, natural gas, naphtha and refinery cuts. The important building blocks are benzene, toluene, xylene, naphthalene, ethanol, butadiene, etc.

Benzene, toluene, xylene, butadiene are obtained by cracking of naphtha etc. Naphthalene is obtained by destructive distillation of coal in steel plants. Ethanol is obtained from molasses.

While India is long on the basic feedstock Naphtha, there is still an acute shortage of various building blocks like methanol, toluene, naphthalene, EO etc. It is paramount to ensure full utilization of a precious feedstock like Naphtha within the country by setting up naphtha crackers and providing building blocks for the production of key

downstream chemicals. Export of surplus naphtha from the country must be dis-incentivized and fiscal incentives must be provided for investment in naphtha crackers in the country as a top priority. The government needs to set up the right environment to incentivise and attract investments in new crackers. First step has already been taken by the introduction of the PCPIR policy. However, this must be followed by effective policy implementation to ensure the growth of the Indian chemical industry. Naphtha must be made available to the PCPIRs and a consortium approach could be adopted to ensure off-take of basic building blocks from these crackers by downstream companies in the consortium.

Every PCPIR must have a naphtha cracker which produces all the building blocks. Such crackers need to be set up under a concept of "Consortium Crackers" through government PSU. The Consortium Crackers to offer each of the building blocks to different promoters interested in setting up downstream petrochemicals/ intermediates. Looking to the experience during the first phase of implementation of PCPIRs and slow inflow of investments in these regions, it is felt that PSUs must step in as 'Consortium of Crackers' to facilitate and attract further down-streaming.

While the issue will be adequately addressed in the petrochemical policy, it is necessary to emphasize the importance of availability of basic building blocks (produced by naphtha crackers) in the context of the chemical industry to ensure sustainable growth.

The best practices highlighted in the National Manufacturing Policy must be adopted for chemicals manufacturing. Manufacturing policy incentives like exemptions and tax breaks must be extended to PCPIRs to attract investors and ensure effective and efficient operationalization of these regions at the earliest.

Organic Chemicals / Petrochemicals feedstock

India is experiencing very good growth for polymers, bulk petrochemicals, fertilizers etc. as a growing Indian population and improving infrastructure including housing boost up for consumption.

However, most of the increasing demand is met by imports and no new domestic production capacity is forthcoming. One major reason for this is shortage in availability of building blocks.

For most of the above businesses, the feed stock has been :

1. Naphtha
2. Natural Gas, and
3. Coal

Major end-users are Fertilizers, Power and Petrochemicals. While the above 3 compete between each other for allocation, technologically the ideal feed stock for each of the industry would be as follows:-

Industry	Coal		Naphtha		* Gas (lean)	
	Advantage	**Disadvantage**	**Advantage**	**Disadvantage**	**Advantage**	**Disadvantage**
Fertilizers	**Least**	Very high capital cost to process coal to get pure H2 for fertilizer prodn.	**Low**	Variable cost significantly high.	Since maximum H2 available in Gas **Best**	
Power	a) Since converting coal to steam, relatively low investment. b) Variable cost low per cal. of energy. **Best**		**Least**	Since variable cost very high.	In between Coal and Naphtha. **Low**	
Petrochemicals	**Least**	Since very high capital cost.	Since rich in petroleum fraction (carbon-Hydrogen) **Best**		**Low**	Since very low olefins in gas

* Gas to be stripped, Methane (C1)(lean gas) to be used for fertilizer. The separated rich gas (Ethane (C2) etc) to be used for petrochemicals only.

The following strategies for enhanced feed stock availability could be considered

Strategy 1 - Right feed stock allocation for right product:

It would be ideal to allocate maximum naphtha for petrochemicals, maximum lean gas for fertilizers and maximum coal for power generation.

Strategy 2 - Increased feed stock availability:

- Future refinery configuration should shift in favour of producing more feed stocks instead of fuel by incorporating proper modifications in refining technology
- Encourage "Consortium Cracker" Project: Every PCPIR must have a naphtha cracker which produces all the building blocks. Such crackers need to be set up under a concept of "Consortium Crackers" through government PSU. The Consortium Crackers to offer each of the building blocks to different promoters interested in setting up downstream petrochemicals/ intermediates. Looking to the experience during the first phase of implementation of PCPIRs and slow inflow of investments in these regions, it is felt that PSUs must step in as 'Consortium of Crackers' to facilitate and attract further downstreaming.
- Export of surplus naphtha from the country is loss of a precious resource, and hence, must be dis-incentivized. Investment to use naphtha in the country must be incentivised
- Every major refinery/ petrochem-polymer project to be required, at planning stage itself, to allocate at least 10% of basic building blocks for non-polymer, non-fuel merchant sale to intermediate producers, on long term contracts. This is critical for the development of the specialties and functional chemicals industries.

Strategy 3 - Encouragement of sourcing feedstock/ building blocks from feedstock rich countries:

India has to have a strategic plan to secure its feedstock from feedstock rich countries with competitive supplies. The Government must also participate in securing mining rights in coal-rich countries. There are certain countries, which are blessed with high amount of feed stocks, for e.g.

- Gas, Oil rich countries, such as in Middle East & Russia
- Coal rich countries, like Indonesia, South Africa, Australlia

A long term tie up with these countries is essential for India.

PSU's may set up refineries in oil-rich countries & supply the feedstock back to India for domestic industry for further conversion into value added products.

Strategy 4 – Encouraging new Technologies:

Certain technologies which are capital intensive require support from the government by way of long term steady policies and fund support, such as the following –

- Coal gasification – Simultaneously production of power and fertilizer based on coal gasification
- Coal to Methanol/ Olefins/ Acetic Acid

Focused research centers:

In order to be a cost competitive producer, it is necessary that India develops skills and better catalysts and processes. The government needs to consider both options of spinning of research centers such as those belonging to PSUs into autonomous research center. At the same time, the current research centers such as IIP and CSIR units such as NCL need to be made more focused on research programs to keep India on the leading edge of technology. The government should encourage competition amongst research units to improve productivity.

Inorganic Chemicals Feedstock

The feedstock availability for inorganic chemicals is equally important as organic chemicals. The important feedstock where India is dependent on mines in resource rich countries are:

- Sulfur
- Rock Phosphate
- Potassium Chloride

India is deficient in the above three basic feedstocks and industry needs to take similar initiatives as recommended for organic chemicals viz,

- Acquisition of mines in resource rich countries for above

- Setting up of Umbrella Concept as in organic chemical in the resource rich countries for conversion of inorganic intermediates
- Initiate Govt. to Govt. agreement for long term supply of basic minerals at competitive price

Surplus Minerals

India is surplus in following raw materials.

- Iron Ore
- Bauxite
- Ilmenite
- Zircon
- Rare earths

At present some of these feedstocks are exported. Similar to Naphtha, the Government needs to dis-incentivize exports of the above minerals and incentivize exports of down-stream products.

Bio-based raw materials for chemical industry

There is need to provide incentives for bio-based raw materials as a way to reduce dependence on crude oil based products. The bio-based raw materials could be (1) bio-ethanol from agro-wastes for chemical feedstock (2) Glycerin. Bio-based raw materials provide cheap raw materials and processes are environmental friendly.

Glycerin is important feedstock coming out as by-product from bio-diesel production. National research laboratories such as NCL and IICT should take initiatives towards process development for commercial products such as epichlorohydrin, propylene glycol and 1,3 propanediol and similarly for bio-ethanol from agro-wastes, a key strategic resource for the future and of particular relevance to India.

D. Strategy for human resource development and employment generation

The chemical industry has not been able to attract top-class talent which has created a severe shortage of skilled manpower, seriously impacting its productivity and growth. To realize the complete potential of the domestic industry, steps to attract talent, such

as offering R&D/ marketing-oriented job profiles and attractive career paths, should be implemented. Additional specialized universities, IIT's in chemical stream and vocational training institutes could significantly improve the employability of the workforce in the chemical industry.

India has around 170 institutes, including IITs, NITs and university chemical engineering departments, offering programmes in chemical engineering. These institutes produce approximately 11,000 chemical engineers every year. However, the number of Ph.Ds is not adequate. In India, the ratio of engineering doctorates to engineering graduates is estimated to be less than 1% while in developed nations like Germany, USA and UK, it is 7-9%. China had a ratio of around 0.25% in 1988 which has now improved to 3%. According to Indian Institute of Chemical Engineers, there is a pressing need for the other top institutes in the discipline to establish M.Tech/ Ph.D programmes, as there is a severe shortage of qualified staff members to provide chemical education in India.

Chemical industry will require additional 4.5 to 5 million skilled workers by FY17, including 0.25 million professional manpower for the specialty chemicals industry. Adequate educational infrastructure would be required to impart vocational training to develop the required manpower. India would need to take some urgent steps to strengthen technical education in the country and establish newer institutes with good facilities. To meet the future demand, 1,000 new ITIs, vocational training institutes and diploma institutes would be required. This will help in creating skilled & knowledgeable technical manpower to service the projected growth of the industry.

- Govt. could set up specialized universities, vocational training institutes and develop skill base
  - ® Institutes could be set up closer to clusters
- Industry could invest more in training
  - ® Govt. could provide similar rebate on training & development as given for R&D
- Govt. could set up & promote universities, ITIs in chemical field & BSc / B. Tech in dyes & pigments technology, etc.
  - ® Govt. could encourage PPP model for ITI

- Set up CIPET like institutes, ITIs in Gujarat and Maharashtra
- Government should work in collaboration with industries to upgrade the current chemical Departments in universities to become state-of-the-art Departments (in terms of infrastructure, faculty qualifications, industry interaction, and administration).

E. Need for consolidation of acts and rules concerning environment protection

At present, there are multiple legislations in India governing the chemicals industry and fall under the purview of different ministries as given below:

Ministry	Act
Ministry of Environment & Forests	Environment Protection Act, 198
Ministry of Labour	Factories Act, 1948
Ministry of Shipping, Road Transport & Highways	The Motor Vehicles Act, 1988
Ministry of Industry & Commerce	The Explosives Act, 1987
Ministry of Home Affairs	The Disaster Management Act, 2005
Deptt. of Chemicals & Petrochemicals	The CWC Act, 2000

The REACH legislation, enacted by the European Union with the main aim of protecting human health and environment from the hazardous effects of chemicals and to have a sustainable chemical policy replaces around 40 different environment related legislations. Several other countries such as Australia, Canada, Japan, China etc. are also adopting a similar policy to retain their position in the global market. India may also have to pursue similar measures.

Apart from multiplicity of regulations, there are no specific Indian legislations pertaining to

- Registration of substances
- Preparation of a national inventory
- Restrictions on hazardous substances
- Banning of certain substances

- Detailed classification and labeling criteria and
- Transport classification

Some of these issues have been briefly addressed under certain legislations; however they have not been addressed adequately in a scientifically coherent manner.

There is a need for holistic approach towards chemical legislations. A centralized body – 'Indian Chemical Agency' should to be established by law which will be responsible for and authorized to introduce chemicals legislations. A competent body should be instituted to monitor the implementation of these legislations. The multiple legislations governing chemicals may be consolidated into one coherent and comprehensive piece of legislation which will simplify its implementation and monitoring. This will also facilitate the creation of a chemicals inventory in the country. There is need to create REACH like legislation in India for safe use of chemicals for protection of human health & environment.

F. Technology up-gradation fund (TUF) for chemical industry

To remain globally competitive and comply with requirements like REACH, the Indian chemical industry needs to upgrade its technology to meet world standards and show improved performance in global trade. A number of chemical plants are of smaller capacities and operating at uneconomic scales of production with obsolete technologies. The industry, especially the small and medium enterprises sector, does not have access to capital to upgrade technology on its own. To address this issue, the government could establish a technology up-gradation fund (TUF) that addresses specific technology issues faced by the industry. The specific technologies that qualify for government-supported funding could be selected based on industries that generate maximum benefit such as consumer safety and employment. The fund should also support adoption of environment friendly, greener technologies and setting up of common chemicals infrastructure (E.g. effluent treatment plants) which would benefit SMEs and the environment.

The success of the textiles TUF in India is a good precedent for the industry. Since its inception in 1999 to 2010, more than 28,000 projects worth $ 46 billion benefited from the fund (with a total sanction of $ 16.5 billion). The details of the textile TUF and the potential scheme for chemicals are illustrated below.

ACTIVITY	SALIENT FEATURES OF TEXTILES TUF	POTENTIAL SCHEME FOR CHEMICALS
Define objective of TUF	• Provide access to funds to upgrade technology in existing and new units to increase competitiveness in global markets	• Provide access to funds for industry (esp. SMEs) to upgrade technology to enable it to manufacture products in line with global standards
Frame scheme relevant to industry	• One of the key initiatives is to provide 5% reimbursement on the interest actually charges for capital expenditure on approved equipment	• Similar norm could be laid down for procurement of specific technology for up-gradation of the process or environment protection
Shortlist eligible segments	• Cotton ginning and pressing, jute, silk, reeling & twisting, combing & carpet, viscose staple fibre & viscose filament yarn, processing of fibres, technical textiles etc.	• Government should decide eligible segments after studying potential impact of up-gradation on society (consumer safety, environment, employment etc.)
Design operating framework	• Inter-Ministerial Steering Committee under Secretary (Textiles) to monitor & review • Technical Advisory and Monitoring Committee under Textiles Commissioner for verifying eligibility of units • Computerized monitoring system connecting all nodal banks to monitor disbursement of loans/ subsidies	• Similar committee should be constituted under the leadership of Secretary (Chemicals) • To define eligibility criteria & track compliance, an independent body comprised of govt., industry, academia should be formed • Similar system needs to be put in place to monitor progress in the fragmented industry

The Indian chemical industry requires much needed support for up-gradation to world standards so that it can show improved performance in the global competitive environment. The Government may set up a technology up-gradation fund to assist the industry to enable it to develop/ manufacture chemicals in line with global standards.

The technology up-gradation fund (TUF) scheme will aim at modernization and technology up-gradation in the Indian chemicals sector. A TUF outlay of Rs. 500 Crore (USD 111 million) has been proposed for the Indian chemical industry for the XIIth Five year plan. This implies an average yearly outlay of Rs 100 Crore (USD 22 million). Indian chemical industry including organic chemicals, inorganic chemicals, dyes, pesticides and specialty chemicals is estimated to be ~ USD 22 billion. An yearly outlay of USD 22 million (0.1% of the value of the industry) is a modest start. If the scheme is successfully implemented and receives a positive response from the industry, it could be further extended or the outlay increased as was observed in the case of the TUF scheme for textiles.

IX. Recommendations and critical milestones

The following section lists down the key recommendations and levers which stakeholders such as industry, government and academia can use to overcome the challenges faced by the domestic chemical industry

1. Improve infrastructure

There is an urgent need to build better infrastructure and provide adequate power/ water to support industrial growth of chemicals. Infrastructure is inadequate with respect to safe transportation of products as well as proper goods storage and exports. Significant investments are needed in roads, railways, waterways, ports, warehouses etc. to support the overall industrial growth in India. Various levers could be explored to provide adequate infrastructure to the chemical industry

a. PPP model for building necessary infrastructure, especially for ports and roads

b. Availability of finance to improve infrastructural facilities for SMEs: Setting up of an Empowered Group of Ministers (EGoM) has worked well in recent years to coordinate with states. The EGoM would be empowered to resolve infrastructure and other regular industry issues. It could expedite large scale infrastructure projects, especially those involving multiple states

c. Creation of cluster/ inter-linkages map: An all India chemical cluster map could be formed highlighting linkages with roads to pipelines, effluent treatment plants, power, utilities, etc.

d. Making the Petroleum, Chemicals and Petrochemicals Investment Regions (PCPIRs) more effective and encouraging additional investments in already planned PCPIRs

    i. Infrastructure such as roads and ports near the SEZs/ PCPIRs could be developed.

    ii. Anchor companies could undertake responsibility to make raw material available for downstream units in the cluster, thereby facilitating integration of the entire value chain

iii. A site operator with the right functional expertise should be appointed to market and manage each PCPIR. The site operator will be responsible for establishing comprehensive services and marketing of the site to potential manufacturers to ensure timely participation from companies in the PCPIR. The site operator could be a joint venture with any of the top 10 EPC players in India and/or any of the experienced global chemical infrastructure service providers (e.g., Infraserv, Currenta, Infracor) with relevant functional expertise.

e. Facilitating land acquisition: Land acquisition is another roadblock faced by the private sector in setting up new infrastructure. States/ Centre have adequate capability to resolve the issue by coming together to develop a common policy for land acquisition and identify/ earmark areas for green-field plants

f. Pooling of common infrastructure at existing clusters

i. Industry can benefit from common production and distribution infrastructure for industries with similar characteristics and complementary requirements

ii. Government could encourage development of clusters around the large existing plants by extending benefits similar to those provided to PCPIRs.

2. Ensure feedstock availability

a. Encourage "Consortium Cracker" project: Every PCPIR must have a cracker which produces all the building blocks. Government could endorse a consortium cracker project

b. Export of surplus naphtha from the country should be dis-incentivized. Investment to use naphtha in the country must be incentivised.

c. Government could facilitate industry to participate in securing feedstock and mining rights (for coal) from gas and oil rich countries, such as in Middle East and Russia and coal rich countries, like Indonesia, South Africa, and Australia, respectively. PSU's may set up refineries in oil-rich countries & supply the feedstock back to India for domestic industry for further conversion into value added products. Similar approach could also be adopted for inorganic feedstocks such as Sulfur, Rock Phosphate and Potassium Chloride. Initiation of Govt. to Govt. agreements for long

term supply of basic minerals at competitive prices could be considered and may involve setting up infrastructure in those countries.

d. Certain technologies which are capital intensive require support from the government by way of long term steady policies and fund support, such as Coal gasification (simultaneously production of power and fertilizer based on coal gasification) and Coal to Methanol/ Olefins/ Acetic Acid

e. Government and industry could develop strategies for allocation of feedstocks to best suited products (Gas for fertilizers, Coal for power, Naphtha for petrochemicals)

f. For better processing and value addition to feedstocks it is necessary that India develops better catalysts and processes. The government could consider the option of spinning of research centers such as those belonging to PSUs into autonomous research centers. The current research centers such as IIP and CSIR units such as NCL need to be made more focused and strengthened in resources.

g. Government must ensure supply of Ethylene Oxide (EO) and mandate stringent manufacturing standards for EO. The anchor petrochemical tenant in the PCPIR should put up an EO plant to cater to the aggregated demand (25 to 50 per cent of a typical EO plant capacity). The additional EO requirement by the specialty chemical industry by 2020 will be around 260,000 TPA, which could comfortably support 1 to 2 EO plants and/or multiple EO derivatives plants within the PCPIRs.

3. Provide support for new technologies and establish technology up-gradation fund (TUF)

a. To promote investments in R&D and green technologies, fiscal incentives such as accelerated depreciation, tax benefits, subsidies etc. could be provided

b. Promote investments in alternate technologies such as coal to methanol. This will help leverage India's coal reserves and promote investments in formaldehyde, MTBE, DMT, DME etc.

c. A technology up-gradation fund (similar to textiles) should be set up for chemicals. A fund size of Rs. 500 Crore for the XIIth plan period is proposed.

4. Implement the 6-point plan for strengthening R&D

a. Establish chemical sector council for innovation having representatives from the government, chemical companies, industry associations and reputed research/ educational institutes (e.g., NCL, ICT)

b. Establish an autonomous USD 100 million chemical innovation fund by securing 10% of the total inclusive national innovation fund set up by the National Innovation Council to encourage commercialization efforts for innovations generating inclusive growth

c. Develop three regional clusters and two innovation centers in universities dedicated to chemical industry

d. Sign international collaboration agreements with Germany and Singapore which could be good partners for India to learn and develop capabilities in chemical product and process innovation. Both of these countries have world class examples of large scale chemical parks (e.g., Ludwigshafen in Germany, Jurong in Singapore) with integrated infrastructure, knowledge management and R&D facilities; India can benefit significantly from their experience while establishing PCPIRs

e. Launch an outreach program with the target of building a chemical innovation eco-system between several constituents like innovators, venture capitalists, research institutes, companies and industry associations.

f. Chemical Innovation Council shall recommend and help government in creation of dedicated fast track court to handle IP issues and enable stricter enforcement of IP rights, which will significantly reduce the time required for judicial dispositions

5. Set-up talent development infrastructure

a. India will need over 14,000 highly skilled, chemical engineers within the next decade to join the specialty chemical industry alone. A potential short fall of 8,000 to 10,000 chemical engineers is indicated driven by limited talent from Tier 1 universities and lack of attractiveness of the chemical sector for employment. To resolve this shortfall, the industry must improve the value proposition for chemical engineers while the Government should work in collaboration with industries to

upgrade the current chemical departments in Tier 2 universities to become state-of-the-art departments (in terms of infrastructure, faculty qualifications, industry interaction, and administration)

b. To meet the future demand, 1,000 new ITIs, vocational training institutes and diploma institutes should be set up

c. Government could set up specialized universities, vocational training institutes and develop skill base. Institutes could be set up closer to clusters and government could provide rebate on training & development as given for R&D. Corporates could be incentivized to engage trainees/ students from these institutes on projects to provide industry exposure. This could lead to a closer bonding between industry and academia which has been observed as a best practice followed by China and lead to the development of indigenous technology and intellectual property.

6. Improve image of the industry

a. Government could provide incentives for bio-based raw materials to reduce dependence on crude oil, encourage companies to seek "Responsible Care Certification" and facilitate priority loans to those who meet environment norms

b. Providing greater autonomy to Pollution Control Boards (PCBs) for stricter enforcement could be considered.

c. A fund of Rs 25 Crore is proposed for promotional activities for the Chemical Promotion and Development Scheme which includes holding of various events such as India Chem and holding international and national conferences etc. for development and promotion of chemical industry

7. Consolidate acts into an Integrated Chemical Legislation, simplify regulatory structure and strengthen regulations

a. It will be expedient in the interest of development of chemical industry to consolidate multiple legislations governing the chemical industry into one Integrated Chemical Legislation. This legislation should cover the entire life cycle of chemicals. This will act as REACH like legislation for safe use of chemicals for protection of human health & environment.

b. There has to be a system of positive incentives for compliant industries. The best way could be to use the internationally recognized measures of excellence for

chemical company performance in environment, safety, health, community perception: viz “Responsible Care Certification”; and encourage companies with such certification through star rating and fast track clearance for expansions, product diversification etc.

c. Government should expedite swift implementation of GST to lower transaction costs and avoid cascading of taxes; involvement of states in policy formulation should be encouraged, e.g. Central government constituted empowered committee of state finance ministers led to smoother and faster VAT implementation

d. Government should also focus on removing redundancy associated with multiple regulatory bodies (e.g. crop protection comes under Dept. of Chemicals, Ministry of Agriculture & Health Ministry) and simplifying registration approval procedures, especially for pharmaceuticals and agrochemicals.

8. Rationalize taxes and duties

a. Feedstocks and basic building blocks for the downstream chemical products should be preferably at zero duty. This should be followed by slightly higher duty for primary chemicals, still higher for secondary chemicals and still higher for final products/ chemicals, to provide an opportunity for value addition and also provide adequate competitive protection. Example, Naphtha which is a basic feedstock, should have zero duty, followed by slightly higher duty for primary products like Ethylene, Propylene, Butadiene etc. and still higher duty for secondary products like polyethylene, polypropylene etc.

b. Chemical industry could be granted tax and duty reductions for specific identified products such as import duty reduction on inputs like coal, furnace oil, naphtha, etc., inclusion of a wider range of inputs under CENVAT credit, making power cost VATable and encouraging companies to set up captive power plants etc.

c. CENVAT and MODVAT returns process should be rationalized and made smooth; processing of refund claims should be faster

9. Develop usage standards for chemicals

Consumption standards are policies implemented by the government to promote the safe use of products. These standards are necessary for both improving society’s standard of living and enhancing consumer safety. Most developed have implemented

stringent consumption standards across various end-use markets. As the economy develops, India will need to regulate products more stringently, and strengthen consumption standards, which in turn will promote increased usage of specialty chemicals. For e.g. limit on VOCs (volatile organic compounds) in paints. Mandating the usage of water-based paints (that contain 5-15% petrochemicals) will help ensure health and safety of consumers and encourage the consumption of higher cost, water based paints.

10. Develop India's chemical inventory

A chemical inventory is a listing of industrial chemicals manufactured in, or imported by, a country created from information submitted to government authorities by manufacturers, processors, users, and/or importers. Such an inventory can allow authorities to maintain an updated overview of chemicals marketed in their country, reveal whether substance manufactured is used within a country or exported therefore the applicability of new research knowledge to the country and identify risk zones to facilitate the setting of risk reduction priorities. The government should setup a dedicated cell of 5 to 10 competent scientists and chemical engineers to lead the development of India's chemical inventory along with establishing the relevant funding mechanism, infrastructure (e.g., research laboratories), and a state-wise administrative support (e.g., the US required $2 million to set up their chemical inventory database and $9 million to implement it). It is proposed that the government allocate a budget of Rs 50 Crore for the establishment of the Indian chemical inventory during the XIIth plan period. Post the setting up of the chemical inventory, the government will also need to allocate a budget to keep the database current (e.g., the US spends $400,000 annually to maintain their database).

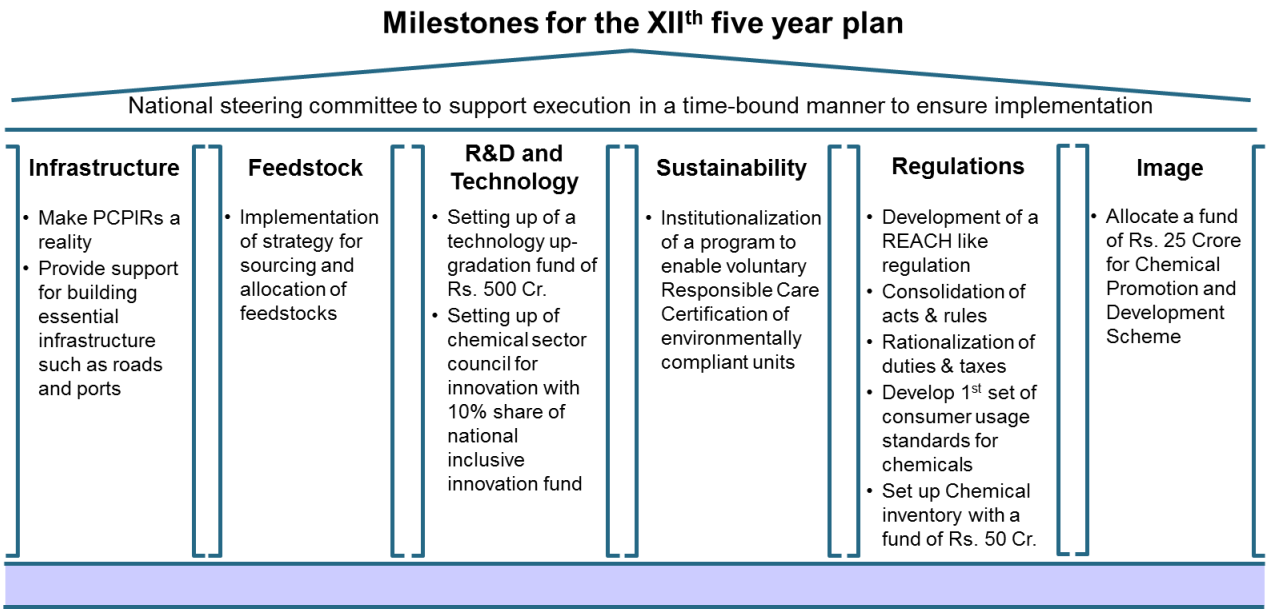
It is recommended that a national steering committee be set up under the Ministry of Chemicals and Fertilizers to ensure successful implementation of the 10 point agenda. The committee should have representatives from government (Ministry of Chemicals), industry (representatives from key sectors) and academia. Possible members could be the Minister of Chemicals & Petrochemicals, the Secretary of Chemicals & Petrochemicals, members from the Planning Commission, managing directors from large-scale and small-scale specialty chemical companies, directors of chemical universities (like Institute of Chemical Technology or any Indian Institute of Technology) and consultants. The

committee must work with a clear mandate and agenda to lead the execution of the policy recommendations to ensure that the Indian chemical industry achieves its aspirations.

Some of the critical milestones to be achieved within the XIIth five year plan for the attainment of the long term goals of the industry are highlighted below:

1. Ensuring successful implementation of the PCPIR policy with world class infrastructure and common utilities
2. Setting up of a committee for developing and implementation of a strategy for feedstock sourcing and allocation with a view of implementation by the end of the five year plan
3. Setting up of the Technology up-gradation fund
4. Setting up a Chemical sector council having representatives from the government, chemical companies, industry associations and reputed research/ educational institutes (e.g., NCL, ICT) to implement the proposed R&D action plan. The council should aim to secure 10% of total national inclusive innovation fund (of $ 1 billion) to invest in ventures/ innovations for the chemical industry
5. Adoption of concrete steps towards the development of a first draft of an overarching regulation for the chemical industry, along the lines of the REACH regulation, encompassing the entire lifecycle of chemicals
6. Setting up of committee to work towards simplification for regulatory structure and removal of redundancies associated with multiple regulatory bodies. This committee could also undertake a review of the various acts and rules governing the chemical industry and attempt some measure of consolidation of such acts and rules. The committee must also strive for rationalization of taxes and duties for the chemical industry with a view to implementation at least by 2014-15
7. Development of the first set of chemical usage standards for the chemical industry
8. Establishment of the Indian chemical inventory and setting up of a mechanism to keep it updated

9. Allocate of a fund of Rs. 25 crores for Chemical Promotion and Development Scheme which includes holding international and national conferences etc. for the promotion of the industry



X. Feedstock availability and pricing over the XIIth plan period

Key feed stocks for the chemical industry include benzene, toluene, xylene, naphthalene, industrial alcohol and ethylene oxide.

Benzene

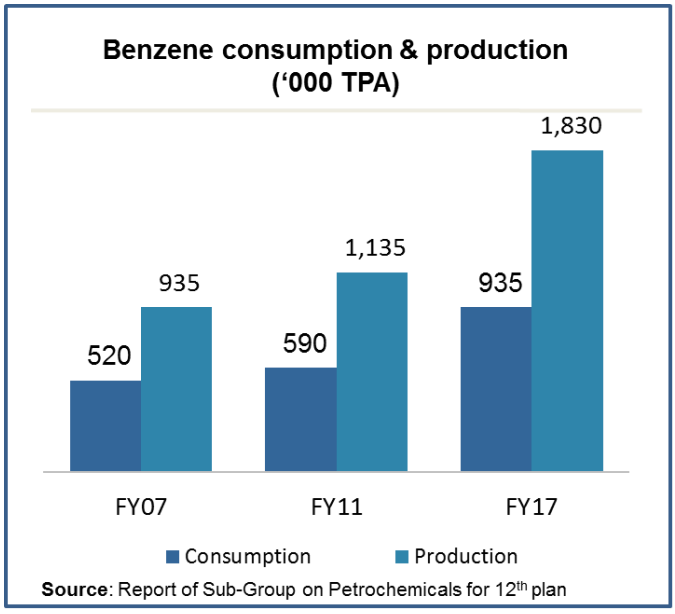
Benzene is an aromatic chemical. It can be produced from a variety of sources - through a reformer at a cracker complex, as a refinery product in steel plants (as a recovery product from coke oven gas, obtained during the carbonization of coal) and from toluene in a toluene disproportionation unit (TDP).

Benzene is used as a raw material in the following products:

- Caprolactam, utilized for making nylon filament yarn (NFY)
- Linear alkyl benzene (LAB), used in detergents
- Styrene, consumed in polystyrene and styrene butadiene rubber, which is used for laminates
- Nitrobenzene and chlorobenzenes, used as dye intermediates
- BHC and lindane, used in pesticides

Demand

During 2006-07 to 2010-11, domestic demand for benzene has grown at a slow pace from around 520,000 tonnes to around 590,000 tonnes, largely because of the lack of capacity additions in major end-user segments like LAB, caprolactam and phenol which together accounted for about 72 per cent of total domestic demand for benzene and continued in 2010-11. Over the next five years, demand for benzene is expected to

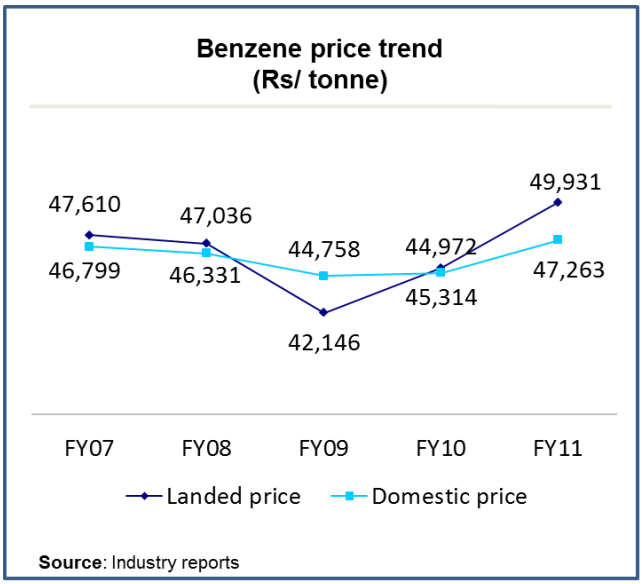


Source: Report of Sub-Group on Petrochemicals for 12th plan

grow at a compounded annual growth rate of 7-8%. Demand from nitrochlorobenzene segment, which is used in pharmaceuticals and agrochemicals, is expected to drive benzene demand.

Supply

Installed capacity of benzene increased to 1.397 million TPA in 2010-11 with the commencement of 125,000 tonnes capacity of IOC in Panipat in May 2010. It is expected to increase to 1.8 million TPA by FY16. ONGC Petro Additional Limited (OPAL) and ONGC Mangalore Petrochemicals Limited (OMPL) are expected to add capacities of 135 KT and 273 KT respectively in FY14. Production will increase at an average rate of 7% per annum over the XIIth five year plan period. With new capacity additions, growing production and muted domestic demand, exports are expected to rise as a % of production to 55% in FY16 from the current levels of 46%



Prices

Domestic prices of benzene moved in line with landed costs. In 2010-11, domestic prices increased by around 5 per cent and averaged at Rs 47,263 per tonne as compared to Rs 44,972 per tonne in 2009-10, landed cost increased by 10 per cent in 2010-11 and

averaged Rs 49,931 per tonne as compared to Rs 45,314 per tonne in 2009-10.

In 2011, international benzene prices are expected to increase further by around 25 per cent and average around $1,140-1,160 per tonne. Price increase in benzene is expected to be higher than that in naphtha owing to tight supply situation caused by plant shutdowns in Japan (due to the earthquake) and plant maintenance turnarounds during the first half of the year. However, in 2012, with the likely decline in upstream naphtha prices, benzene prices are also expected to decline by around 12 per cent and average around $1,000-1,020 per tonne.

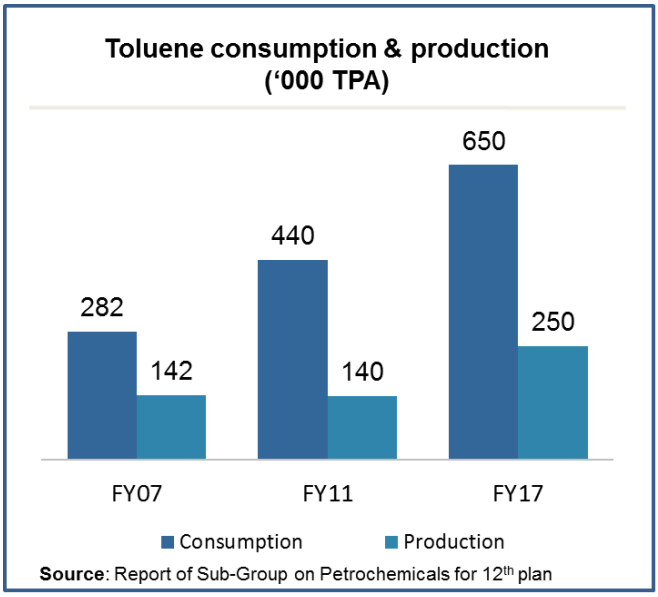
Toluene

Toluene is a basic aromatic chemical produced in a reformer, along with benzene and xylene. It is also obtained as a byproduct in oil refineries. Toluene has varied applications as a solvent in thinners, paints, inks and also in the pharmaceuticals industry (these account for nearly half of the total domestic demand). It is also used to produce nitrotoluenes, toluene sulphanomide, toluene di-isocyanate (TDI), dyes, pesticides, chlorinated derivatives, and drugs.

Demand

During 2006-07 to 2010-11, domestic demand for toluene grew by about 11% per annum, driven by demand from end-user segments.

During the XIIth five year plan period, demand for toluene is estimated to grow at an average annual rate of 7%. Thinners/ solvents, toluene diisocyanate (TDI) and toluene chloro derivatives segments are expected to drive demand.



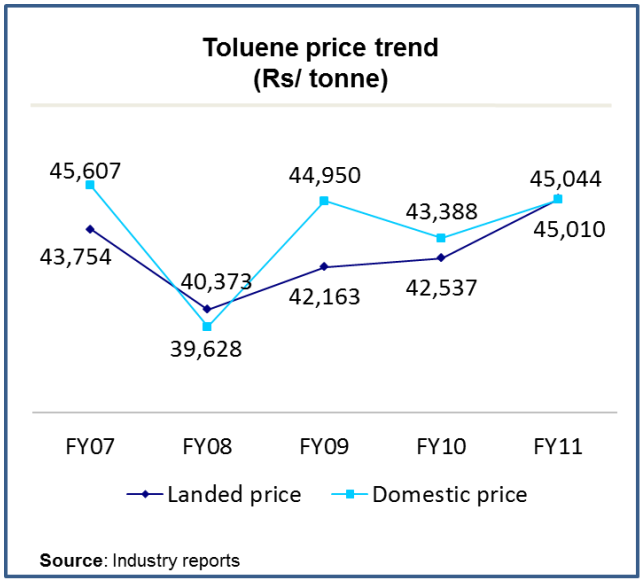
Supply

In 2010-11, the total installed domestic capacity of toluene is estimated to have been at about 310,355 TPA, while production is estimated at around 139,800 tonnes. Imports have grown at 10% per annum from FY07 to FY11, as the industry's utilization rates continued to remain low.

Over the next five years, imports are likely to increase at an annual average rate of ~5%. Absence of capacity additions, increasing demand and continuation of low operating rates of the industry are expected to lead to this increase.

Prices

Domestic prices generally move in line with landed costs. In 2010-11, domestic toulene prices increased by 4 per cent and averaged at Rs 45,010 per tonne from Rs 43,388 per tonne in 2009-10. Landed costs also increased by about 6 per cent and averaged at Rs 45,044 per tonne as compared to Rs 42,537 per tonne in 2009-10.



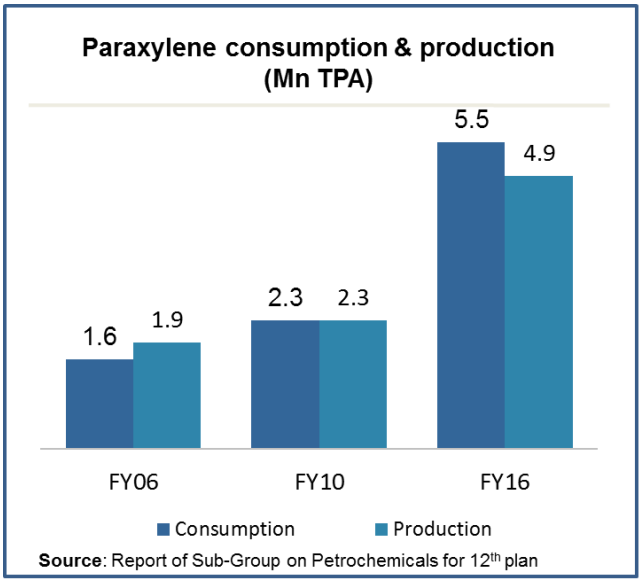
International toluene prices are expected to increase in 2011 by around 21 per cent and average around $1,005-1,025 per tonne. This increase will be in line with expected high feedstock prices particularly during the first half of the year and moderate demand. In 2012, however, in line with expected decrease in upstream crude prices, toluene prices are expected to decline and average around $860-880 per tonne.

Paraxylene

Paraxylene is used as a raw material for manufacturing PTA and DMT. Demand for paraxylene stood at 1.9 MnTPA in FY10, growing at about 11% annually since FY06

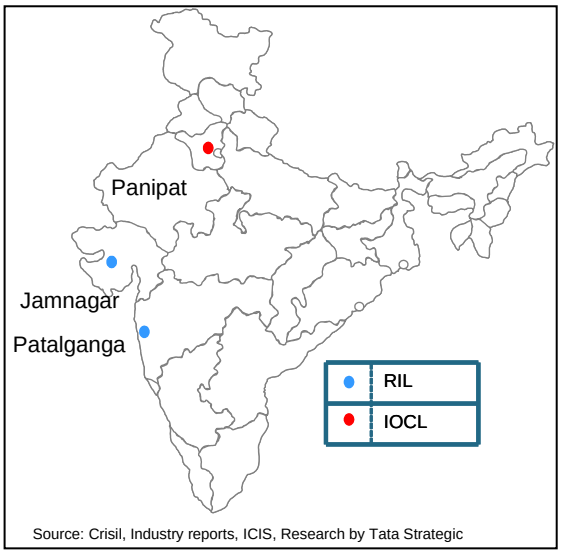
Demand supply scenario

Total production in India for during FY10 was 2.3 MnTPA, resulting in India being a small net exporter of paraxylene. India's total installed paraxylene production capacity was also 2.3 MnTPA as on FY10. RIL and IOCL are the two key domestic manufacturers of paraxylene, with



installed capacity of 1.85 MnTPA and 0.36 MnTPA, respectively. Both producers use naphtha cracking to produce paraxylene. Demand for paraxylene is expected to grow at ~16% p.a. to reach 5.5 MnTPA by FY16. The demand will be mostly driven by a commensurate growth in its key end-use application: PTA production, which is growing at more than 13% p.a. in the same period. Expected capacity addition of 2.7 MnTPA is likely to make the total capacity of paraxylene as 4.9-5.0 MnTPA by FY16. Despite additional capacity, demand supply gap of 0.6 Mn TPA is expected by FY16.

Manufacturing locations of key companies



Source: Crisil, Industry reports, ICIS, Research by Tata Strategic

RIL has roped in UOP of USA as a technology partner, whereas IOCL uses Invista T10 (now DuPont) technology.

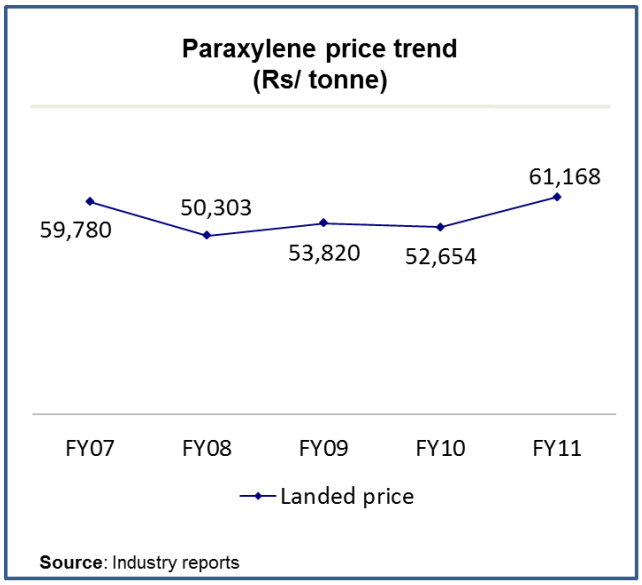
Additionally, several large petrochemical manufacturers have announced paraxylene projects, which could potentially increase existing capacity by almost 2.7 MnTPA within next five years. IOCL has also planned to set up a 1.2 MnTPA plant at Paradip. However, its status is not definitive.

Capacity additions

Companies	Locations	Capacity ('000 TPA)	Expected completion date
IOCL	Vadodara	370	FY12
MRPL	Mangalore	920	FY12
RIL	Jamnagar	1,400	FY 14
Total	-	**2,690**	-

Prices

Landed price for paraxylene is expected to be around Rs 61,168 per tonne in FY11.



Naphthalene

Naphthalene is a byproduct of coal tar distillation and used in Sulfonated Naphthalene Formaldehyde, dye and organic compound intermediates in fine chemicals, pharmaceuticals, beta naphthol, phthalic anhydride, tanning agents, moth balls and domestic disinfectants. It is used primarily in the manufacture of phthalic anhydride which is a very versatile chemical used in the manufacture of a wide number of industrially important chemicals. It is also one of the key feedstocks for the manufacture of dyes.

Demand

Naphthalene demand in India is around 57,000 tonnes

Supply

Production capacity for naphthalene in India is approximately 10,000 tonnes per annum. Himadri Chemicals has 8,000 tonnes per annum naphthalene manufacturing capacity which is used internally to manufacture Sulfonated Naphthalene Formaldehyde used in ready mix concrete and for admixture manufacture. Himadri is the only large organized sector player producing naphthalene and accounts for approximately 70% of the market.

Prices

Prices of naphthalene have risen from Rs 24,000 per tonne in FY07 to Rs 41,500 in FY11.

Industrial alcohol

Demand

Demand for ethanol from chemical and beverages industry was respectively in 2010. This is expected to rise to 3.2 billion litres by 2017. At 5% blending, ethanol demand for EBP (Ethanol Blending Program) is expected to reach around 2 billion litres by 2017. However the National Policy on Biofuels mandates a 20% blending by 2017. This implies ethanol demand for blending of around 6.5 billion litres. Thus a total of 9.2 billion litres of ethanol may be required by the 3 end-use sectors by 2017.

Supply

Over the last decade, India has produced an average of 1.8 billion litres of molasses based ethanol per year. This could rise to around 3.9 billion litres of molasses based ethanol by 2017. Thus to meet the demand of 9.2 billion litres by 2017, an additional 5.3 billion litres of ethanol will have to manufactured through next generation feedstocks.

Prices

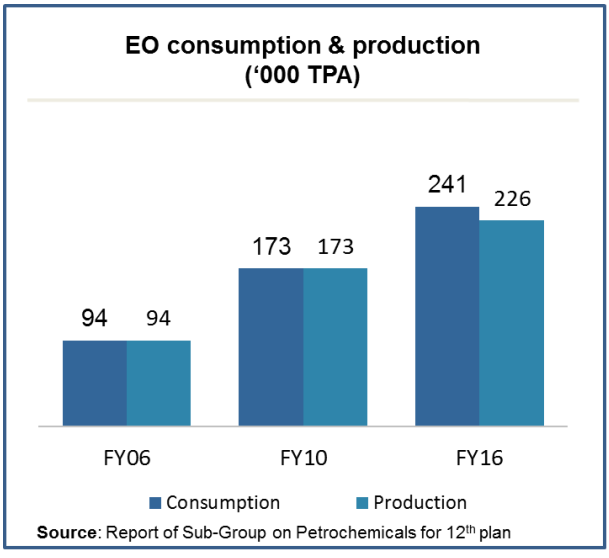
Price trend from sales realization of a representative company in India is as follows:

Price Data	(Rs/ KBL)	FY07	FY08	FY09	FY10	FY11
Company 1	Sales realization	30,612	22,764	30,645	NA	NA

Ethylene Oxide (EO)

The largest applications of EO are in the manufacture of surface active agents (non-ionic alkyl phenol ethoxylates and detergent alcohol ethoxylates) and other EO derivates like ethanolamines. EO derivatives find use in a wide array of end use applications, including

- Textiles
- Agrochemicals
- Pharmaceuticals, personal care & detergents



- Automotives, paint & coating industry

Demand

Since FY06 the demand has grown at over ~16.5% to reach 173,000 TPA by FY10. EO is an intermediate in production of EG, and in this analysis only pure EO which is used for other derivatives are considered. A key observation is that trade in EO is negligible because of hazards and constraints in transportation.

The expected demand growth of specialty chemicals is very high as its usage is in very nascent stages and in future its penetration levels will go up. During FY10-FY16, agrochemicals are expected to grow at 12% p.a. Oilfield chemicals are expected to grow at 14% p.a. Specialty chemical usage in textiles is expected to grow at over 10% p.a.

If EO is made available, then downstream specialty chemical manufacturing will grow and create more demand for EO. Currently the market is also in nascent stage and it provides great opportunity for entering and building a strong base for EO and its derivatives into specialty chemicals.

With the conservative estimate of demand growing at 6-7% taking into account the subsequent announced production plans of EO derivative only the demand is expected to reach 241,000 TPA by FY16.

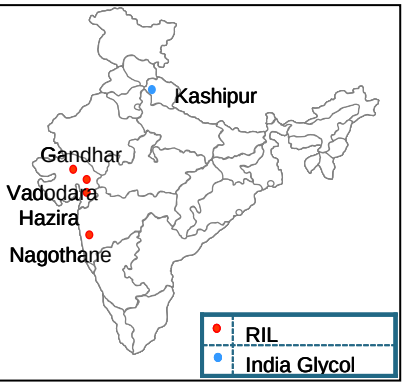
Supply

RIL is the largest producer of EO in India, accounting for almost 70% of the total installed capacity. Additionally, RIL has announced an EG/ EO plant with capacity of 720,000 TPA by 2014 at Jamnagar (expected pure EO capacity of 45,000 TPA). Moreover, it plans to increase the pure EO production by 34,000 TPA by FY12.

EO– Key producers and locations

	Key producers	Locations	Capacity, FY11 (TPA)	Raw material
1	RIL	Hazira, Nagothane Vadodara, Gandhar	120,000	Ethylene
2	India Glycol	Kashipur	55,000	Molasses
	Total		**175,000**	

Source: Industry reports, Research by Tata Strategic



EO is a critical feedstock for production of many specialty chemicals. Currently, RIL is the only seller of EO in India. India Glycols Ltd. consumes its production domestically. Also EO transport is difficult and hazardous hence the downstream production of many specialty chemicals is limited because of EO availability. Capacity addition is expected by RIL at its Jamnagar plant announced to commence operations from FY13. Expected capacity of EO by FY16 is ~226,000 TPA.

Prices

Ethylene oxide is not widely traded. Price trend from sales realization of a representative company is as follows:

Price Data	**(Rs/ tonne)**	**FY07**	**FY08**	**FY09**	**FY10**	**FY11**
A representative Indian company	Sales realization	69,376.14	68,987.00	80,814.60	69,444.96	NA