

EXPLORATORY STUDY OF RISK MITIGATION SOLUTIONS FOR INDIAN CHEMICAL INDUSTRY

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Abstract

The chemical industry is a vital part of the global economy and supply-chain network. It involves conversion of raw materials like oil or natural gas to thousands of products which are essential to modern life. India is the 6th largest producer of chemicals globally, 3rd in Asia and it is the 4th largest producer of agrochemicals after the United States, Japan and China. The Indian chemical industry is expected to register at CAGR 9.3% by 2025.

The pharmaceutical industry comprises of research, development, production and distribution of drugs. According to CARE ratings of August 2021, the Indian pharmaceutical business is expected to develop at an annual rate of ~11% over next two years. The market has increased up from 13.7% in 2020 annually to 17.7% in 2021 and the market revenue is expected to be over 12% y-o-y in FY22.

This study aims to identify the size and opportunities relating to pharmaceutical and chemical industries and to do potential mapping for both industries and to create a Risk Register for both pharmaceutical and chemical industries by utilizing the comprehensive list of risks identified affecting the industries. Through this research following outcomes were achieved: revenue- opportunity mapping for both pharmaceutical and chemical industries, brought to light the risk exposures of both the industries, distinguished between insurable and non-insurable risks, different insurance solutions available for the risks have been proposed as a result of this research study.

Keywords: Chemical Industry, Pharmaceuticals, Risk Management, Insurance, India

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INTRODUCTION

Chemical Industry in India

The supply-chain network and the global economy both depend on the chemical sector. It entails the transformation of raw elements like oil, natural gas, minerals, etc. into countless goods that are necessary to contemporary life. One of the most important pillars of every economy's growth and development is the chemical industry. The use of sulfuric acid is the primary premise used to assess the industrial progress of the nation. Basic/bulk chemicals, specialty chemicals, agrochemicals, and petrochemicals are the different subsectors of the chemical industry. In 2017, the direct gross added value of the chemical sector to the global GDP was US\$1.1 trillion. In 2020, the BRICS nations will represent 50.2% of global chemical sales.

After the US, Japan, and China, India is the world's fourth-largest producer of agrochemicals and ranks third in Asia in terms of overall chemical production. More than half of the technical grade pesticides are produced there. At the international level, excluding pharmaceuticals, the nation ranks 8th in chemical imports and 14th in chemical exports. With the exception of a few hazardous chemicals, India's chemical sector is unlicensed and highly varied. Its product selection includes more than 80,000 industrial goods. The sector generates about 2.5% of all chemical sales worldwide.

Industry Size

Revenue Potential for Insurers

By 2025, the chemical industry in India is projected to grow at a 9.3% CAGR. By 2025, the market is predicted to be worth US\$304 billion, up from US\$173 billion in 2019. The business is anticipated to contribute \$300 billion to the Indian GDP by 2025, and the industry's demand is anticipated to increase by 9% annually during that time. Speciality chemicals make up around 22% of India's whole chemical and petrochemical sector. The Indian specialty chemical market, which was valued at US\$18 billion in 2014 and US\$32 billion in 2019, is predicted to grow to US\$64 billion by 2025, according to a report by J M Financial. India's share of the world market for specialised chemicals climbed from 3% in 2015 to 4% in 2019. By 2025, this is projected to increase to 5.5 percent. Petrochemical demand is anticipated to increase by 7.5% CAGR and polymer demand by 8% from FY19.

Export Evaluation

In terms of global chemical imports and exports, excluding pharmaceuticals, India is ranked eighth and fourteenth, respectively. The nation produces the most dyes and exports 16%–18% of the world's dyestuffs. India exports dye to more than 90 nations. In the years 2021–2022, exports of chemicals and petroleum products made up 11.9% of all exports. India has a lower per capita chemical consumption than western nations, which opens up enormous opportunity for the establishment of industrial facilities focused on exports.

No.	Company	Annual Turnover-Rs crores (Consolidated) 2020-21	Insurance spend - 2020-21- Consolidated	Revenue Potential for Insurers (Rs. in crores) Consolidated	Revenue Potential for Insurers (Rs. in crores) - Standalone			
1	Reliance Industries Ltd (Oil to Chemicals)	301587	613	61.3	38.4			
2	United Phosphorus Ltd.	38952	186	18.6	3.1			
3	Asian Paints	21712.79	28.36	2.84	2.17			
4	Coromandel International Ltd.	14213.48	27.89	2.79	2.75			
5	Chambal Fertilizers & Chemicals Ltd.	12719.01	31.79	3.18	3.18			
6	Rain Industries Ltd.	10464.69	72.89	7.29	0.01			
7	TATA Chemicals	10200	63.17	6.32	1.4			
8	Rashtriya Chemicals and Fertilizers Ltd	8413.83	44.22	4.42	4.42			
9	SRF Ltd.	8400.04	39.57	3.96	3.33			
10	DCM Shriram Industries Ltd	8308.16	22.26	2.23	2.18			

Table 1: Top 10 chemical companies

Source : Authors (as per their respective annual reports 2020-21).

Figure 1: Insurance spend versus revenue potential



Source: Indian Brand Equity Foundation (IBEF)

India	Amount in million
	USD
Total Annual Turnover	194600
Total Insurance Spend	538.74
Ratio of Ins to Turnover	0.28%
Revenue Potential for Insurers	53.87
Тор 50	Amount in
	million USD
Total Annual Turnover	69840.69
Total Insurance Spend	193.35
Ratio of Insurance to Turnover	0.28%
Revenue Potential for Insurers	19.34
% contribution to overall T/O	35.89%
Тор 10	Amount in
_	million USD
Total Annual Turnover	66803.06
Total Insurance Spend	180.98
Ratio of Ins to Turnover	0.27%

Table 2: Turnover versus Insurance Potential (Chemical)

Source: Indian Brand Equity Foundation (IBEF)

From the analysis we can decipher that the revenue potential the chemical industry in India holds is US\$ 53.87Mn while that of top 50 companies (annual turnover basis) holds US\$ 19.34Mn and top 10 carries US\$ 18.10Mn. Even acquiring the business of top 10 companies enables insurers to achieve approximately 30% of the market share in the broker sector in chemical industry.

Indian Pharmaceutical Industry

India is the largest generic drugs provider globally. By volume in pharmaceutical production, India ranks 3rd and by value India ranks 14th. It supplies 25% of all medicine in the UK, 40% generic demand to US and over 50% of global demand for vaccines.

The industry across 60 therapeutic categories has 60,000 generic brands. Major segments include generic drugs, Active Pharmaceutical Ingredient (API)/Bulk drugs, Over-the-counter (OTC) medicines, Contract Research and Manufacturing (CRAMS), Biosimilar, Biologics and Vaccines. Currently the industry provides employment to over 2.7 million people in highly skilled areas such as manufacturing and research and development.

The global pharmaceutical market generated a total revenue of 1.27 trillion USD in 2020. Some of the major multinational companies include US: Pfizer, Johnson & Johnson, Merck & Co., Europe: Novartis, Roche, and GlaxoSmithKline.

Market Size

Known as the "Pharmacy of the World", India has established a leading position in the generic pharmaceutical market in a global level. About 2% of India's GDP is contributed by the pharmaceutical sector. Presently valued at US\$ 42 billion, the Indian domestic pharmaceutical market is likely to reach US\$65 billion by 2024 according to Indian Economic Survey 2021.

The market is poised to reach ~US \$120-130 billion

by domestic pharmaceutical market is likely to reach US\$65 billion by 2024 according to Indian Economic Survey 2021. The market is poised to reach US \$120-130 billion by 2030. According to India Ratings and Research, the market revenue of Indian pharmaceuticals is expected to be over 12% y-o-y in FY22. The market has increased to 17.7% annually in August 2021 against 13.7 % in July 2020.

More than 200 countries import Indian drugs, US being the key market. Being the 12the largest exporter of medical goods in the world, India's pharmaceutical sector contributes 6.6% to the total merchandize exports. Indian drugs and pharmaceutical industry saw a foreign direct investment (FDI) inflow of US\$1.206 billion between April – December 2021. Moreover, the government has allowed 100% FDI under the automatic route for greenfield pharmaceuticals. India has the highest number of biosimilar approved globally and CAGR of 22%.

Indian pharma exports witnessed a growth of 103% since 2013-14, from INR 90, 415 Crores in 2013-14 to INR 1,83,422 Crores in 2021-22. Exports achieved in 2021-22 is the Pharma Sector's best export performance ever.

It is a remarkable growth with exports growing by almost \$10 Bn in 8 years. India is the only country with largest number of US-FDA compliant plants (more than262 including APIs) outside of USA. We have nearly 1400 WHO-GMP approved Pharma Plants, 253 European Directorate of Quality Medicines (EDQM) approved plants .



Source: Indian Brand Equity Foundation (IBEF)

	Table3: Top 10 pharmaceutical companies								
No.	Company	Annual Turnover USD Consolidated (2020-21)	Insurance Spend Million-USD (2020- 21)Consolidated	Insurance Spend Million-USD (2020-21) Standalone	Revenue-Potential Insurers (Consolidated Million USD				
1	Sun Pharmaceuticals Industries Ltd	4466.42	31.47	9.86	3.15				
2	Aurobindo Pharmaceuticals Ltc	3303.28	11.88	5.91	1.19				
3	Dr Reddys Laboratories	2578.52	9.01	6.08	0.9				
4	Cipla Ltd	2554.61	0.83	5.2	0.08				
5	Intas Pharmaceuticals Ltd	2269.9	8.14	6.89	0.81				
6	Lupin Ltd	2021.73	12.43	9.21	1.24				
7	Zydus Lifesciences Ltd	2018.59	11.29	5.65	1.13				
8	Piramal Pharma Ltd.	1,707.91	5.124	0.54	0.51				
9	Glenmark Pharmaceuticals Ltd	1459.19	4.06	1.72	0.41				
10	Alkem Laboratories Ltd	1182	4.62	2.52	0.46				

Source: Authors (as per their respective annual reports 2020-21).

India	Amount in USD Mn
Total Annual T/O	42000
Total Insurance Spend	177.86
Ratio of Ins to Turnover	0.42%
Revenue Potential for Insurers	17.79
Top 50	Amount in USD Mn
Total Annual Turnover	38020.89
Total Insurance Spend	161.01
Ratio of Ins to Turnover	0.42%
Revenue Potential for Insurers	16.10
% contribution to overall Turnover	91%
Top 10	Amount in USD Mn
Total Annual Turnover	23562.15
Total Insurance Spend	98.87
Ratio of Ins to Turnover	0.42%
Revenue Potential for Insurers	9.89
% contribution to overall T/O	56%

Table 4:	Turnover versus	Insurance	spend ((Pharma))

Source: : Indian Brand Equity Foundation (IBEF)

From the analysis we can decipher that the revenue potential the pharmaceutical industry in India holds is US\$ 17.70Mn while that of top 50 companies (annual turnover basis) holds US\$ 16.10Mn and top 10 carries US\$ 9.89Mn. Acquiring the business of top 50 companies should be the target for insurers taim to garner market share in pharmaceutical industry.

LITERATURE REVIEW

A strong conceptual framework has been produced as a result of extensive research on various aspects of risk and risk management.

Both mathematical theories of probability and scientific techniques for establishing causal relationships between negative health impacts and various hazardous activities serve as the foundation for modern risk analysis. Mumpower, J., and V. T. Covello (1985). An historical viewpoint on risk analysis and risk management. 103–120 in Risk Analysis, 5(2).

The concept of "risk" itself, albeit subject to various meanings, indicates the ex ante possibility that things could go wrong or not turn out as planned. This is one potentially significant feature of risk communication. M. Power (2004). the handling of all risks. The Risk Finance Journal.

The goal is to achieve an optimal response to risk, prioritised in accordance with an appraisal of the risks, because the resources available for risk management are limited. Every organisation must take steps to manage risk in a way that it can justify to a level that is acceptable. Risk cannot be avoided. The type, scope, and complexity of the organisation, as well as the threats it encounters, will determine the necessary spectrum of solutions. P. Hopkin (2018). Understanding, assessing, and putting into practise efficient risk management are the foundations of risk management. Publishers Kogan Page.

Even with wholesale price contracts, certain businesses may totally escape inventory risk (the cost of unsold inventory) even while every firm in a supply chain suffers supply risk (the cost of insufficient supply). With a push contract, there is a single wholesale price and the retailer assumes full inventory risk by ordering their entire supply before the selling season. G. P. Cachon (2004). Push, pull, and advance-purchase discount contracts are the methods used in a supply chain to distribute inventory risk. 50(2):222-238 in Management Science.

Many nations that are experiencing previously unheard-of pressure to reduce carbon emissions are paying increasingly more attention to the environmental issue of climate change (Song and Leng, 2012b; Benjaafar et al.; 2013; He et al.; 2016).

Intuitively, reducing carbon emissions puts a supply chain (SC) in a lose-lose situation since it either reduces SC output or makes it more expedient to reduce emission rates, which is counter to both environmental goals and short-term economic interests. Journal of Cleaner Production, year 2019.

The three key determining variables for outsourcing management are price, quality, and

time to market. Under the Full Information (F) case and the Asymmetric Information (A) case, where the buyer does not share her internal variable cost information with the supplier, a game theoretic model is used to design the best outsourcing contracts that take into account these three factors. The results of a numerical experiment are also reported, along with the optimal outsourcing contracts that were derived. Insights on how to manage outsourcing risks brought on by asymmetric information are provided for a variety of industries, including those that are cost-, time-, quality-sensitive. 2016, Logistics and and Transportation Review, Part E of Transportation Research.

The drug research, development, production, and distribution sectors make up the pharmaceutical industry. The Indian pharmaceutical industry is anticipated to grow over the next two years at an annual pace of almost 11%, according to CARE assessments from August 2021. The market has grown from an annual growth rate of 13.7% in 2020 to 17.7% in 2021, and market revenue is anticipated to be over 12% year-over-year in FY22.

The supply-chain network and the global economy both depend on the chemical sector. It entails the transformation of raw materials like oil or gas into many goods that are necessary to modern life. In 2020, the BRICS nations will represent 50.2% of global chemical sales. By 2025, the chemical industry in India is projected to grow at a 9.3% CAGR.

The study goal is to map out potential for both the chemical and pharmaceutical industries and determine their size and opportunities. The extensive list of dangers found that influence the industries is also used to build a Risk Register for the pharmaceutical and chemical industries.

Research Methodology

The project study was completed using secondary data gathered from the annual reports of different chemical and pharmaceutical companies in India and data from research papers, articles, and reports by consultancy firms like PWC, McKinsey & Co., etc., disclosures by RBI, and other government agencies like Indian Brand Equity Foundation (IBEF), etc.

Research goals were as follows:

- 1. To develop a revenue-opportunity map for the chemical and pharmaceutical sectors
- 2. To highlight the risks that both industries face
- 3. To discriminate between hazards that can be

insured and those that cannot

4. To identify the risk-mitigation options that are accessible.

Discussion

Challenges Faced by the Chemical and Pharmaceutical Industries

Cyberattacks on businesses increased dramatically during the pandemic, and the healthcare industry was not exempt. Following a cyberattack, Dr. Reddy's Laboratories, an Indian pharmaceutical company, was forced to close several production facilities in October 2020. In addition to shutting down facilities in the US, UK, Brazil, India, and Russia, it also isolated all data centres. The incident happened right before Dr. Reddy's was preparing for the last round of trials for the Russian Sputnik V vaccine. Clinical trial data, a priceless piece of intellectual property at this stage of the epidemic, was present on the targeted servers.

The industry is faced with significant obstacles like outdated technological infrastructure, high capital expenses, and the high cost of fundamental raw resources like natural gas and crude oil.

The structure of the global value chain, in particular the extent to which China is relied upon globally for pharmaceutical intermediary inputs, is another important concern. 57 active pharmaceutical ingredients (APIs) for antibiotics, vitamins, and steroids could run out of supply if there is a protracted shutdown in China, according to a recent report by the Indian Drug Regulatory Authority.

For domestic manufacturers, poor pipeline connectivity, limited access to railroads, and ports are important issues. Since small and mediumsized manufacturers cannot afford captive power plants, unlike their larger counterparts, power supply is another significant challenge for these businesses.

Possibilities for the sector

Make in India production linked incentive (PLI) launched and approved in 2021 with an INR 18100 Crore budgeted layout spread over 5 years. In order to lower battery prices in the nation and lower the price of electric vehicles, the government is implementing a plan to increase domestic production of advanced chemical cells. The plan was created to be independent of technology.

Industry (Chemical Industry) –Licensing

With the exception of a few hazardous chemicals, India's chemical sector is unlicensed and highly varied. Its product selection includes more than 80,000 industrial goods.

Plastic parks, special economic zones (SEZ), and the petroleum, chemical, and petrochemical investment region (PCPIR)

The government is establishing four Petroleum, Chemical and Petrochemical Investment Regions (PCPIR) across the nation in Dahej (Gujarat), Vishakhapatnam-Kakinada (Andhra Pradesh), Paradeep (Odisha), and Cuddalore and Nagapattinam (Tamil Nadu) in order to encourage investments in the sector. Investors will benefit from a transparent and accommodating regulatory and facilities framework thanks to the clustering of PCPIRs.

The plan for creating Plastic Parks was developed by the Department of Chemicals and Petrochemicals with the intention of bringing together and integrating the diverse components of the Indian Plastics Industry. The scheme's overarching goal is to support the economy by boosting sectoral investment, production, and exports while also creating jobs.

Up to 50% of the project's cost in grant financing, up to a maximum of INR 40 crore, will be provided by the Indian government.

The State Industrial Development Corporation or the State Government shall cover the remaining project costs. Under the Plastic Parks initiative, parks made of plastic are being built in the states of Madhya Pradesh, Odisha, Jharkhand, Assam, and Tamil Nadu.

Direct foreign investment

In the chemical industry, 100% FDI is permitted under the automated method, barring dangerous substances. Between April 2000 and March 2022, the Chemicals industry received a total of USD 19,452.33M in FDI (excluding fertilisers).

The majority of the Indian pharmaceutical industry's segments are seeing the presence of multinational corporations, who have been consistently investing. A significant portion of the Indian population now has easier access to medical care thanks to their investments in tier II cities and rural areas. Between April 2000 and June 2020, the sector received cumulative FDI inflows worth US\$16.54 billion.

Government-instituted "patent box" with a 10% royalty income tax rate concession

Pipeline for National Infrastructure

NIP plans to invest a total of USD 1,826.46 billion

Eur. Chem. Bull. 2023, 12(Special Issue 5), 1198-1209

in 7,604 selected infrastructure projects in the areas of transportation, logistics, energy, communication, water and sanitization, as well as social and commercial infrastructure. By 2022, the Indian government wants the cost of logistics to be less than 10% of GDP, down from 14% today.

India's strategic location and simple access to several markets India has three sides that are bordered by water, making its location notably favourable for trade.

A big domestic market, maritime exports, and a strong private sector all contribute significantly to the country's economy. Given that over 65% of India's feedstock mix depends on crude oil, the western and southwest coasts of the country have served as the transit landfall for Middle Eastern crude oil. The country may establish intimate touch with West Asia, Africa, and Europe from the Western shore, and Southeast and East Asia from the Eastern coast, thanks to its location at the centre of the trans-Indian Ocean route, which links it with both the western continents and East Asia.

Availability of manpower at a reasonable price

The reduction in overall capex is facilitated by the availability of a skilled labour at a reasonable price, which lowers fabrication costs and boosts profit margins.

Integrating industry and infrastructure through the Industrial Corridor Project:

The National Investment and Manufacturing Zones (NIMZs) will be traversed by the industrial corridors that provide multimodal transport services, and freight cargo will be carried there via rail and road feeder links that provide last-mile connectivity.

Grades required by the Bureau of Indian Standards (BIS)

The Bureau of Indian Standards (BIS) has defined specific standards and grades for the import of certain chemicals and petrochemicals, which the DCPC, Government of India, has mandated to meet. With this initiative, the government hopes to both raise the calibre of domestically produced chemicals and petrochemicals and lower the calibre of imported chemicals.

Foreign Environment:

Multinational corporations are refocusing their efforts and may seek a trustworthy alternative to China in order to prevent supply disruptions. Indian chemical companies are in a good position to profit from this change and take home a sizable share of the market. With other nations, including those in South Asia, Japan, Korea, Croatia, Finland, Chile, Afghanistan, Singapore, and Malaysia, India has a number of trade and commercial agreements.

Robust export industry:

India had shipped medicines worth US\$ 15 billion to more than 200 nations, including those with strict regulations like the US, Europe, Japan, and Australia. A broad portfolio of anti-infective and anti-retroviral medications helps Indian companies stand out globally, even in emerging countries.

Market competition

With new and inventive business modules, a lot of second-tier Indian enterprises have developed, fostering market competitiveness.

Low production costs, R&D, and the presence of top-notch clinical trial facilities

By volume, the Serum Institute of India (SII) is the world's top vaccine manufacturer. Nasovac, a

Risk Register and Mitigation Solutions

locally created intra-nasal vaccine for the prevention of H1N1 infections, has been successfully introduced. They had also worked together as a manufacturing partner on the Oxford-AstraZeneca COVID-19 vaccine.

Inventive scientific talent:

India boasts the second-largest English-speaking population in the world, behind the US, and a wealth of scientific potential. The nation has prestigious institutes like the National Institute of Pharmaceutical Education and Research (NIPER) to support further research in the pharmaceutical industry. As a member of the Association of Commonwealth Universities, the institute.

Increasing trade balance in the pharmaceutical industry:

With pharmaceutical exports of US\$20.7 billion and imports at US\$2.31 billion in FY20, the sector has been producing trade surpluses.

Table 5: Regulatory and Compliance Risks							
RISKS	KEY SCENARIOS	SOLUTIONS					
Regulatory Changes	 Price Control Delay in facility inspections Delay in drug approvals 	Delay in start-up (ALOP)					
Taxation	•Adherence to local tax regulations in each country of operations •Inaccurate interpretations of tax laws in different jurisdictions	Tax Insurance					
Environmental & Safety Requirements	High vigilance on environmental protection Tightening regulations on environmental safety Environmental pollution	 Pollution Legal Liability Commercial General Liability 					

Table 6: Management and Liability Risks

RISKS	KEY SCENARIOS	SOLUTIONS
Product Liability/Recall	 Failure-to-warn allegations •Contamination of the drugs •Faulty packaging •Manufacturing defect •Tampering by third party •Voluntary/Regulatory recall •Counterfeit drugs 	Commercial General Liabilities Product Recall Contaminated Product Insurance Barcode Coverage Product Guarantee & Financial Loss Manufacturing Professional Indemnity
Corporate Liability	•Misrepresentation of material facts like financial statements • Failure to comply with regulations	Directors & Officers Policy
Theft/Dispute of Intellectual Property	 Reduction in projected profits •Suspension of production and sales •Loss of access to use of technology and payment for its usage 	Cyber Insurance
Clinical Trials	•Bodily harm to research subject due to negligence •Physical damage to any research object	Clinical Trial
Mergers & Acquisitions/Public Offer	Undisclosed pending litigations •Omissions or mistakes in financial statements •Cultural clash •Overpayment •Change of Management •Change in holding company •Change in control •Listing/public offer	 Mergers & Acquisition Insurance Run-off Policy Public Offering of Securities Insurance
Employee Liabilities	Occupational injuries, employee mental health •Workplace vi olence/threat/mistreatment •Business travel risks •Abduction & extortion	 Employment Practice Liabilities Insurance Kidnap & Ransom Workmen Compensation
Breach of Contract	•Contractual penalty/loss of contract •Business interruption	Professional Indemnity

Table 7: Operational and Financial Risks

RISKS	KEY SCENARIOS	SOLUTIONS
Supply Chain Disruption	•Reliance on few key suppliers •Import/export ban •Geo-political tension •Escalation in transportation cost •Damage in transit •Delay in supplies	 Marine Cargo Insurance Marine Sales Turnover Policy Marine Stock Throughout Policy Contingent Business Interruption
Property Damage & Business Interruption	•Fire perils •Nat cat •Social perils •Engineering perils	 Industrial All Risk Policy (incl. BI) Erection All Risk/Construction All Risk Policy
Cyber Risk & Data Protection	•Ransomware attack •Phishing attacks •Leak of R&D data •Leak of research subject data •System failure	 Cyber Insurance Contingent Business Interruption Patent Infringement Insurance
Political & Credit Risk	•Embargoes (trade ban), •Import/export license cancellation •War •Seizure of assets •Bankruptcy •Insolvency	 Trade Credit Insurance Political Risk Insurance
Non-Damage BI	•Epidemic/pandemic •Regulatory Action	 Non-Damage Business Interruption Insurance
Human Capital	•Loss of skilled employees •Employee dishonesty	Employee Benefit InsuranceCrime Insurance
Changes in market dynamics	•New market entrants •Change in marketing strategy by competitors •Increase in competitive intensity •Emerging & disruptive technologies/marketing practices, digitization	 Not Insurable – can provide tailor made solutions according to the clients' need

Conclusion

The chemical and pharmaceutical sectors in India have enormous potential for the country's economy and development as well as for the insurance industry. For the chemical and pharmaceutical industries, the project was able to create a revenueopportunity mapping that revealed the revenue potential for the insurance industry as a whole as well as specific Insurers.

The chemical sector in India is worth US\$53.87 million, while the top 50 businesses (based on yearly turnover) are worth US\$19.34 million and the top 10 are worth US\$18.10 million. The pharmaceutical industry in India has a revenue potential of US\$ 17.70 million, compared to US\$ 16.10 million for the top 50 businesses (based on yearly turnover) and US\$ 9.89 million for the top 10.

Additionally, it succeeded in its goal of identifying the risk exposures for both companies, which were examined and divided into three major groups: financial and operational risks, management liability risks, and regulatory and compliance risks. As a risk-mitigation strategy, appropriate insurance solutions for these risks were found. The risk register might not be thorough and might have overlooked some concerns or solutions. Reducing this gap might be made easier by routinely updating the registry.

The study's implications for the insurance sector confirm that there is a huge market opportunity for insurance-based risk management products in the chemical and pharmaceutical sectors. By displaying income potential mapping for both industries, it study provides a clear knowledge of the same. Making a risk register for both of these businesses was another component of the research project. The insurers may be able to take advantage

Eur. Chem. Bull. 2023, 12(Special Issue 5), 1198-1209

of this by developing a client-centered, specialised solutions. As a result, insurers can offer more than just transactional services.

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ANNEXURES

No.	Company Name	Annual Turnover in Rs crores (Consolidat ed) 2020-21	Annual Turnover in Rs crores (Standalone) 2020-21	Headquarters	Manufacturing Locations (India & Overseas)	Insurance Spend Rs. in crores (2020- 21 Consolidated)	Revenue Potential for Brokers (Rs. in crores) - Consolidated	Insurance Spend Rs. in crores (2020- 21 Standalone)	Revenue Potential for Brokers (Rs. in crores) - Standalone
1	Reliance Industries Ltd (Oil to Chemicals)	301587.00	261866.00	Mumbai	India(10) - Jamnagar, Hazira, Dahej, Nagothane, Vadodara, Patalganga, Silvassa, Barabanki and Hoshiarpur, Malavsia (3)	613.00	61.30	384.00	38.40
2	United Phosphorus Ltd.	38952.00	11458.00	Mumbai	43 facilities - India, Korea, Vietnam, China, S.Africa, Ivory Coast, Spain, France,Belgium, Netherlands, UK, Argentina, Brazil, Colombia, Costa Rica, Mexico, USA	186.00	18.60	31.00	3.10
3	Asian Paints	21712.79	18516.86	Mumbai	Rohtak, Kasna, Ankleshwar, Khandala, Patancheru, Visakhapatnam, Mysuru, Sriperumbudur, Cuddalore, Sarigam, Taloja	28.36	2.84	21.65	2.17
4	Coromandel International Ltd.	14213.48	14163.00	Hyderabad	Jammu, Raebareli, Kota, Udaipur, Vadodara, Nimrani, Dahej- Ankelshwar, Sarigam, Hospet, Vishakapatnam, Kakinada, Ranipet, Ennore, Cuddalore	27.89	2.79	27.54	2.75
5	Chambal Fertilizers and Chemicals Ltd.	12719.01	12719.01	New Delhi	Gadepan (Unit I,II,III)	31.79	3.18	31.79	3.18
6	Rain Industries Ltd.	10464.69	47.63	Hyderabad	CANADA - Hamilton, Ontario; USA - Robinson (Illinois), Lake Charles, Chalmette, Gramercy, Norco (Louisiana), Purvis (Mississippi); GERMANY - Castrop-Rauxel, Duisburg; RUSSIA - Cherepovets; POLAND - Kedzierzyn - Kozle; INDIA - Suryapet (Telangana), Visakhapatnam, Atchutapuram, Kurnool (Andhra Pradesh); BELGIUM - Zelzate	72.89	7.29	0.10	0.01
7	TATA Chemicals	10200.00	2999.00	Mumbai	USA - Green River Basin; UK - Winnington, Lostock, Middlewich; Africa - Magadi (Kenya), Jorf Lasfar- (Morocco JV), North Africa; Asia - Mithapur (Gujarat), Cuddalore (Tamil Nadu), Nellore (Andhra Pradesh), Ankleshwar, Dahej (Gujarat), Lote, Akola (Maharashtra)	63.17	6.32	13.98	1.40
8	Rashtriya Chemicals and Fertilizers	8413.83	8413.83	Mumbai	Tromboy, Thal - Maharahstra	44.22	4.42	44.22	4.42

Annexure 1: TOP 50 Chemical Companies in India

Eur. Chem. Bull. 2023, 12(Special Issue 5), 1198-1209

	Ltd								
9	SRF Ltd.	8400.04	6988.32	Gurgaon	Tamil Nadu - Manali, Viralimalai, Gummidipoondi; Gujarat - Dahej; Rajasthan - Jhiwana; Madhya Pradesh - SEZ Indore, Industrial Growth Centre Pithampur, Uttarakhand	39.57	3.96	33.26	3.33
10	DCM Shriram Industries Ltd	8308.16	8211.99	New Delhi	Kashipur Kota, Bharuch	22.26	2.23	21.84	2.18
11	Pidilite Industries Ltd.	7292.71	6186.67	Mumbai	Mahad (Maharashtra), Vapi (Gujarat), Baddi (Himachal Pradesh), and Kala Amb (Himachal Pradesh)	12.91	1.29	9.30	0.93
12	Bajaj Hindusthan Sugar Ltd.	6688.56	6688.20	Mumbai	(UP): Golagokarannath, PaliaKalan and Khambarkhera, Barkhera, Kinauni, Gangnauli, Thanabhavan and Budhana, Bilai, Maqsoodapur, Pratappur, Rudauli, Kundarkhi and Utraula	12.59	1.26	12.49	1.25
13	Deepak Fertilizers and Petrochemicals Corporation Ltd.	5808.49	1811.31	Pune	Taloja – Maharashtra, Srikakulam – A.P., Panipat – Haryana and Dahej – Gujrat.	21.67	2.17	7.03	0.70
14	Shree Renuka	5555.37	5461.53	Belgaum,	Athani, Pathri, Raibag, Gokak,	9.77	0.98	9.32	0.93
L	Sugars Ltd			Karnataka	Munoli, Panchaganga, Havalga				
15	India Glycols Ltd.	5427.47	5402.08	Noida	Dehradun, Kashipur, Gorakhpur	13.50	1.35	13.13	1.31
16	Aarti Industries Ltd	5023.00	4808.00	Mumbai	20 - Locations, Dahej SEZ	10.95	1.10	9.71	0.97
17	P I Industries Ltd.	4577.00	4276.20	Gurgaon	Gujarat - Panoli (I,II), Jambusar SEZ	14.00	1.40	12.70	1.27
18	Deepak Nitrite	4382.00	1823.00	Gujarat	Nandesari, Dahej (Gujarat) Roha, Taloja (Maharashtra), Hyderabad - Unit I,II,III (Telangana)	13.25	1.33	8.85	0.89
19	Atul Ltd	3731.47	3512.35	Gujarat	Atul, Ankleshwar (Gujarat)	14.86	1.49	13.36	1.34
20	Supreme Petrochem	3178.49	3178.49	Mumbai	Amdoshi (Maharashtra), Manali	6.58	0.66	6.58	0.66
21	Ltd. Gujarat Heavy Chemicals Ltd	2927.12	2849.71	Noida	(Tamil Nadu) Sutrapada(Gujarat), Madurai & Manaparai, Nagapattinam(Tamil Nadu)	19.27	1.93	19.12	1.91
22	Solar Industries India Limited	2537.05	1610.04	Nagpur	India -Rajasthan Madhya Pradesh Telangana Maharashtra West Bengal Chhattisgarh Odisha Jharkhand Tamil Nadu, Turkey - Ankara, Zambia - Chambeshi, Nigeria - Lagos, S.Africa - Middleburg, Ghana, Australia, Tanzania, Indonesia	50.69	5.07	16.30	1.63
23	Gujarat	2523.61	2650.50	Noida	Dahej, Ranjit Nagar(Gujurat); Taurirt	14.17	1.42	13.56	1.36
24	Laxmi Organic Industries	1768.45	1606.11	Mumbai	(Morrroco) Mahad(2), Ratnagiri, Kolhapur, Satara, Pune (Maharashtra)	5.79	0.58	5.71	0.57
25	Himadri Speciality Chemicals Ltd.	1679.46	1679.46	Kolkata	Hooghly, Liluah I, II - Howrah (W.B.), Korba (Chattisgarh), Visakhapatnam (A.P.),Vapi (Gujarat), Sambalpur (Odisha),Falta SEZ Unit (WB), China - Shandong Palayawa Parada (Guisast)	4.29	0.43	4.29	0.43
20	Organics Ltd	1211.46	1227.78	Mahanashtra	Falanpui, Baroua (Oujarat)	2.25	0.10	0.09	0.07
27	Balaji Amines Ltd	1311.40	1227.78	Manarashtra	(Telangana)	12.25	0.23	1.07	0.17
20	Chemicals Ltd	1290.52	1275.11	Chennai	(Gujarat)	7 57	0.76	7.57	0.76
30	Ltd	1200.74	1242.44	Navi Mumbai	Nadu); Karaikal (Puducherry)	3.42	0.70	3.42	0.70
30	Chemicals Ltd	1230 17	1152.72	Kolkete	India (16) Nenal (2) Poland Duccio	10.37	1.04	7 72	0.77
51	Derger 1 dilles	1237.41	11,22.12	isoindia	Ahmedabad(Unit I II III IV)	10.57	1.07	1.12	0.77
32	Bodal Chemicals Ltd.	1226.43	1129.73	Ahmedabad	Vadodara (Unit VII,VIII, X), Bharuch (IX), Khambat, Mathura	2.86	0.29	2.68	0.27
33	Heranba Industries Ltd.	1218.65	1218.65	Mumbai	Vapi (Unit I,II,III)	1.97	0.20	1.97	0.20
34	NACL Industries Ltd.	1206.73	1206.03	Hyderabad	Srikakulam, Ethakota (Andhra Pradesh)	4.59	0.46	4.59	0.46
35	Camlin Fine Sciences	1187.10	600.05	Mumbai	Dahej (India); Ravenna (Italy); China	8.26	0.83	4.40	0.44
36	Navin Fluorine International Ltd	1179.39	1133.11	Mumbai	Surat (Gujarat), Dewas (Madhya Pradesh)	6.35	0.64	5.78	0.58
37	I G Petrochemicals Ltd	1123.62	1123.62	Mumbai	Taloja (Maharashtra)	5.31	0.53	5.31	0.53
38	Kanoria Chemicals and Industries Ltd	1094.86	387.95	Kolkata	Ankleshwar, Visakhapatnam, Naidupeta	3.64	0.36	1.65	0.17
39	Manali Petrochemicals Ltd	1019.52	922.23	Chennai	Manalı (Chennaı) - Plant 1 & 2	4.13	0.41	2.47	0.25
40	Pondy Oxides and Chemicals Ltd.	1004.27	1004.27	Chennai	Pondicherry(2), Kancheepuram(4), Thiruvallur (Tamil Nadu), Chittoor (Andhra Pradesh)	0.49	0.05	0.49	0.05
41	vinati Organics Ltd	954.26	954.26	Mumbai	Manad, Katnagiri (Maharashtra)	4.43	0.44	4.43	0.44
42	Anupam Rasayan India Ltd	810.89	810.89	Gujarat	Sachin (Unit 1,2,3,6), Jhagadia(Unit 4,5)	1.79	0.18	1.79	0.18

Eur. Chem. Bull. 2023, 12(Special Issue 5), 1198-1209

43	Rossari Biotech Ltd	709.35	690.41	Mumbai	Silvassa, Dahej	1.32	0.13	1.29	0.13
44	Indigo Paints Ltd	723.32	723.32	Pune	Jodhpur (Rajasthan), Kochi (Kerala),	1.68	0.17	1.63	0.16
					Pudukottai (Tamil Nadu)				
45	Jubilant Ingrevia	684.10	668.93	Noida	Gajraula(UP), Bharuch, Savli	1.65	0.17	1.42	0.14
					(Gujarat),				
					Nira, Ambernath (Maharashtra)				
46	Meghmani	609.78	609.78	Gujarat	Ankleshwar, Dahej, Panoli(2), Vatva,	1.80	0.18	1.80	0.18
	Finechem Ltd			-	Dahej SEZ				
47	Plastiblends India	577.33	577.33	Mumbai	Daman, Palsana, Roorkee	2.13	0.21	2.13	0.21
	Ltd								
48	Apcotex Industries	540.64	540.64	Mumbai	Taloja(Maharashtra), Valia(Gujarat)	1.83	0.18	1.83	0.18
	Ltd								
49	Indo Amines Ltd	540.53	539.35	Mumbai	Baroda, Dombivli, Rabale, Dhule,	1.31	0.13	1.22	0.12
					Tarapur, Mahad				
50	Clean Science and	512.43	512.43	Pune	Kurkumbh MIDC (Maharashtra)	1.23	0.12	1.23	0.12
	Technology Ltd								
51	Fairchem Organics	396.57	396.57	Maharashtra	Sanand (Ahmedabad)	0.51	0.05	0.51	0.05
52	Vinyl Chemicals	395.34	395.34	Mumbai	Mahad	0.50	0.05	0.50	0.05
	Ltd								