

An empirical assessment of the impact and role of the indenting agents in the supply chain of pharmaceutical raw material from China

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Abstract

Even though India ranks third in the world for pharmaceutical output, there is an undue reliance on China for APIs (Active Pharmaceutical Ingredients), bulk pharmaceuticals, intermediates, primary raw materials, and fermentation technology. Only Chinese raw materials are used in the nation's production of pharmaceutical raw materials. The Export Promotion Council for Pharmaceuticals is taking steps to reduce this undue reliance on China. If China elected not to provide those products, it would have problems addressing both domestic health needs and export requests. India must act to create a production process strategy since China's costs are gradually growing. The Pharmaceuticals Export Promotion Council also represents these issues in the relevant fora, and the Center takes the condition into consideration. To accomplish these goals, the researcher in this paper is attempting to determine the impact of the indenting agent's position in the supply chain between Chinese manufacturers and end-users during the import of pharmaceutical raw materials. China still has a more important role to play, though. To identify the variables and accomplish the research's goals, analysis of variance methodologies was employed and 118 end consumers from various regions of India were recruited.

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1. Introduction

The third-largest volume producer of pharmaceuticals in the world is India. 20% of the world's exports of "generic" medicines are imported into the nation, according to the Department of Pharmaceuticals. Some products no longer have a patent and can therefore be produced and sold by either company, or they are often priced reasonably. India has the most FDA-approved seeds outside of the US, and it is thought that 40% of generic drugs sold in the US come from there. The loss of pharmaceutical product patents from 1972 to 2005, along with restrictions on foreign investment in the 1970s and 1980s, led to the development of a unique and competitive manufacturing sector in India, a country best known for its role as a provider of services in the global economy.

The majority of India's APIs come from China as well, which worries the Indian government, which has formed a task force to look into the issue. In the 1950s and 1960s, two state-owned pharmaceutical companies were established, and since then, the nation has possessed a sizable amount of API self-sufficiency. However, more stringent environmental rules have been put in place in recent years, which many believe has constrained this sector of the Indian economy. Chinese prices for land, energy, and output are also lower. India now imports around 70% of its APIs from China as a result. Additionally, China is the only source of some well-known medications including ibuprofen, amoxicillin, and paracetamol for India. Although the United States, Europe, and India have voiced worries about China's overdependence, Africa is the most reliant on the global pharmaceutical supply chain. Almost all APIs and 80-90 percent of finished drugs consumed on the continent are imported, with India accounting for most of them. Even before the pandemic, there had been significant debate about the globalized existence of the pharmaceutical sector and its vulnerability. In the global pharmaceutical manufacturing sector, India has become increasingly significant. Its well-known expertise in formulation production finished drug manufacturing, and product marketing in controlled markets has made it a reliable partner for major pharmaceutical firms looking for generic development and/or marketing partners. China's current advantages are its improved production infrastructure, large-scale raw material production facilities, and comparatively low labor and material costs. Process growth, medication formulation, dosage form processing, and marketing in well-regulated markets are among India's current strengths.

As a result, it can be inferred that Indian firms are currently the best choice for designing, producing, and selling dosage-type medicines. Upstream jobs, such as contract manufacturing (and sourcing) of advanced pharma intermediates and APIs, is a better match for Chinese firms. Furthermore, Chinese businesses charge less for the same form of services/products than their Indian rivals, resulting in greater cost-cutting gains.

However, as our research has shown, although China and India are currently the global hotbeds for pharmaceutical manufacturing, they still play a much smaller role than developed countries, especially in high-end areas such as special formulation techniques and the manufacture of APIs and finished drugs that are still protected by patents. The condition is primarily dictated by these two countries' inherent vulnerabilities in terms of pharmaceutical R&D spending. This detailed research shows that the supply chain, which seems to be flexible and hassle-free is not, in fact this whole supply chain is baked by indenting agents on both sides, and those who set the rule of this supply chain of pharma industry are none other than indenting agents and they have complete control on this whole mechanism.

2. Review of literature

The lack of pharmaceutical raw materials is a global issue, and the most impacted nations have begun to take action to address it by collaborating with pharmaceutical firms (Svarm, 2018). Understanding each node in the complex web of the pharmaceutical supply chain is essential to managing a shortage of pharmaceutical raw materials. As contemporary Indian Indenting Agents vendors enter the supply chain after the manufacture of raw materials, their potential is investigated in this study.

The literature on developing Pharma raw material resistance and supply chain models in the pharmaceutical sector have been reviewed to better understand the significance of effective indenting agents in the unavailability of pharmaceutical raw materials. For the analysis of the pharmaceutical market, two books on Porter's five forces model and papers on the application of the model in other industries are used. Primary data was collected to get a deep understanding of Indian Indenting Agents, and secondary data such as government reports and articles on the Indenting Agents market in India were analyzed.

Mahajan (2014) examines the development of the Indian pharmaceutical business through an examination of exports and related

growth rates. With expanding R&D facilities, India is establishing itself as a significant exporter of formulations and bulk chemicals in order to increase its market share.

Huq's (2016) study on the reasons that cause disruptions in the pharmaceutical supply chain takes a comprehensive look at the whole supply chain with an emphasis on the issues with supply chain configurations brought on by the tactics of the major pharmaceutical firms. With data gathered over time, several sourcing models are thoroughly addressed, and the main problems brought on by this regional spread of operations are identified. In order to convey managerial implications, the essay provides a comprehensive knowledge of the concepts in sourcing with factual facts.

To enhance profits and value, Kapoor (2018) views supply chain management in the pharmaceutical sector as the key aspect that enables the company to make better use of its resources and assets. According to the report, fraud, adverse reactions, issues with supply-chain players, production, retailers, transportation, storing and warehousing, and issues with raw material suppliers are the main issues in the pharmaceutical supply chain in the Asian areas. Ten consequences in total for the entire sector can be derived from all the issues, including tighter regulatory guidelines, more requests for modifications to the logistical setup, and the use of technological solutions to provide visibility and transparency throughout the entire supply chain.

The danger associated with outsourcing is further explained by Koh's 2003 study on the issue of counterfeiting, which notes that as regulatory standards change, it becomes more difficult for producers and distributors alike. A summary of each stage of the complete pharmaceutical supply chain is provided in the report, together with information on the accountability systems in place to ensure it. The use of technology, which can increase the process' overall openness, is related to the growing demand for accountability in the pharmaceutical supply chain.

Future expansion strategies might be based on the performance of Indian pharmaceutical companies and their position in the global market. It is crucial to comprehend each pharmaceutical company's portfolio and their contribution to the business because there are many of them in India (Dun & Bradstreet India, 2016). The standard of the products is used to determine which API manufacturers are chosen in India. Risk evaluation, specifications, analytical findings, document review observations, and inspection findings are all part of the selection process (Mallu et. al., 2015). The choices for Contract Research and Manufacturing Services (CRAMS)

also aid in the expansion of the Indian pharmaceutical industry (LSIT, 2016).

It is critical to improve transparency and accountability throughout the disjointed supply chain system to address the issues of shortage, stock-outs, and scarcity of pharmaceutical raw materials in India. In Asia, particularly India, there is a poor link between a small number of large firms and many small Indenting Agents suppliers (Cogan et. al., 2018; Alward et. al., 2022; Wang et. al., 2009).

3. Research Gap

The study by Huq (2016) on the disruption factors in the pharmaceutical supply chain examines every aspect of the supply chain with a focus on its problems. The primary issues in the Asian pharmaceutical supply chain, according to Kapoor (2018), are counterfeiting, adverse reactions, issues with supply chain players, production, retailers, transportation, storing and warehousing, and issues with raw material suppliers. The influence and function of the indenting agents in the supply chain of pharmaceutical raw materials from China are the specific research issue that has never been attempted to be evaluated.

4. Objectives of the Study

The goal is to evaluate the function of indenting Agents in the supply chain for raw materials. The study contains pharmaceutical raw materials that are inaccessible in India. It examines the tactics used by the Indian API supplier to supply pharmaceutical raw materials to the Indian market. The following are the study's main goals: -

- To identify the difference among the end-users over the access of services of indenting agents for Pharma supply.
- To assess the difference among the end-users over competitive advantage, ease of convenience, logistic support, payment flexibility, and choice of liberty of indenting agents for Pharma supply in the Indian market.
- To analysis the difference among the end-users over brand promotion and advantage of emergency like COVID-19 for indenting agents in Pharma product supply.
- To study the difference among the end-users over legal formalities support bargaining power and price war support of indenting agents for Pharma supply in the Indian market.

5. Hypotheses

- I. There is no significant difference among the end-users over the access of services of indenting agents for Pharma supply.
- II. There is no significant difference among the end-users over competitive advantage, ease of convenience, logistic support, payment flexibility, and choice of liberty of indenting agents for Pharma supply in the Indian market
- III. There is no significant difference among the end-users over brand promotion and advantage of emergency like COVID-19 for indenting agents in Pharma product supply.
- IV. There is no significant difference among the end-users over legal formalities support, bargaining power, and price war support of indenting agents for Pharma supply in the Indian market.

6. Methodology

For the research to produce rational responses to the research questions, a clear approach must be followed. Based on the examination of the accessible scientific publications, essays, and annual reports of the companies, current Indenting Agents in India will be identified. Interviews with the various market participants, including supply chain managers, commercial managers, procurement managers, and other clients of pharma raw material, are used to gather the data. The approaches that were decided upon to achieve the work's objectives are justified. The limitations of the used approaches are also described. The research assumptions were verified using analysis of variance.

7. Sampling and Data Collection Method

The first stage of the research, which is quantitative in nature, is carefully analyzing all the information that is already available in the form of publications from various researchers. In this regard, a variety of books and journal articles were employed to understand the background information and to clarify the research's purpose. The first step in the process is to study all the pertinent publications and determine the main issues that can be covered during the semi-structured interview. articles on pharmaceutical raw materials, resistance to pharmaceutical raw materials, and their scarcity in India. The approach is divided into two stages, the first of which was devoted to analyzing all the pertinent

information sources related to the research questions, and the second to identifying the crucial inquiries that must be addressed in order to achieve the study target.

Limitation

It was challenging to locate information sources focused on the API manufacturers without the larger context of the pharmaceutical sector due to the close relationship between the pharmaceutical industry and manufacturers of active pharmaceutical ingredients. As the information we requested is sensitive to their company, it was difficult to persuade participants to participate in this survey. A membership is required to access some of the private information on the Indian API market. The distance between us and the supply manager made it difficult to conduct a face-to-face interview that may have provided more information. Due to the length of time, it takes for people to respond to emails and the difficulty of persuading someone over email, time is a key constraint. The participants must be persuaded to agree to an interview and offer some insight into the topic over the course of at least two to three emails. The scale of interviewers varies since the interviews are conducted with employees working at various levels, which could affect the outcomes. There aren't enough interviews to make any conclusive statements or pinpoint any distinct tendencies.

8. Data Interpretation and Analysis

Table 1
Case Processing Summary

	Name of City	Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
Do you access services of indenting agents for Pharma supply	Telangana	52	100.0%	0	0.0%	52	100.0%
	Tamilnadu	11	91.7%	1	8.3%	12	100.0%
	Gujrat	14	100.0%	0	0.0%	14	100.0%
	Maharashtra	14	100.0%	0	0.0%	14	100.0%
	Karnatka	16	94.1%	1	5.9%	17	100.0%
	Delhi	11	100.0%	0	0.0%	11	100.0%

Contd...

Do Indenting Agents Provide Ease of Convenience	Telangana	52	100.0%	0	0.0%	52	100.0%
	Tamilnadu	11	91.7%	1	8.3%	12	100.0%
	Gujrat	14	100.0%	0	0.0%	14	100.0%
	Maharashtra	14	100.0%	0	0.0%	14	100.0%
	Karnatka	16	94.1%	1	5.9%	17	100.0%
	Delhi	11	100.0%	0	0.0%	11	100.0%
Do Indenting Agents Gives You Competitive Advantage in Supply of Pharma Raw Material	Telangana	52	100.0%	0	0.0%	52	100.0%
	Tamilnadu	11	91.7%	1	8.3%	12	100.0%
	Gujrat	14	100.0%	0	0.0%	14	100.0%
	Maharashtra	14	100.0%	0	0.0%	14	100.0%
	Karnatka	16	94.1%	1	5.9%	17	100.0%
	Delhi	11	100.0%	0	0.0%	11	100.0%
Do Indenting Agents Helps You to Complete Legal Formalities in Chinese Market	Telangana	52	100.0%	0	0.0%	52	100.0%
	Tamilnadu	11	91.7%	1	8.3%	12	100.0%
	Gujrat	14	100.0%	0	0.0%	14	100.0%
	Maharashtra	14	100.0%	0	0.0%	14	100.0%
	Karnatka	16	94.1%	1	5.9%	17	100.0%
	Delhi	11	100.0%	0	0.0%	11	100.0%
Do indenting gives you logistic support	Telangana	52	100.0%	0	0.0%	52	100.0%
	Tamilnadu	11	91.7%	1	8.3%	12	100.0%
	Gujarat	14	100.0%	0	0.0%	14	100.0%
	Maharashtra	14	100.0%	0	0.0%	14	100.0%
	Karnataka	16	94.1%	1	5.9%	17	100.0%
	Delhi	11	100.0%	0	0.0%	11	100.0%
Do indenting agents promote your brand to end users in Indian market	Telangana	52	100.0%	0	0.0%	52	100.0%
	Tamilnadu	11	91.7%	1	8.3%	12	100.0%
	Gujrat	14	100.0%	0	0.0%	14	100.0%
	Maharashtra	14	100.0%	0	0.0%	14	100.0%
	Karnatka	16	94.1%	1	5.9%	17	100.0%
	Delhi	11	100.0%	0	0.0%	11	100.0%
Do indenting agents provide payment flexibility	Telangana	52	100.0%	0	0.0%	52	100.0%
	Tamilnadu	11	91.7%	1	8.3%	12	100.0%
	Gujrat	14	100.0%	0	0.0%	14	100.0%
	Maharashtra	14	100.0%	0	0.0%	14	100.0%
	Karnatka	16	94.1%	1	5.9%	17	100.0%
	Delhi	11	100.0%	0	0.0%	11	100.0%

Contd...

Do indenting agents take advantage of emergences like Covid-19	Telangana	52	100.0%	0	0.0%	52	100.0%
	Tamilnadu	11	91.7%	1	8.3%	12	100.0%
	Gujrat	14	100.0%	0	0.0%	14	100.0%
	Maharashtra	14	100.0%	0	0.0%	14	100.0%
	Karnatka	16	94.1%	1	5.9%	17	100.0%
	Delhi	11	100.0%	0	0.0%	11	100.0%
Did Covid-19 increase the bargaining power of indenting agents?	Telangana	52	100.0%	0	0.0%	52	100.0%
	Tamilnadu	11	91.7%	1	8.3%	12	100.0%
	Gujrat	14	100.0%	0	0.0%	14	100.0%
	Maharashtra	14	100.0%	0	0.0%	14	100.0%
	Karnatka	16	94.1%	1	5.9%	17	100.0%
	Delhi	11	100.0%	0	0.0%	11	100.0%
Do indenting agents gives of choice of liberty as far as suppliers are concern?	Telangana	52	100.0%	0	0.0%	52	100.0%
	Tamilnadu	11	91.7%	1	8.3%	12	100.0%
	Gujrat	14	100.0%	0	0.0%	14	100.0%
	Maharashtra	14	100.0%	0	0.0%	14	100.0%
	Karnatka	16	94.1%	1	5.9%	17	100.0%
	Delhi	11	100.0%	0	0.0%	11	100.0%
Do indenting agents give of price war/ inflation?	Telangana	52	100.0%	0	0.0%	52	100.0%
	Tamilnadu	11	91.7%	1	8.3%	12	100.0%
	Gujrat	14	100.0%	0	0.0%	14	100.0%
	Maharashtra	14	100.0%	0	0.0%	14	100.0%
	Karnatka	16	94.1%	1	5.9%	17	100.0%
	Delhi	11	100.0%	0	0.0%	11	100.0%

As shown in Table 1 For the in-depth examination of the stated topic, we have selected 6 different states Telangana, Tamil Nadu, Gujarat, Maharashtra, Karnataka, and Delhi. And 52 respondents were selected from Telangana which is a maximum, 14 each was selected from Gujarat and Maharashtra. Delhi, Karnataka, and Tamil Nadu had 11, 16, and 11 respectively.

9. Hypothesis Testing

I. Hypothesis

There is no significant difference among the end-users over the access of services of indenting agents for Pharma supply.

Table 2
ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Do you access services of indenting agents for pharma supply	Between Groups	.311	5	.062	.102	.992
	Within Groups	69.481	114	.609		
	Total	69.792	119			

As shown in Table 2 The mathematical method of analysis of variance, or ANOVA, divides observed variance data into various components for use in additional experiments. Here the Sig Value of (.992) is higher than the (0.05) hence it's concluded that there is no significant difference among the end-users over the access of services of indenting agents for Pharma supply and most of them accessing the services of indenting agents for supplying pharma product in the market.

II. Hypothesis

There is no significant difference among the end-users over competitive advantage, ease of convenience, logistic support, payment flexibility, and choice of liberty of indenting agents for Pharma supply in the Indian market.

Table 3
ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
do indenting agents provide ease of convenience	Between Groups	.089	5	.018	.035	.999
	Within Groups	57.378	114	.503		
	Total	57.467	119			
do indenting agents give you a competitive advantage in the supply of pharma raw material	Between Groups	5.120	5	1.024	1.080	.375
	Within Groups	108.080	114	.948		
	Total	113.200	119			

Contd...

do indenting gives you logistic support	Between Groups	6.098	5	1.220	1.407	.227
	Within Groups	98.827	114	.867		
	Total	104.925	119			
do indenting agents provide payment flexibility	Between Groups	1.966	5	.393	.471	.797
	Within Groups	94.353	113	.835		
	Total	96.319	118			
Do indenting agents give of choice of liberty as far as suppliers are concerned?	Between Groups	1.286	5	.257	.237	.945
	Within Groups	123.639	114	1.085		
	Total	124.925	119			

As shown in Table 3 Sig Value of (.999) of ease of convenience, Competitive advantage (.375), logistic support (.227), payment flexibility (.797), and choice of liberty (.945) of indenting agents for Pharma supply in the Indian market are higher than the (0.05), hence we can conclude that null hypothesis is to be accepted that, There is no significant difference among the end-users over competitive advantage, ease of convenience, logistic support, payment flexibility, and choice of liberty of indenting agents for Pharma supply in Indian market and alternative is to be rejected.

III. Hypothesis

There is no significant difference among the end-users over brand promotion and advantage of emergency like COVID-19 for indenting agents in Pharma product supply.

Table 4
ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
do indenting agents promote your brand to end-users in the Indian market	Between Groups	12.981	5	2.596	2.637	.027
	Within Groups	112.219	114	.984		
	Total	125.200	119			
do indenting agents take advantage of emergency like COVID-19	Between Groups	14.000	5	2.800	2.802	.020
	Within Groups	113.925	114	.999		
	Total	127.925	119			

As shown in Table 4 A different observation was seen and a significant difference was noticed for brand promotion and advantages were taken by

indenting agents in emergency condition like COVID -19, as Sig value of was (.027) and (0.020) were less than (0.05), therefore null hypothesis is to be rejected and an alternative is to be accepted, that states, there is the significant difference among the end-users over brand promotion and advantage of emergency like COVID-19 for indenting agents in Pharma product supply.

IV. Hypothesis

There is no significant difference among the end-users over legal formalities support, bargaining power, and price war support of indenting agents for Pharma supply in the Indian market.

Table 5
ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Do Indenting Agents Help You to Complete Legal Formalities in The Chinese Market	Between Groups	10.923	5	2.185	2.226	.056
	Within Groups	111.869	114	.981		
	Total	122.792	119			
Did COVID-19 Increase the Bargaining Power of Indenting Agents?	Between Groups	1.826	5	.365	.422	.833
	Within Groups	98.674	114	.866		
	Total	100.500	119			
Do Indenting Agents Give of Price War / Inflation	Between Groups	3.416	5	.683	1.188	.320
	Within Groups	65.576	114	.575		
	Total	68.992	119			

As shown in Table 5 As far as Sig Value (0.56) of indenting agent's helps to complete legal formalities is concerned no significant difference was observed. On the other side the sig value of (.833) and (.320) in the Chinese market is concerned for bargaining power and price war are concerned respectively, both found insignificant as the Sig value of both of them were more than (0.05), hence we reject alternative and accept the null hypothesis, that states that there is no significant difference among the end-users over legal formalities support, bargaining power and price war support of indenting agents for Pharma supply in the Indian market.

10. Conclusion

The role of indenting agents at a crossroads. When conventional business models go away, forward-thinking firms will have an opportunity to grow their market share in a deeply fragmented sector without touching upon indenting agents. Although in this researcher it is observed that pharma raw supply chain is completely depending upon the chines manufactures and it's not easy to access them without indenting agents help and almost across the state It has been observed that Indian end-users and pharma companies almost having the same opinion over the services which are being taken by Indian pharma companies. In the wake of the COVID-19 pandemic, India may benefit from the probable change in global supply chains away from China to other economies. Respondents believe that India will benefit from the change and that a significant portion of manufacturing will migrate from China to India in the immediate future. However, this is all in the future; as of now, our research shows that most pharma manufacturers depend on indenting agents to ensure the proper supply of pharma products in the Indian market.

References

- [1] Cogan, S., Krasniqi, B., & Awan, M. A. : Exploring the Role of Indenting Agents in the Supply Chain of Pharmaceutical Industry. *European Journal of Logistics, Purchasing and Supply Chain Management*, 6(4), 38-52 (2018).
- [2] Tiwari, S., Dharwal, M., & Fulzele, R. : An impact of environment on consumer loyalty towards sustainable businesses in India. *Materials Today: Proceedings*, 60, 911-916 (2022).
- [3] Dun & Bradstreet India. Indian Pharmaceutical Industry Report 2016 (2016).
- [4] Huq, F. : Disturbance Factors in the Pharmaceutical Supply Chain: A Comprehensive Review. *Journal of Industrial Engineering and Management Science*, 3(1), 8-17 (2016).
- [5] Kapoor, M. : Supply Chain Management in Pharmaceutical Industry: A Comprehensive Review. *Journal of Health Management*, 20(3), 327-339 (2018).

- [6] Koh, L. : Counterfeiting in the Pharmaceutical Industry: Implications for Supply Chain Management. *Journal of Marketing Channels*, 11(2), 7-37 (2003).
- [7] LSIT (Life Sciences Industry Trends). Indian Pharmaceutical Industry: CRAMS and API Market (2016).
- [8] Mahajan, R. : An Analysis of the Emergence of the Pharmaceutical Industry in India. *Journal of Pharmaceutical Research*, 13(3), 125-130 (2014).
- [9] Mallu, M., Reddy, P. R., & Kumar, M. V. : Selection of API Manufacturers in India: An Analytical Hierarchy Process (AHP) Approach. *International Journal of Pharmaceutical Sciences Review and Research*, 32(1), 230-235 (2015).
- [10] Svarm, P. : Pharma Raw Material Shortages - A Global Problem. *Journal of Commercial Biotechnology*, 24(2), 43-45 (2018).
- [11] Alward, Y., Singh, O., & Ansari, M.A. : Industrial automation and control systems development future and challenges, *Journal of Information and Optimization Sciences*, 43:1, 71-83 (2022), DOI: 10.1080/02522667.2022.2036354
- [12] Wang, S.T., Lin, W. T. & Wang, L. C. : Research on success factors of pharmacies using FDAHP and gray sequencing: Taiwan as Example, *Journal of Information and Optimization Sciences* (2009), 30:2, 279-290, DOI: 10.1080/02522667.2009.10699878.