



# Trend Report – The True Cost of API Price Rises

The pressures of increased API pricing on  
the pharmaceutical supply chain



# Introduction

# Introduction

Active pharmaceutical ingredients (APIs) are the substances within a pharmaceutical drug or therapeutic that are the main source of beneficial health effects labelled by the drug [i]. As global events continue to shape the pharmaceutical landscape, key players in the industry are left wondering how such events will affect API sourcing and pricing [ii].

With an increase in demand for therapeutics to manage rising incidences of oncological, cardiovascular, and related lifestyle diseases such as diabetes, as well as the expiration of various drug patents, various reports predict an increase in API prices over the coming years due to increased difficulty of their sourcing and transportation, something already felt in various sectors of the pharmaceutical industry [ii]. While different companies with specific focuses will evidently be affected in different ways by increasing API prices, more and more effort has been shifted towards relieving the pressures of rising prices. These challenges are compounded by an increasing demand for shortened development time, reduced cost of development, process design, and new regulations and quality standards. The COVID-19 pandemic and subsequent vaccine effort have not helped to relieve the mounting pressures within the market. These create domino effects that trickle down from the sourcing of APIs, straight through to patients and consumers.

A well-rounded, flexible strategy will prove beneficial for all parties affected by recent challenges in API sourcing and prices. This Trend Report will focus on small molecule APIs and the various sectors of the pharmaceutical industry likely to see their processes affected by fluctuating prices. We will also analyse the results of our API Trend Report survey in which members of the CPHI Online community were invited to share their thoughts on the current outlook for API prices, manufacturing, and sourcing.

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**As global events continue to shape the pharmaceutical landscape, key players in the industry are left wondering how such events will affect API sourcing and pricing [ii].**

A top-down view of various pharmaceuticals including white round tablets, orange capsules, and green-and-white capsules scattered on a light-colored surface.

## **Contents**

[Trend Overview](#)

[Public Opinion: Survey Analysis](#)

[Key Learnings: What the Recent Past has Taught Us](#)

[Future Trends: Can We Predict the Market?](#)

## Contributors



### **Ammar Badwy, Pharmaoffer**

Over the past 10 years, Ammar Badwy has worked in various departments within pharma companies. Currently, as one of the founders and CEO of Pharmaoffer, he is disrupting the traditional API market with a digital platform that shows all qualified API suppliers in one place. With his series of explainer videos, Ammar is making difficult pharma topics accessible to anyone.



### **René Zoetmulder, 4SCENERGY**

René Zoetmulder holds a BSc in chemistry. With more than 20 years of experience at Philips, he was responsible for operations and later procurement with a focus on outsourcing and supplier development in China. He worked for 10 years at DSM as Global Category Director and was responsible for some of the core materials for different business groups. He spent over 3 years at Aspen API where he redesigned the organization and optimized the availability of pharmaceutical starting materials for the in-house production of APIs and intermediates. He has been a partner at 4SCENERGY for 2 years, cooperating with Nanjing Chemphar International to further enhance the security of supplying pharmaceutical starting materials and key fine chemicals from China for end-users in countries outside China. Since 2021, he has been a member of the Strategic Advisory board of CPHI.



### **Stefan Schmidinger, KEMIEX**

Stefan is the Chief Economist at global API procurement and intelligence platform KEMIEX. Before joining KEMIEX, a globally leading and the only GDP-certified information and procurement software provider for Active Pharmaceutical Ingredients (API) and related chemicals, he was a strategy and business development director at UBS, the global investment bank. Prior he held roles servicing global institutional clients at Credit Suisse and as supply chain management analyst in the Swiss retail sector.



### **Gabriele Rebuzzini, ANSA SpA**

Gabriele Rebuzzini is Managing Director at AMSA SpA, a CFM group company. He is also a member of the Managing Committee for the Chemical Pharmaceutical Generic Association CPA, which represents Italian manufacturers of Active Pharmaceutical Ingredients. He joined the CFM group in 2010, covering various roles in R&D and Business Development in the API field. Before that, he had carried out his MSc and PhD work in Industrial Biotechnology at UniMIB and DiaSorin, focusing on recombinant protein expression for biocatalysis and immunodiagnostics.



### **Dr. MD. Abu Zafor Sadek**

Dr. Zafor is the former short-term Consultant at The World Bank, and researcher in the pharmaceutical industry.

**What's the true  
cost of API price  
rises?**

# The only way is up?

The past 2 decades have seen a sharp increase in API pricing and many challenges related to API sourcing. The API market is set to reach USD \$333.3 billion by 2031 as a shift to in-house manufacturing begins [iii]. In several low- and middle-income countries in Latin America and Asia Pacific, in-house manufacturing trends are predicted to gain traction for many pharmaceutical companies, changing the supply and manufacturing chain pathway and its related costs. From our API Trend Report survey, over half of respondents stated that there was a significant (30–49%) or drastic (>50%) increase in current API prices when compared with prices from 5 years ago. Below we examine some trends that may be contributing to the price increase many in the pharmaceutical industry are witnessing.

## Raw materials and supply chain disruptions

Other factors influencing a soar in API pricing stem from apparently less controllable causes – global events such as the COVID-19 pandemic and the war in Ukraine have placed additional strain on global drug supply chains, igniting fears over potential shortages of drugs and generics. With China supplying 70% of the APIs for India's generics industry, and India accounting for 18% of global generic drug manufacturing, approximately 60% of the world's APIs are manufactured across only two countries.

In addition to this, the WHO estimates that China currently accounts for 20% of global API manufacturing. From the outbreak of COVID-19, travel restrictions and strict import/export measure have resulted in decreased manufacturing output and production capacity [iv]. Such knock-on effects have led to increased concern over import dependencies [v], and many countries' regulatory bodies have considered or even announced the relocation of API manufacturing back to their home countries [4]. In 2020, Germany Federal Minister of Health Jens Spahn called on the EU to return API manufacturing to Europe: 'We want to build new supply chains, we need more transparency about supply shortages and more quality controls... We want to put in place financial incentives to bring the production of important active ingredients back to Europe.' [vi]

These effects are not limited to Europe – other Asian countries have also seen their supply chains disrupted due to a reliance on China and India for their APIs, as Dr. MD. Abu Zafor Sadek, Former Short-term Consultant and Researcher in the pharmaceutical field, comments on the Bangladeshi API market: "A lot of our APIs are imported from individual countries-India had limited the export of their few drugs during COVID-19 pandemic and, in the case of China, we had a long gap because of transportation, shipping, and other issues, so it affected the total supply chain."

While COVID-19 may have accelerated the eventual effects of import dependency on just a handful of nations, it is unsurprising that the move to shift generic drug production to China and India by Western drug companies and CDMOs in a bid to cut costs and dodge environmental responsibility has resulted in an inevitable struggle to cope with ingredient sourcing disruptions and skyrocketing API prices [v].

In addition to raw materials for the manufacturing of API precursors, raw materials used in packaging and delivery for the finished APIs also factors into their rising costs. As the second largest exporter of raw aluminium in 2020, Russian aluminium exports have taken a blow with the outbreak of the war in Ukraine and subsequent sanctions and supply chain disruptions out of Eastern Europe [vii]. While these sanctions did not cover medicines and medical equipment, Russian banks have been severed from the SWIFT international payment system, impacting production cycles and leaving manufacturers worldwide scrambling to continue daily operations [viii]. Ukraine is also a major exporter of aluminium, further raising the prices for the packaging and delivery of APIs and drugs.

In our API Trend Report survey, some of the key reasons for rising prices included price-related differences in certain regions. One anonymous respondent stated: “The price of generic drugs varies greatly across European countries, not only related to the cost of production and distribution, but also to the different legislative environments for generic drug pricing and compensation in each country.



The price of generic drugs in these countries is mainly set in the form of rebates in the circulation process, not necessarily through price competition.”

Rene Zoetmulder of 4SCENERGY summarised the most important factors contributing to increased raw material pricings and high API prices: “Supply chain disruptions on the transportation costs, with impact during and post-COVID, stemming from shortages of vessels and containers, followed by the blockage of the Suez Canal, on top of global productivity picking up rapidly after COVID causing material and labour shortages resulting in material prices and labour costs to rapidly increase. Global productivity had already caused an increase of the oil price, recently followed by a surge by the Ukraine–Russia situation, and next to ramping up energy costs, there is a big impact on price and availability of the required petrochemicals for the production of APIs.”

### **The issue with dependency: China and India**

As it stands, China is currently the global leader in the production, manufacturing, and export of APIs, serving approximately 60% of the world’s API production. India trails not far behind, with more than half of the 342 global manufacturing facilities with more than ten active US-approved API products based in India [ix]. 74% of European countries, including those housing pharma giants GSK, Sanofi, and Roche, are dependent on Asia for their API production [x].



Historic outsourcing efforts stems from the cost reduction and, in many cases, 'greenwashing' of API manufacturing, as Stefan Schmidinger of KEMIEX calls it. By outsourcing the actual production and manufacturing of APIs, American and European pharma companies were able to absolve themselves of some sustainability, feedstock, and safety related issues with [high-scale hazardous chemical production](#) [xi]. "Production factors still benefit China and other Asian countries at the moment, however; China has become significantly more stringent and costly in the past 5 years too. Some shortages of finished pharmaceutical products are not driven by the lack of reliable API supply from Asia, but from insurance tender contracts that do not account for common fluctuations in raw material prices over the years. Manufacturers are simply forced to stop producing a medicine if costs are not covered anymore," Schmidinger states.

Our API Trend Report survey found that the US, China, and Russia were claimed to be the leading determinants of API pricings and sourcing, as one respondent put it: "China is developing very fast, but the US is still the first in the world [in terms of development]." With China and India as leading exporters of raw materials, and the United States a leading manufacturer, it is generally agreed that the global supply for API materials and production are concentrated in only a few nations.

For the pharmaceutical supply chain, dependency on only a handful of countries for API production bears similar risk to a famine.

If a blight hits one of the sources responsible for over 70% of APIs globally, it will effectively starve all those depending on that one source of APIs of any subsequent pharmaceutical manufacturing.

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**Basically, the entire world is quite dependent on China and India...since a lot is happening over there and [materials are] transported to basically all countries in the world, there is also a long supply chain that, if you're looking at prices, is increasing. The farther you are in the supply chain, usually the more you are affected by price increases.”**

Ammar Badwy, Pharmaoffer

The reliance on only a handful of suppliers from a few countries has key players understandably concerned for the future of API sourcing and their subsequent pricings. Ammar Badwy of Pharmaoffer comments: “Basically, the entire world is quite dependent on China and India...since a lot is happening over there and [materials are] transported to basically all countries in the world, there is also a long supply chain that, if you’re looking at prices, is increasing. The farther you are in the supply chain, usually the higher you are affected by price increases.”

Schmidinger echoes these sentiments of dependency issues but is hesitant to broadly generalise the effect the supply chain has on pricing: “There is no one opinion because prices move in an idiosyncratic way.

It really depends on the supply chain of a product. For example, for paracetamol, one of the major intermediate producers was shut down by the Chinese government.

In the meantime, [the producers] have rebuilt their factory in a compliant way, with ongoing procedures regarding commissioning and rebuilding. Paracetamol has doubled in price and now shows signs of relief since then... Prices are not always going up. Some materials are getting cheaper again and for most categories, it’s business as usually. It really depends on the quality of the producer. Prices are very selective for each product and category... For the 270 products listed as a shortage in Europe, the underlying API is selective, and depends on the supply chain of a very specific product.”

While opinion on the scope of supply chain issues may differ among experts regarding API sourcing and pricing, the general consensus remains: China and India hold much of the world in an API chokehold, which have many of their outsourcing customers in other countries concerned.



## The biggest losers: Generics vs Innovative

Geopolitics aside, the effect of supply chain disruptions will be felt to varying degrees in different sectors of the pharmaceutical industry. Many agree that drug companies and manufacturers of generic pharmaceuticals will be hit harder than those of innovative pharmaceuticals. Explaining from a supplier's point-of-view, Gabriele Rebuzzini, PhD and Member of the Managing Committee for the Chemical Pharmaceutical Generic Association: "Let's say that the API is the part [of the drug] that rises the most compared to other parts. An increase in API will be mostly felt or more felt by generic[s] just because the API represents a higher percentage of the total cost for a generic compared to a brand molecule which has a higher margin and the cost of materials in the end is much less... Say [for] the generic drug, the API might be 10–20% of the sale price while for a typical brand molecule the API might be 3–5% of the sale price."

The role of generic APIs in the pharma market have shifted in recent years. The pharmaceutical market, while driven by innovation, cannot be sustained on novel drugs and APIs alone. For manufacturers, the generic market has become increasingly competitive, with a significant number of drugs losing their patent protection and expanding the range of generic APIs available for manufacturing in recent years [xii].

Yet, many experts agree that the increase in APIs, compounded with supply chain disruptions, have made issues much more difficult for generic manufacturers than they have for innovative manufacturers, leading to higher overall costs.

Schmidinger comments: "Innovatives are, typically, not outsourced as the price the API is so expensive and there are not a lot of alternative manufacturers. There is a lot of investment in research and development, and the market is not saturated with competitors. Generics, on the other hand, are commodities and this goes back to supply chain issues."

Badwy adds: "Generic producers are quite efficient in their production process. They're very cost price-focused and the API price (or the ingredient prices of the medicine itself) has a way bigger impact than for innovative medicines, where you usually also calculate R&D costs in your cost price or marketing costs. If your production process is very efficient, and then the [API] price starts to increase, then you get in trouble with your selling prices."

An increasing number of pharmaceutical companies have considered, or are already, cutting back on the number of generics offered, following the economic downturn in recent years. Some health policy measures have been aimed at promoting the prescription of generics, but generic manufacturers may still see a decrease in their output.

An interesting juxtaposition to these expert opinions is the results of our API Trend Report survey, in which over half of respondents (52%) stated that innovative and generic drugs would be equally affected. One respondent stated that “As the gap between product price and production cost is narrowed, drug manufacturers will become more sensitive to the API supply price, and the decline in the end-market price will have a negative impact on the upstream API and intermediate market price. As a result, domestic sales prices and volumes of intermediates and APIs may be somewhat adversely affected by the bulk purchase policy. Faced with the acceleration of medical reform, API enterprises still need to [carry out] system reform and find new development ways, among which the integrated development strategy of raw materials and pharmaceutical products may bring certain cost advantages and market competitiveness.” With prices of intermediates and APIs increasing across the board, some believe that, regardless of the use for the product, whether it be in an innovative therapeutic or generic, manufacturers will be hit with the effects of bulk purchasing of APIs as prices rise due to increased demand with less supplies. Another respondent stated that the amount of money and manpower invested into the research portion of innovative drugs will, in the end, affect manufacturers of innovatives to the same degree as generics manufacturers, whatever the demand for APIs is.



# Public Opinion: Survey Analysis

As part of this report, we sent a survey on the impact of API price rises to the global CPHI database, in order to understand the true impact of shifting industry dynamics on the pharma community.

As our infographic shows, the vast majority of respondents believe API prices have significantly increased, compared with 5 years ago.

The top three contributors to increasing API prices all seem to stem from external global events – rising energy costs, COVID-19 related challenges, and suspension of exports from key countries due to government and regulatory restrictions.

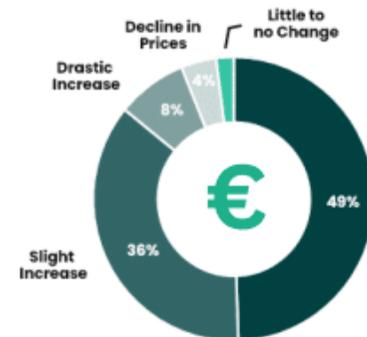
Diseases that demand the most for API sources and their subsequent pricings include chronic conditions such as diabetes, heart disease, and cancer, which tops our respondents' list.

## The True Cost of API Price Rises

How increased API pricing is affecting the pharmaceutical supply chain

### The Current Landscape of APIs

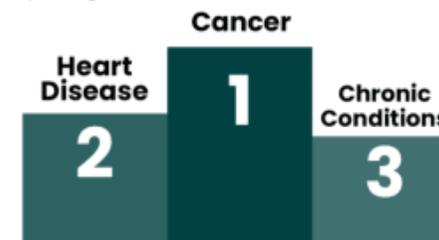
When compared with prices 5 years ago, current API prices have seen a...



The biggest contributors to an increase in API prices are...



Which diseases are the most demanding for API sourcing and pricing?



API manufacturers are likely to be the most affected by API prices and sourcing disruptions along the pharmaceutical supply chain.

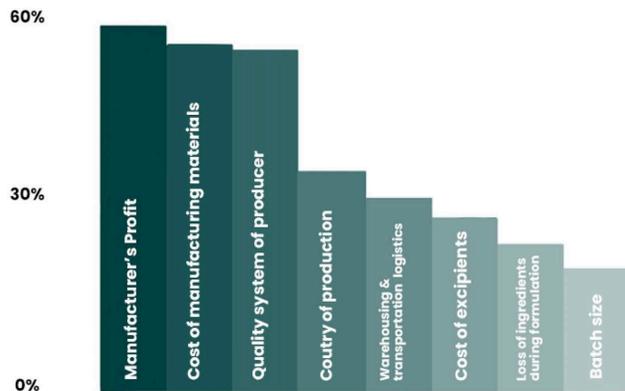
If intermediates and APIs cannot be sourced in a timely and cost-efficient manner, manufacturers will see a once-efficient pipeline spiral into backlogs and soaring prices.

With the situation as it currently stands, our respondents expect both innovative pharmaceuticals and generic pharmaceuticals to be equally impacted by rising API prices – despite what some of our experts interviewed for this report say. This may be due to the effect supply chain issues will have on all APIs, not just those for generic pharmaceuticals.

The future is not all bleak – 53% of respondents have stated that mitigation strategies are possible.

### The Future of API Pricings

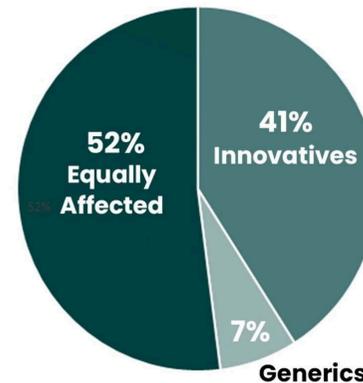
Top important contributors to the price of an API



Who determines API prices?



What will be affected more, innovative pharmaceuticals or generic pharmaceuticals?



Can we predict external global events and their effects on API pricing?



**53%**  
Mitigation strategies are possible



**47%**  
Mitigation is difficult

Despite the obvious challenges, our respondents remain optimistic about the future. Though 64% stated that API prices will continue to increase, 84% noted that certain changes can be implemented to adapt to the increase in API pricing.

Top strategies for adapting to increases in prices include greater flexibility and increased qualification of new or additional suppliers – in other words, diversification of one's portfolio of suppliers, manufacturers, and other industry players.

**64%**

of respondents say API prices will continue to **increase** in the future

**84%**

of respondents say that there are **changes** that can be made to adapt to increases in API prices

Possible changes that can be done to adapt to API price increase include...

1. Greater flexibility in addressing **regulatory changes**
2. **Increased qualification** of new/additional suppliers
3. Increased safety stocks to **stabilize production plans**

Given that supply chain issues will affect different parts of the world in different ways, it is interesting to note that the majority of our respondents (over 50%) were based in the United States.

Biopharmaceuticals, analytical and lab services, and bio-services made up the majority of company types that responded, and manufacturers/innovators were the top organisation types. As demonstrated throughout this Trend Report, it seems these institutions are feeling the full effect of rising API prices.

## Demographics

Top countries respondents are from



1. United States
2. Algeria
3. Australia
4. Azerbaijan
5. Canada

### Top company types of respondents

- 15% Biopharmaceuticals
- 13% Analytical and Lab Services
- 10% Bio-Services



### Top organisation types

- Manufacturer/Innovator 29%
- Academic/Research 16%
- Distributor/Import-Export 13%

# What the recent past has taught us

Though wars and pandemics are not new to our history, they bring unprecedented challenges to the API industry where key players now have access to potential solutions that were previously unavailable. Thanks to our increasingly global and highly connected society, below are some of the key learnings brought to the API industry's attention in the last few years.

## The power of diversification

Among the varying opinions regarding the cause of higher API prices and difficulty sourcing APIs is a common mitigating strategy: diversifying one's sourcing portfolio. The risk of supply chain disruptions stemming from external forces have become more widely evident in the last 2 years, with the COVID-19 pandemic, the war in Ukraine, and the energy crisis, highly dependent and efficient pharma suppliers, distributors, and manufacturers can cascade any issues experienced through the supply chain. If there are no alternatives within a company's portfolio, price increases will be seen at the start from raw materials to the API. Schmidinger advises: "It is very difficult to predict the market because it is almost impossible to see what will happen in recent weeks or months.

You can lose or win a lot of money depending on what you price your API. The last 2 years have told us to have multiple sources along the supply chain. Pharmaceutical companies must diversify more."

Badwy adds, "With Pharmaoffer.com, we fight shortages and unnecessary high prices. We give all medicine makers access to our network of all qualified API suppliers so they're no longer dependent on traders."

The ability to reroute production and components among sites will keep the supply chain running even through global interruptions.

## Regional fragmentation

While outsourcing has not been cited as a sector that is being heavily impacted by high API prices, companies put themselves at risk for shortages by sourcing materials from a single region. Fragmenting regions (such as into Asia, the United States, and Europe) can secure a better input for a company by reverting to domestic production, nearshoring the supply, or offshoring to several different locations [xiii].

This may be a strategy that is easier said than done – although there have been government calls to re-shore production to the domestic markets, experts like Schmidinger and Badwy do not expect that to happen soon: “Reshoring is a strategy to mitigate disruptions in the supply chain, but I don’t see that really happening due to the higher costs.” Schmidinger states. “Reshoring must be economically and environmentally viable, for instance, through innovative, efficient technologies such as continuous manufacturing. Also, producing an API nearby while key starting materials are still concentrated abroad doesn’t solve the systemic risk.”

## **New tools, digital solutions, and process optimization**

With an increasing number of unpredictable situations requiring specific solutions, many companies have turned toward new digital tools and technologies to aid in their predicting and decision-making. Zoetmulder advises suppliers and manufacturers to work and explore together any opportunities to optimise their processes, with the inclusion of a risk model to inform mitigation strategies: “Once you have this risk mitigation methodology really anchored in your whole supply chain and proactively used, instead of addressing questions in case any potential supply chain disruption occurs, I think it’s much better to (pro)actively align and agree on such a structural methodology, from the suppliers of starting materials to the API customers.



**“ Reshoring must be economically and environmentally viable, for instance, through innovative, efficient technologies such as continuous manufacturing. ”**

Stefan Schmidinger, KEMIEX

That's where companies really need to look at: the methodology, instead of the consequences of a specific (potential) incident."

Sadek exemplifies such risk-mitigation strategies with his experiences during the COVID-19 pandemic: "What the good thing was is that we maintain an inventory cycle of 6 months minimum, in some 8 or 9 months. So, during the corona period, the major shift [in supply chains] did not affect us in a greater manner because we had a good period of 6 months or so. We could complete the cycle once corona started and start the next phase as we have maintained the supply chain with a stroke of 6 months."

Schmidinger added insight into the types of services and technologies now available to suppliers, manufacturers, and distributors to stay aware of ongoings within the supply chain, of which KEMIEX is a forerunner: "To make transparent your own supply chain with more information, KEMIEX is a big network with lots of contacts... to connect the various players of the industry, in procurement and also the supply chain."

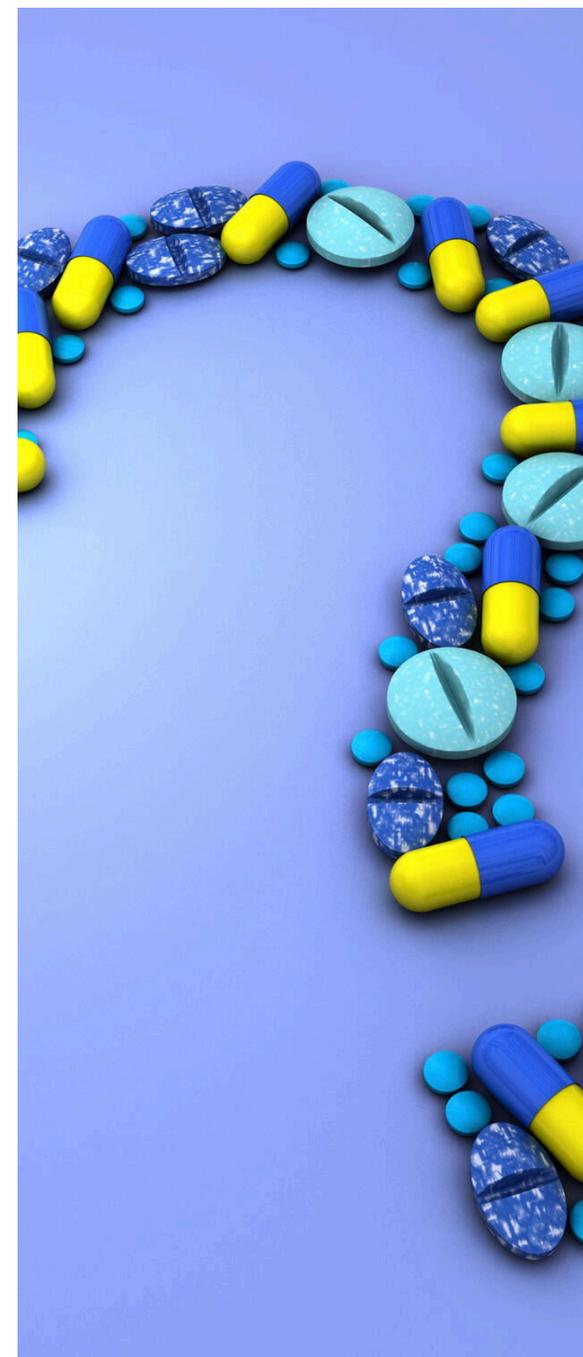


# Future trends: can we predict the market?

Throughout this report we have covered what influences the API market, factors contributing to increased prices in recent years, and some of the key learnings from world events such as COVID-19, the war in Ukraine, and the Suez Canal blockage. We examined the challenges associated with importing and outsourcing from a limited pool of suppliers and manufacturers while investigating the different effects of rising prices on generics and innovative therapeutics. Many experts agree that, given the circumstances, it is difficult to predict the API market with the desired clarity and transparency.

## Three key learnings for the future

What is evident from the last few years is the need to diversify one's portfolio of suppliers, manufacturers, and distributors to mitigate supply chain issues caused by disruptions outside of our control. While we have highlighted other mitigation strategies that may ease the burden of any price increases that may trickle down through the supply chain at any point, the key takeaway from this report, however, is the power of diversification. Pharmaceutical companies should focus on building relationships with a variety of suppliers and manufacturers across the globe to source their APIs, especially any generic APIs within the company's portfolio. Regional fragmentation for the pharmaceutical industry can also lessen the knock-on effect of any future global disruptions. Whether these disruptions be on the scale of the COVID-19 pandemic or something potentially larger, nearshoring supply or offshoring various sectors to different locations might ease the burden of a homogenous value chain.



New technologies, digital solutions, and automated processes can meet global challenges with specific solutions. Ultimately, a company's ability to face unpredictable situations depends on whether they are prepared, which should include a risk model to inform their mitigation strategies.

### What the industry is saying

From the insight of our expert contributors and a survey asking our audience for their perspectives, opinions on the cause and effect of rising API prices seem to vary in relation to the types of products that will be affected. Some of our experts believe generic pharmaceuticals will be most affected while some believe innovatives and generics will be equally affected. When the prices of intermediates and APIs increase across the board, manufacturers will be affected regardless of the type of pharmaceutical they produce.



However, it is generally agreed upon by all pharmaceutical industry experts that prices for APIs have indeed increased substantially in the recent past. Half of our survey respondents stated that there is a significant increase in API prices, meaning an increase of over 40% in pricings compared to 5 years ago. Causes for this increase include price differences across regional markets, different legislative environments for generic drug pricings, and supply chain disruptions caused by global events such as the COVID-19 pandemic, the Suez Canal blockage, and the energy crisis.

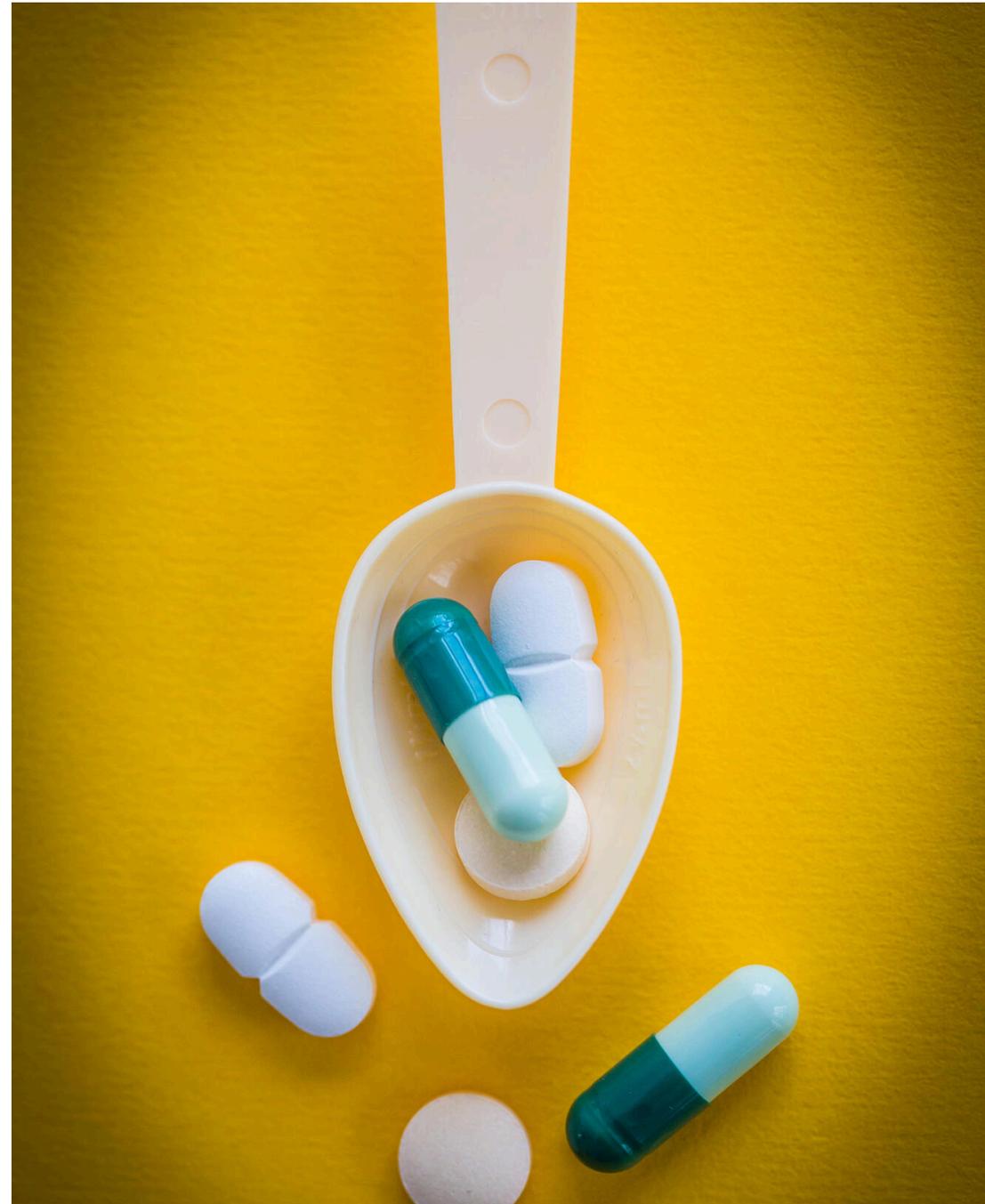
In regards to predicting the market and preparing for the future, most of the pharmaceutical industry agrees that while it is difficult to predict major global events with any real certainty, it is imperative for companies to implement a mitigation strategy plan where possible. While experts agree that prices will generally continue to rise in the next few years, companies can alleviate the pressures of rising API costs with a solid risk management plan and a diverse portfolio of manufacturers and suppliers.

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Companies can alleviate the pressures of rising API costs with a solid risk management plan and a diverse portfolio of manufacturers and suppliers.



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- [i] [Active Pharmaceutical Ingredients - Good Manufacturing Practices - Questions and Answers - Canada.ca](#)
- [ii] [Active Pharmaceutical Ingredients Market | API Industry | Forecast 2029 \(alliedmarketresearch.com\)](#)
- [iii] [Active Pharmaceutical Ingredients \(API\) Market to Reach US\\$ 331.3 Bn by 2031; Shift to In-house Manufacturing of API Expanding Avenue, Finds TMR Study \(prnewswire.com\)](#)
- [iv] [Covid-19 Fuels Debate over API Production Locations | Pharmaceuticals \(gtai.de\)](#)
- [v] [COVID-19 is reshaping the pharmaceutical supply chain \(acs.org\)](#)
- [vi] [Germany calls for financial incentives to bring pharmaceutical production back to Europe from Asia \(linkedin.com\)](#)
- [vii] [Raw Aluminium in Russia | OEC - The Observatory of Economic Complexity](#)
- [vii] [How Pharma Business Can Absorb Russia-Ukraine War's Impact | GEP](#)
- [xi] [US Pharmacopeia report finds high reliance on Indian manufacturers for APIs \(pharmaceutical-technology.com\)](#)
- [x] [How dependent is the European pharma supply chain on China? | Pharmaoffer](#)
- [xi] [Impacts-of-pharmaceutical-pollution-on-communities-and-environment-in-India-WEB-light.pdf \(changingmarkets.org\)](#)
- [xii] [Drugs Becoming Generics—The Impact of Genericization on the Market Performance of Antihypertensive Active Pharmaceutical Ingredients - PMC \(nih.gov\)](#)
- [xiii] [Four ways pharma companies can make their supply chains more resilient | McKinsey](#)



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