Intratec Industry Economics Worldwide

General Methodology Guide

Version: 26-06

Table of Contents

Preamble

Intratec is a leading provider of commodity strategic data and analyses. Our mission is to provide reliable information about commodities' industry, empowering our customers to make accurate, high value-added decisions. In this context, we have developed our Intratec Industry Economics Worldwide.

Overall, Intratec Industry Economics Worldwide is provided as an annual subscription through which subscribers have access to trustworthy and independent monthly data of up to 33 countries around the world.

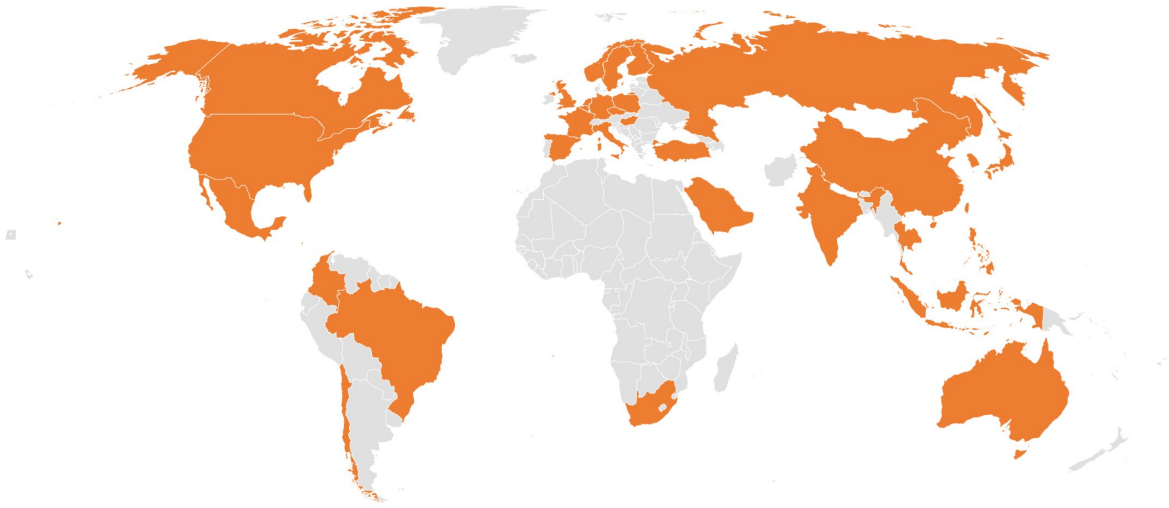

Figure 1 Countries Covered by Intratec Industry Economics Worldwide

Intratec gathers data and uses continuously evaluated models to calculate its data, rather than relying on primary sources. This approach ensures timely and coherent assessments as early as possible each month. Intratec's proprietary, computer-based strategy minimizes human errors and prevents bias from market participants with vested interests. A new figure for each available series is released every month, according to the schedule presented at https://intrat.ec/release-schedule.

Intratec Industry Economics Worldwide serves as a comprehensive guide for companies engaged in the construction, operation, design, and evaluation of process plants. While this resource does not prescribe fixed decisions, it offers timely, valuable insights and overviews of various countries to support informed decision-making in an international context.

The data presented have been successfully used in several ways over the years to:

* Pre-evaluate countries' attractiveness for commodities manufacturing
* Assess utility costs impact on commodities production economics
* Adjust plant construction costs over time and examine cost trends
* Calculate plant capex in a country of interest using the plant capex from other country
* Develop feasibility studies and investment analyses

While Intratec data can serve as a valuable guide in many situations, relying on them alone may not capture cost variations with pinpoint accuracy. Therefore, we recommend their use as indexes to estimate cost trends and country industry economics. For a comprehensive understanding, the reader is encouraged to spend some time reading this document.

Check Specific Assessments Guides

To understand the contents of each coverage and assessments, the reader should check out:

* United States: https://intrat.ec/m?f=/iie-assessments-us_2606
* Australia: https://intrat.ec/m?f=/iie-assessments-au_2606
* Belgium: https://intrat.ec/m?f=/iie-assessments-be_2606
* Brazil: https://intrat.ec/m?f=/iie-assessments-br_2606
* Canada: https://intrat.ec/m?f=/iie-assessments-ca_2606
* Chile: https://intrat.ec/m?f=/iie-assessments-cl_2606
* China: https://intrat.ec/m?f=/iie-assessments-cn_2606
* Colombia: https://intrat.ec/m?f=/iie-assessments-co_2606
* Czech Republic: https://intrat.ec/m?f=/iie-assessments-cz_2606
* Finland: https://intrat.ec/m?f=/iie-assessments-fi_2606
* France: https://intrat.ec/m?f=/iie-assessments-fr_2606
* Germany: https://intrat.ec/m?f=/iie-assessments-de_2606
* Hungary: https://intrat.ec/m?f=/iie-assessments-hu_2606
* India: https://intrat.ec/m?f=/iie-assessments-in_2606
* Indonesia: https://intrat.ec/m?f=/iie-assessments-id_2606
* Italy: https://intrat.ec/m?f=/iie-assessments-it_2606
* Japan: https://intrat.ec/m?f=/iie-assessments-jp_2606
* Mexico: https://intrat.ec/m?f=/iie-assessments-mx_2606
* Netherlands: https://intrat.ec/m?f=/iie-assessments-nl_2606
* Norway: https://intrat.ec/m?f=/iie-assessments-no_2606
* Philippines: https://intrat.ec/m?f=/iie-assessments-ph_2606
* Poland: https://intrat.ec/m?f=/iie-assessments-pl_2606
* Russia: https://intrat.ec/m?f=/iie-assessments-ru_2606
* Saudi Arabia: https://intrat.ec/m?f=/iie-assessments-sa_2606
* Singapore: https://intrat.ec/m?f=/iie-assessments-sg_2606
* South Africa: https://intrat.ec/m?f=/iie-assessments-za_2606
* South Korea: https://intrat.ec/m?f=/iie-assessments-kr_2606
* Spain: https://intrat.ec/m?f=/iie-assessments-es_2606
* Sweden: https://intrat.ec/m?f=/iie-assessments-se_2606
* Taiwan: https://intrat.ec/m?f=/iie-assessments-tw_2606
* Thailand: https://intrat.ec/m?f=/iie-assessments-th_2606
* Turkey: https://intrat.ec/m?f=/iie-assessments-tr_2606
* United Kingdom: https://intrat.ec/m?f=/iie-assessments-gb_2606

Methodology

Introduction

Intratec obtains valuable assessments through structured data processing pipelines developed by a team of market experts, computer scientists, and data scientists. Such a strategy relies on advanced technologies to extract, store, process, and analyze various publicly available data from a wide range of open sources as soon as they are released, so they can be transformed into valuable information about countries through mathematical models.

In short, monthly, we collect, transform, model, and publish data in the most automatic way possible.

Assessment Modifications

Intratec may discontinue, add, or change an assessment in accordance with our commitment to trustworthy information. For more details, the reader is referred to "*Disclaimers – Assessment Addition, Retirement, and Changes*."

Data Sources

Intratec meticulously maps out pertinent sources of information and enhances automated technologies to gather vast amounts of data efficiently and accurately. This process aims to establish a comprehensive database that forms the foundation for developing models used in our analyses.

Intratec has engineered a resilient system to extract data, prioritizing the automatic collection of a large amount and variety of data to construct a well-informed and sturdy country outlook. Given the importance of knowing the general economic scenario of a country, Intratec relies on sophisticated systems to gather and interpret the information, resulting in relevant assessments and indexes.

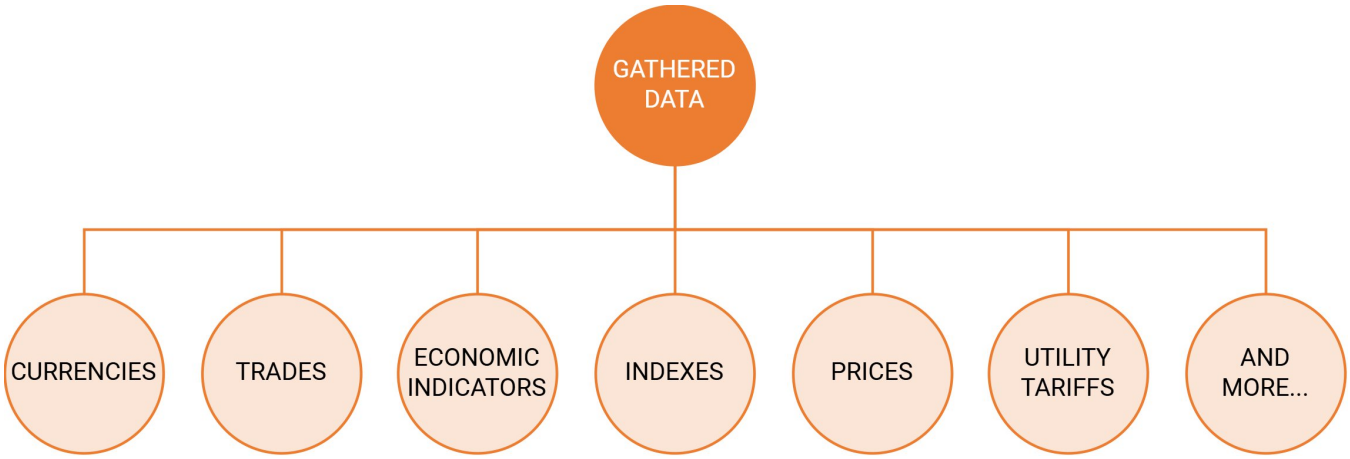

Figure 2 Data Collected by Intratec

The primary economic data Intratec gathers from several countries are:

* Wage rates, directly paid benefits, and other employment expenditures.
* Difference in local productivity data.
* Steel prices.
* Costs associated with a country's infrastructure.
* Prices of energy and raw materials, coming from Intratec Primary Commodity Prices (https://intrat.ec/icp) and Intratec Energy Price References (https://intrat.ec/iep).
* Economic indicators which are key metrics for assessing the performance of national economies, including inflation rates, currency exchange rates, producer price indexes, and other indexes that take into account the costs associated with doing business in the country.

Also, Intratec extensively collects valuable data from both public and private sources, with prior permission from publishers or other third parties holding the rights to the information. These sources include national governments' statistics bureaus, governmental agencies, international multilateral organizations, market exchanges, private commodity exchange, and producers' data.

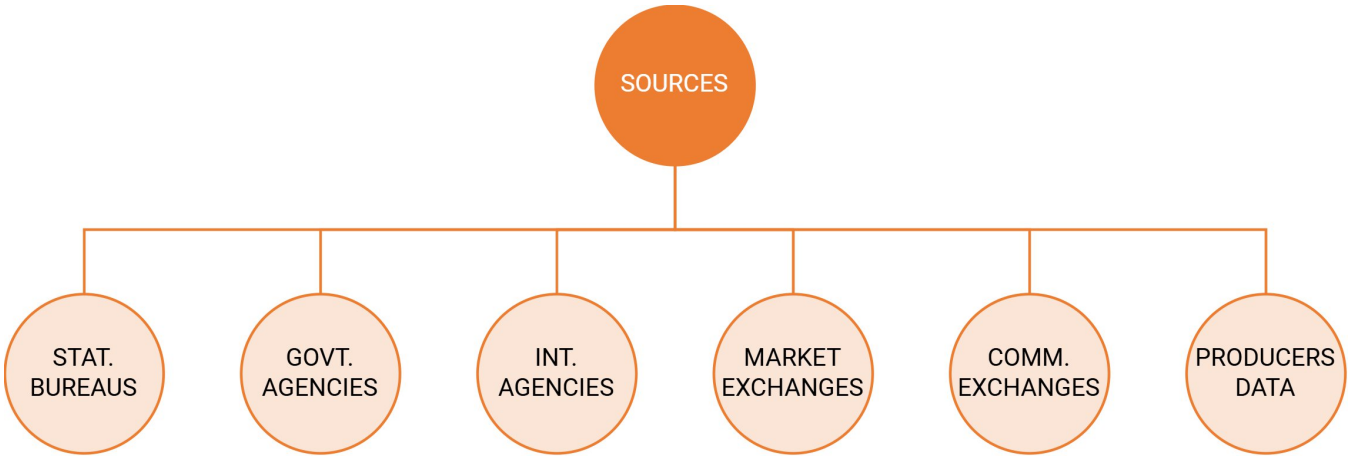

Figure 3 Sources Used by Intratec

It is obvious that source reliability is key. Therefore, Intratec continuously works to assure the quality of our data in the following ways:

* Increasing the number of sources.
* Increasing the usage of national governments' statistics bureaus, foreign trade agencies, international organizations, as well as other recognized institutions.
* Improving data validation.
* Ensuring the quick replacement of any discontinued source.

Intratec is not a Primary Source for Pricing Data

Intratec does not usually conduct surveys or maintain regular communication with owners, government agencies, or other professionals. Actually, the majority of the data in Intratec's database is sourced from public sources, i.e., national governments' statistics bureaus and foreign trade agencies, international organizations, as well as market exchanges.

It is worth noting that, in very exceptional circumstances, Intratec may obtain some information from its own surveys as a primary source.

Gathering

Given the wide range of sources used and the huge amount of data collected, it is Intratec's goal to ensure both the integrity and the accuracy of the collected data. For that goal, Intratec's data gathering process relies whenever possible on automated systems and algorithms to extract, standardize, and load the data into our databases.

Figure 4 Data Gathering

The automated collection processes are thoroughly tested and validated on a monthly basis, ensuring the integrity of any data collected. Furthermore, data consistency is guaranteed by several layers of data checking algorithms, as described in the next paragraphs. The automated extraction relies on Application Programming Interfaces (APIs) either provided by the data sources or developed by Intratec. Requests are automatically performed according to the sources' update schedule and the data retrieved by the API enter an automated workflow for data integrity check.

After data collection, some errors can appear. In the first phase of error detection, the Intratec team checks if the source structure remains the same (e.g., table headers, numbers of lines). If anything has changed, the gathering system is adjusted to collect data from the new source structure and transmit them to the Intratec system.

In addition, some minor specific data sources demand manual collection. In such cases, to prevent errors derived from human mistakes, the same collection process is performed by multiple independent professionals and the result is cross-checked through computer algorithms. If any differences are found in the data collected, additional professionals review the data and check the original source to attest which is the correct data.

At the end of the gathering process, raw data are ready to be transformed through the Intratec system.

Transformation

Before being used in the modeling steps, raw data pass through a uniformization process, called transformation, involving formatting and standardization. Initially, the collected and verified data are organized in such a way that they fit into the Intratec database and can be processed by the Intratec system. The data formatting includes transformation of file and number formats.

Figure 5 Data Transformation

Subsequently, the data undergo a standardization process. It consists of adapting the original arrangement to Intratec's data storage structure, which varies according to each type of data. Also, in the standardization, all data are normalized on the same currency and unit basis when applicable, before the assessments are modeled.

Modeling

Modeling is responsible for converting raw data into useful and relevant data by analyzing all data gathered. From a giant database, in the shortest possible time, Intratec arrives at relevant information that summarizes the country's economics. This process consists of creating models to calculate assessments quickly and efficiently. The modeling flow depends on the calculation method, which varies according to the economic indicator (e.g., utilities, indexes).

Figure 6 Data Modeling

The modeling process starts with the definition of some parameters calculated from raw data and then used to feed the models:

* Labor costs. These costs include wage rates, directly paid benefits, and other expenditures incurred by the employer to employ a worker, as well as the difference in local productivity data. The construction labor and engineering services associated with several sectors are considered.
* Material costs. These costs consider steel prices, process machinery, bulk materials, import needs, availability of local equipment, need of spare equipment, and freight, taxes, and duties on imported and domestic materials.
* Logistic costs. These costs refer to all costs associated with a country's infrastructure, such as: availability and quality of ports, roads, airports, and rails; communication technologies; warehouse infrastructure; border clearance; and local incentives.
* Business environment. It takes into account the costs associated with doing business in the country, such as: readiness of bureaucratic procedures; legal protection of investors; enforcing contracts; and getting credit.

Intratec Plant Construction Cost Indexes

Intratec Plant Construction Cost Indexes (IC Indexes) are indicators, published monthly by Intratec, which enables users to scale capital costs from one time period to another. The index reconciles cost trends of fundamental components of commodity plant construction, providing meaningful historical and forecast data for users.

Basically, the compilation of the indexes involves labor cost, material costs, logistic costs, and business environment parameters. Subsequently, the parameters are weighted according to their relative importance based on an analysis of publications from companies, engineering firms, index publishers, and technical organizations.

Then, the indexes are calculated by summing the weighted parameters to obtain the overall indexes values. At this point, the data are normalized using January 2000 as the base period, when the index is set as 100.

Intratec Plant Location Factors

Intratec Plant Location Factors (IL Factors) are factors, published monthly by Intratec, for converting the capital cost of industrial processing plants from one country to another. The factors are calculated based on extensive local data of different countries, relating to labor cost, material costs, logistic costs, and business environment.

All components that make up the previous major components are then weighted according to their relative importance based on an analysis of publications from companies, engineering firms, index publishers, and technical organizations. Finally, the factors are calculated in a comparative manner: for each country published, there are 32 location factor assessments, obtained by dividing the value of the 32 by the value of the country being evaluated.

Industrial Utilities Costs & Prices

The costs of utilities in a country are estimated with robust cost models, built based on established cost estimating techniques that have been consistently tested and validated by major global corporations who use Intratec's utilities cost estimates. For each country covered, Intratec gathers key variables that impact on the costs of utilities, defines the facility size of each utility, and combines all elements into cost estimation models for the calculation of the utility costs.

The models are based on labor cost, construction costs inflation, and energy costs. Nevertheless, to fully understand and make better use of water and utility costs, it is necessary to know how each commodity is estimated.

* **Compressed air** costs include costs with air filters replacement, electricity required to drive air compressors, maintenance.
* **Process water** and **demineralized water** costs include costs with raw water, chemicals, resins replacement, and electricity.
* **Cooling water** costs include costs with clarified water make-up, chemicals, and electricity required to drive a cooling tower and pumps motors.
* **Chilled water** costs include costs with refrigerant make-up and electricity required to drive compressors and pumps motors.
* **Steam** costs include costs with fuel, boiler feed water make-up, chemicals, maintenance related to boiler operation.
* **Oxygen** and **nitrogen** costs include costs with maintenance, labor, and electricity.

* **Hydrogen** and **carbon monoxide** costs include costs with natural gas/coal, maintenance, labor, and electricity.

Up to three types of data are presented for each utility: on-site cash cost, off-site cash cost, and contract price.

On-site cash cost figures represent estimates of the operating variable and fixed costs of the utility system. The cash margins exclude factors such as depreciation, corporate overhead, or a return on the capital employed. The on-site cash cost considers a typical industrial consumer facility, i.e., consumers who typically self-generate the utility on-site to meet their internal needs.

Off-site cash cost figures represent estimates of the operating variable and fixed costs of the utility system. The cash margins exclude factors such as depreciation, corporate overhead, or a return on the capital employed. Off-site cash cost assumes a large-scale external supplier facility, i.e., large-scale plants primarily constructed as external suppliers to provide the utility to multiple industrial consumers located nearby.

Contract price figures presented consist of estimates for the values paid by an industrial customer for the utility supplied by a typical large-scale off-site facility. It is assumed that such a utility system is part of a commodities manufacturing complex, and the demand of the industrial customer is absorbed by the existing capacity. It is assumed that the price paid covers not only the cash costs but also depreciation, corporate overhead, and return on the capital employed factors.

The pricing of the utility is tied to the capacity of the constructed system. As the plant size increases, the cost per unit of the utility decreases. In this context, for each utility system, a common capacity was defined. The table below presents the assumed capacity for each commodity unit, including assumptions for on-site and off-site facilities.

Table 1 Assumed Unit Capacities for Generation of Utilities

Utility	On-site Capacity	Off-site Capacity	Remarks
Chilled Water	800 kW	-	Supply temperature = 5 °C
Cooling Water	1,000 m3/h	10,000 m3/h	
Process Water	36 m3/h	36,000 m3/h	
Demineralized Water	36 m3/h	3,600 m3/h	
Compressed Air	360,000 Nm3/h	-	Air pressure = 8 bara
Steam (HP)	36 mt/h	360 mt/h	Steam pressure = 45 barg
Steam (MP)	36 mt/h	360 mt/h	Steam pressure = 8 barg
Steam (LP)	36 mt/h	360 mt/h	Steam pressure = 3 barg
Nitrogen	10,000 Nm3/h	20,000 Nm3/h	Purity = 99.7 vol%
Oxygen	10,000 Nm3/h	20,000 Nm3/h	Purity = 99.5 vol%
Hydrogen	30,000 Nm3/h	60,000 Nm3/h	Purity = 99.9 wt%
Carbon Monoxide	30,000 Nm3/h	60,000 Nm3/h	Purity = 99 wt%

In the Event of Data Shortage

When data are insufficient, inadequate, or unavailable, or when Intratec determines that a given approach is not suitable for establishing representative information, Intratec analysts will estimate the assessments based on a wide range of factual market information. Analysts must meticulously collect, verify all country data used, and propose changes in mathematical models. The information utilized for the assessment may encompass other data or indexes.

Forecast

In addition to historical data, Intratec provides short-term forecasts for the majority of assessments presented in Intratec Industry Economics Worldwide. These forecasts are derived from mathematical models utilizing forecast data such as: (i) commodity prices; (ii) economic indices; (iii) industry indicators.

The forecasts presented are reflective of what Intratec considers to be the most probable scenario for the upcoming six months, as of the date such forecasts are updated. It should be noted that the parameters utilized in the calculation of these forecasts can undergo significant revision within short periods of time, which is the reason for monthly updates.

Model Evaluation

During the modeling, the Intratec team also evaluates the accuracy of the models – including forecast – adjusting computational algorithms and regression models if necessary.

After the evaluation, the models are corrected and a new series is generated. Analysts may detect relevant changes in the country's conditions (e.g., wars, economic crisis) or find that the model is not reflective any longer. In the latter case, the model is improved or replaced by a new one to ensure a more accurate assessment. The new series are evaluated again until the inconsistency is solved and Intratec analysts confirm the correct data.

Information Publication

After gathering and modeling, the historical data are rounded to 3 significant figures and directed to publication steps, while forecasted data are rounded to 2 significant figures. Subsequently, the data obtained undergo a series of careful reviews to detect if any inconsistent value has appeared. These inconsistencies can be generated from missing data, mathematical or computational errors, anomalies or discrepancies in the data collected and the models used. After being corrected, the data are published through Intratec's various media.

Figure 7 Intratec's Publication Flow Diagram

Information Review

When an inconsistency is detected at the end of the modeling step, the associated data is flagged for further verification or treatment. This could trigger a review and potential recalibration of the models to ensure accuracy and reliability. Also, Intratec's analysts may investigate the cause of the inconsistency, which could range from erroneous data entry to changes that the model has not yet accounted for.

When the series reflects a typical behavior, it is directed to subsequent steps. Otherwise, Intratec does not use these data and resorts to other models, as explained in the topic "*In the event of data shortage*." Insights from these investigations are then fed back into the model to improve its accuracy and reliability over time, especially in the quarterly model reviews.

Final Presentation

After assessments are reviewed, they are loaded to our online database and, after a test in a test presentation display by the Intratec team, they are made available to customers. A new value for each available series is released every month, according to the schedule presented at https://intrat.ec/release-schedule.

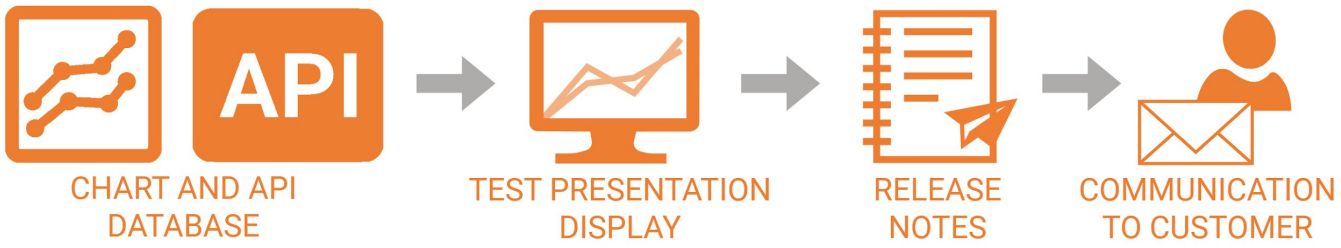

Figure 8 Final Presentation Diagram

The new data are firstly uploaded in the Intratec system: the API database is updated, followed by the website (online) database. Then, Intratec publishes release notes about the latest improvements and updates made to databases, as well as revisions of published data available at https://medium.com/intratec-release-notes. After the final publishing is available, the Intratec team sends an e-mail notifying customers that the database has been updated.

Methodology Review

The publication of reliable information that are representative indicators of country economics is the methodology's overriding goal. To achieve that goal, Intratec employees perform regular examinations of our methodologies and frequently compare them to industry practices. In addition to this ongoing review of methodology, Intratec undertakes at least an annual review of all its methodologies and methodology documents.

Figure 9 Final Presentation Diagram

Some criteria that justify a methodology revamp after the annual review are:

* Alteration in the raw data used for assessment calculations.
* Modification in the calculation methodology, such as modeling enhancements.
* Clarification and simplification of our methodology redaction based on the subscribers' feedback, ensuring that they can understand what we provide and how we produce such data.

Transparency is a non-negotiable value at Intratec. Any modifications to methodology resulting from a review are announced in advance to customers before they take effect, as well as the duration of the transition period.

Notes

- A notification will be published detailing the changes as well as the earliest possible implementation date for most of the changes.
- Even if a decision is made to discontinue an information, Intratec may opt to continue publishing it for a defined period if consultation results suggested it would benefit the market.
- Any new information will undergo shadow testing for a period before their official release.

Disclaimers

Assessment Addition, Retirement, and Changes

Intratec gathers most of its data from public sources, i.e., national governments' statistics bureaus, foreign trade agencies, and international organizations; therefore, the continuity of its assessments depends on the availability of raw data from the sources in each respective country. In this context, Intratec reserves the right to initiate, terminate, or change a series at any time, according to the data availability.

In the event of a prolonged shortage of data that meets our requirements for an assessment, the Intratec team adopts one of the following approaches to correct this issue: (i) use of a model based on good previous and/or related data, (ii) change of data source, (iii) alteration of the assessment. If the lack of data persists, Intratec reserves the right to discontinue the assessment following our commitment to the quality of our products.

Additionally, Intratec may modify its series, including updates and improvements to the models. The availability of new and relevant information, as well as any interruption in data sources, will be carefully considered to enhance the models.

Corrections

Intratec is committed to accurately presenting reliable and representative information; thus, occasionally, published data might be reviewed. The correction process includes errors caused by clerical and typographical mistakes, calculation errors, technical glitches, or methodology misapplication. Also, data corrections involve retroactively adjusting assessments when new information becomes available or a model enhancement occurs.

Check Reviewed Data

Whenever such data reviews are made, they are communicated in the "Release Notes," at https://medium.com/intratec-release-notes.

Ethics and Compliance

At Intratec, we uphold the highest standards of ethics and compliance in all aspects of our operations. We recognize the paramount importance of maintaining integrity, transparency, and independence in our practices, ensuring trust and reliability.

Independence and impartiality are central to Intratec and what we do. Intratec has no vested interest in the economic information we report; our goal is to reflect the actual market landscape.

Aligned with industry best practices, all Intratec employees are required to confirm annually the absence of any personal relationships or financial interests that could influence or even be perceived as influencing their ability to perform their duties as objective, impartial, and effective individuals.

Legal Information

For detailed legal information regarding www.intratec.us and Intratec products and services, the reader can refer to https://cdn.intratec.us/docs/legal/index.pdf.

References

Intratec has built its knowledge based on relevant textbooks, encyclopedias, and technical papers related to the countries' economics. Such expertise has established a large foundation that enriches all Intratec products, in a way that the reader can expect the most trustworthy information. The methodology references reflect this foundation of bibliographical data, used in the development of Intratec Industry Economics Worldwide, particularly in the elaboration of the methodology.

[M1] Acland, M., et al. 2012. Cost Estimation Handbook (2nd ed.). The Australasian Institute of Mining and Metallurgy

[M2] Brennan, D.. 2020. Process Industry Economics (2nd ed.). Institution of Chemical Engineers

[M3] International Monetary Fund. 2009. Balance of Payments and International Investment Position Manual (6th ed.)

[M4] International Monetary Fund. 2009. Export and Import Price Index Manual. Organisation for Economic Co-Operation and Develop.

[M5] Mankiw, G.. 2020. Principles of Economics (9th ed.). Cengage

[M6] Miao, G.; Wegner, E.. 2022. Using Unit Value Indices as Proxies for International Merchandise Trade Prices. SDD Working Paper No. 111. OECD, Paris.

[M7] Peters, M. S.; Timmerhaus, K. D.; West, R. E.. 2002. Plant Design and Economics for Chemical Engineers (5th ed.). McGraw-Hill Education

[M8] Turton; Bailie; Whiting; Shaeiwitz; Bhattacharyya. 2012. Analysis, Synthesis, and Design of Chemical Processes (4th ed.). Prentice Hall

[M9] Ulrich, G. D.; Vasudevan, P. T.. 2003. Chemical Engineering Process Design and Economics: A Practical Guide (2nd ed.). CRC Press