

How Accurately Do You Estimate Your Future Logistics Costs?

Estimate the cost base for your logistics tenders with artificial intelligence support.

Introduction

Logistics costs play a critical role among operational cost items for companies, with an ever-growing importance as the scope of operations is becoming more complex. Logistics has conventionally been one of the main pillars of operations in manufacturing industry, yet, while value chains in almost all sectors tend to get more sophisticated, importance of logistics operations mounts for all companies.

Nevertheless, many companies are inclined to outsource logistics operations due to several important factors.

Amongst them, physical expansion of operations, logistics-specific know-how requirements, heavy-asset necessities, involvement of macroeconomic and political factors are prominent reasons for companies to outsource such a fundamental process. However, the uncertainty brought by these factors are at the center of the business model of 3rd Party Logistics (3PL) service providers. These companies tend to leverage this uncertainty and complexity of operations to maximize their earnings.

PwC's analysis and recent study called "Supply Chain Management Survey" shows that the ratio of transportation costs to revenue is estimated to be approximately 5% for many industries such as retail, FMCG, automotive and chemicals in Turkey.¹ In addition, another recent study, PwC's "Next Generation Procurement Survey 2021" asserts that logistics is the one of the top three spend category and expected to retain its position other procurement categories in the next 5 years.²

Therefore, supply chain and procurement executives looking for cost reduction opportunities and approaches to balance budget variances have put a spotlight on procurement of services related to logistics.

On the cost reduction side, companies adopt various strategies to optimize their logistics services procurement costs in today's settings. Many companies restructure their procurement operating models, implementing functions like strategic sourcing and category management to increase the maturity of their organizations. For logistics operations, companies digitalize their processes and plan their shipments on enterprise applications called Transportation Management Systems (TMS). While analytical solutions running in TMS solve problems like shipment planning and route optimization, it is becoming increasingly difficult for such systems to capture the complexity in cost structure of 3PL service providers. Therefore, such analytical solutions in TMS are mostly incapable of predictive budget planning.



¹ PwC – TEDAR Supply Chain Management Survey 2019

² PwC – TEDAR Next Generation Procurement Survey 2021

Given the intricate nature of operation and a multitude of input parameters, it is often difficult for companies to come up with an accurate estimation to form a basis for planning projections and budgeting. Majority of companies lack a data-driven decision support system to increase their control on the logistics costs, predict logistics costs based on historical data, and manage logistics tenders and negotiations more effectively to reduce logistics procurement costs.

The logistics service category has the highest amount of expenditure in the indirect purchasing categories of companies today and in the next five years. More accurate estimation of logistics-related expense budgets in the coming years according to the dynamic and changing conditions of this category is of critical importance in order to prevent the shrinkage of profit margins due to the uncontrolled increase in operational costs.

In addition, modeling future price expectations for the logistics procurement category with such a cost estimation enables companies to calculate the cost base for the said procurement tenders with a detailed data-based preparatory study. As a result of this preparation, savings that exceed the targets can be achieved by conducting the negotiations more effectively in the tender management process.

Companies organize tenders when the need for a 3PL service provider arises and competing service provider firms make offers based on the specifications. These specifications range from routes and shipment volumes to modes and yearly estimated number of transportations. Service providers use these specifications, while adding their internal calculations into the combination, to come up with their offers. From the opposite perspective, in order to adjust their budgets accordingly, it is important for companies to estimate the costs of tenders prior to any offer is received.



However, companies face difficulties while making their estimations since tender prices are dependent on many external factors. Historical data is not always explanatory, as some variables (e.g. oil prices) might fluctuate drastically during the time between two tenders. Moreover, companies must rely on data from similar routes as the basis of their estimations when there is no previous data for a certain route.

In order to fill this gap, the analytical approach developed by PwC targets these pain points with an AI-powered solution. On the contrary to conventional transportation management solutions, artificial neural networks as the basis of the AI-engine successfully captures relationships between potential cost drivers and pricing mechanism of 3PL service providers. Therefore, the AI-engine takes not only the client's tender specs such as loading location, destination, volume and etc., but also external factors like fuel prices, infrastructural connectivity and economic activity into consideration.

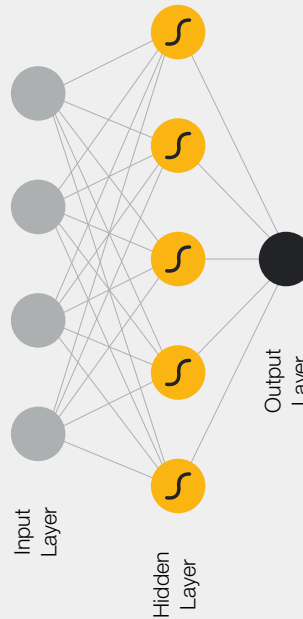
Working Principles of Forecast Modeling

Input Parameters



80%

of the entire dataset selected randomly provides input to the Artificial Neural Network algorithm for training purposes.



Artificial Neural Network

Weighting is done for the parameters in the input layer.

Each "neuron" in the hidden layer organizes entire with a nonlinear function.

Weighting is also done for hidden layer results.

Actual prices are compared with the results in the output layer.

The algorithm repeats itself by changing weights until the model's error is at its lowest level.

Forecast Modeling

R-Squared: It compares the prices realized in the whole dataset with the estimated prices. Indicates how much the change in prices can be explained.

MAPE: It is the average of the percent deviation between the actual prices and the estimated values in the test dataset.



The remaining 20% of data constitutes the test dataset.

While evaluating model results, it was targeted to achieve **R-Squared** (R^2) value above **85%** and the **MAPE** value up to **10%**.

Based on the client's historical data for logistics tenders and aforementioned external factors, AI-engine predicts cost intervals for logistics tenders with unprecedented accuracies compared with conventional approaches. As the AI-engine is built up with the client's data, it adjusts its design exclusively for different logistics procurement categories (e.g. international/domestic road transportation, container transportation, storage etc.) in the client's business model. Yet, besides the client's data, external data included in the model by highly credible sources such as UNCTAD, World Bank and OECD significantly increase the robustness of the model. Moreover, depending on the granularity level of data, the tool can be configured to be used for various modes of transport or any other major differentiating factor in the dataset such as business units or product categories. Initiatives on data management and increasing volume of clean data promise further progress in the forecast accuracy of the analytical model developed.



Business Case

Logistics cost estimations were carried out for a leading industrial manufacturing company using the cost estimation tool developed by PwC. As a part of this project, 5 different AI-engines were developed and delivered for 5 different modes of transport (domestic inner-city, domestic inter-city, international road transportation, maritime container and bulk transportation). All models were delivered supported by training documents and user manuals exclusively prepared for the company.

PwC's supply chain consulting team prepared a longlist of client data. After dialogues with experts, external parameters representing the external factors in 3PL service providers' cost structure were also listed up. After gathering a pool of potential parameters, an impact assessment to filter the ones having a significant impact on the costs was conducted.

Thereafter, an AI-engine with artificial neural networks was built after sessions of training and testing of the design. Later, the design was simulated with a renowned statistical method called Monte Carlo Simulation to identify real-life potential intervals for tender prices. Finally, the software design was completed on both Python and R.



For the robustness KPI of the models, the company expected every model to have an R-squared (R^2) score above **85%** level.



For all modes of transportation, almost 95% of the tenders are predicted with less than **10%** deviation (mean average percentage error [MAPE]).



For four modes of transportation (domestic inner-city, inter-city, international road transportation and maritime bulk transportation) R^2 scores were above **95%** and for the most complex model built for maritime container transportation, R^2 scores were above **85%**.

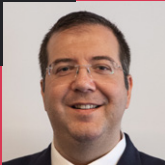
How Can We Help as PwC?

PwC's procurement solutions continue to set examples of best practice in the field.

Artificial intelligence technology developed for estimating cost base for the logistics purchasing category leads to the highest level of maturity in this field by providing a scientific, objective and transparent approach. PwC successfully applies the artificial intelligence approach and technology in its projects, combining it with its expertise and experience in the fields of procurement and logistics. We transfer our specialized and differentiated models for both current and future business needs to companies after project works are completed. This way, we ensure that the models can be used after the working period with PwC and that it continues to generate benefits for companies...

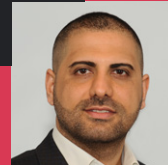
Contact us to estimate your logistics costs with a systematic approach based on analytical foundations, achieve savings higher than your targets in your logistics tenders and to get more detailed information on this subject.

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