
# Retrospective Analysis of Technology Forecasting: In-Scope Extension

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## Final Report

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# EXECUTIVE SUMMARY

The purpose of this study is to obtain a larger data set of verified technological forecasts than was obtained during the previous effort (at least 1,000), which will allow us to achieve the sample size necessary to identify predictive trends and causal relationships associated with forecast accuracy if they exist. A previous study of 310 verified forecasts revealed that technology forecasts developed using quantitative methods were more accurate than were other methods, forecasts about autonomous systems and computers were more accurate than were forecasts about other technology area tags, and that while forecasts tended to be neither optimistic nor pessimistic, there was not a strong correlation between the nine attributes we studied and the accuracy of a forecast. It is the purpose of this study to reevaluate and add to those findings using a larger sample size.

The Assistant Secretary of Defense for Research and Engineering (ASDR&E) is focused on developing tools and techniques to improve technological forecasting to guide future technology development. In support of these efforts The Tauri Group conducted an analysis of technology forecasting methods. The analysis will inform current and future efforts to improve forecasting, support automated methods of forecasting and, and establish a performance baseline against which new forecasting methods and tools can be compared.

## *Methodology and research results*

The Tauri Group conducted a broad survey and analysis of retrospective forecasts from academia, industry, government and other sources. Forecast documents were thoroughly reviewed and 2,279 forecasts were extracted from those documents. Of these forecasts, 2,092 were found to be timely, specific, complete and relevant enough to be further verified and assessed for accuracy. These "assessable" forecasts were extracted from 300 forecast documents. Data collection metrics are summarized in figure ES-1.

| Collected data | |
|---|---|
| Number of forecast documents | 300 |
| Assessable forecasts | 2,092 |
| Verified forecasts | 1,055 |
| Number of verification documents | 2,016 |

**FIGURE ES-1. COLLECTED DOCUMENTS AND FORECASTS**

The forecasts were categorized using nine objective attributes including forecasting methodology, technology area tag, and timeframe, as seen in figures ES-2 and ES-3. We were able to verify 1,058 forecasts to establish if the predicted event occurred and if so when. The sample of 1,055 "verified" forecasts were used to provide descriptive statistics of our data and statistical analysis of the general population of forecasts.

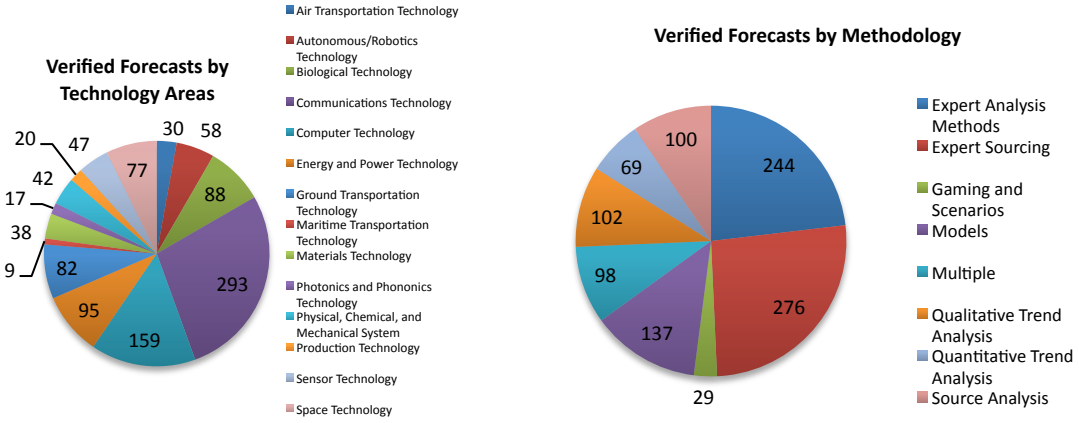


**FIGURE ES-2. NUMBER OF FORECASTS BY TECHNOLOGY AREA TAG AND METHDOLOGY**

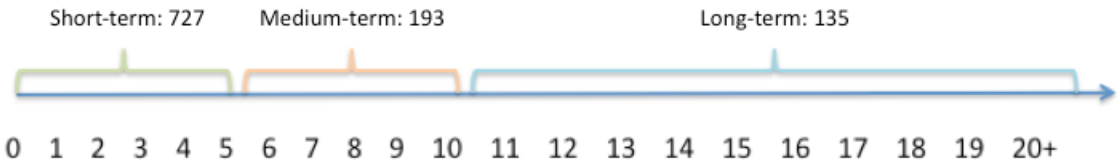


**FIGURE ES-3. NUMBER OF FORECASTS BY TIME FRAME**

## *Key Findings*

Verified forecasts were analyzed descriptively and statistically. Forecast accuracy was analyzed against the nine attributes to identify statistical differences and trends within the sample and greater population. The key statistical and language findings are shown in table ES-2.

**TABLE ES-2. KEY STATISTICAL AND LANGUAGE FINDINGS**

| |
|---|
| In general, forecasts provide more accurate predictions than uninformed guesses. Six of the eight methodologies statistically are more accurate than a theoretical probability of success (random guess). Although qualitative trend analysis and gaming and scenarios methods have observed accuracies better than a random guess, at a 95% confidence interval there is no statistical evidence that these methods would perform better than a guess. |
| Forecasts based on numeric trends are more accurate than forecasts based on opinion. Forecasts generated from quantitative trend analyses have statistically higher success rates than do forecasts generated from other methodologies. |
| Forecasts are more likely to overestimate the event date. This is a change from our previous study, which indicated that there was a balance between pessimistic and optimistic forecasts. |
| Short -term forecasts are more accurate than medium- and long-term forecasts. |
| A predictive model of forecast accuracy could not be developed. Forecast accuracy appears to be influenced by a random component or some other attribute not captured in the study. |
| Forecasts that clearly describe timeframe, technology, predicted event, and associated performance metrics are more informative. |