

# Suggestions for Further Research

## FORECASTING PRINCIPLES

Source: forecastingprinciples.com

## Need for Research?

(rated by J. S. Armstrong 6/13/01)

### PROBLEM

#### 1. Setting Objectives

1.1. Describe decisions that might be affected	Common sense
1.2. Agree on actions for different possible forecasts	Common sense
1.3. Make forecast independent of organizational politics	Weak need
1.4. Consider whether events or series are forecastable	Weak need
1.5. Gain decision makers' agreement on methods	Moderate need

#### 2. Structuring the Problem

2.1. Identify possible outcomes prior to making forecasts	Moderate need
2.2. Tailor the level of data aggregation to the decisions	Common Sense
2.3. Decompose the problem into sub problems	Moderate need
<b>2.4. Decompose time series by causal forces</b>	<b>Strong need</b>
2.5. Structure problems to deal with important interactions	Moderate need
2.6. Structure problems that involve causal chains	Moderate need
2.7. Decompose time series by level and trend	Moderate need

### INFORMATION

#### 3. Identifying Information Sources

<b>3.1. Use theory to search information on explanatory variables</b>	<b>STRONG need</b>
3.2. Ensure that data match the forecasting situation	Moderate need
3.3. Avoid biased data sources	Common sense
3.4. Use diverse sources of data	Moderate need
<b>3.5. Obtain information from similar (analogous) series or cases</b>	<b>STRONG need</b>

#### 4. Collecting Data

4.1. Use unbiased and systematic procedures to collect data	Weak need
4.2. Ensure that information is reliable	Common sense
4.3. Ensure information is valid	Common sense
4.4. Obtain all important data	Weak need
4.5. Avoid collection of irrelevant data	Weak need
4.6. Obtain the most recent data	Common sense

#### 5. Preparing Data

5.1. Clean the data	Common sense
<b>5.2. Use transformations as required by expectations</b>	<b>STRONG need</b>
<b>5.3. Adjust intermittent series</b>	<b>STRONG need</b>
5.4. Adjust for unsystematic past events (outliers)	Moderate need
<b>5.5. Adjust for systematic events (e.g., seasonality)</b>	<b>STRONG need</b>
5.6. Use multiplicative adjustments for seasonality for stable series w trends	Moderate need
<b>5.7. Damp seasonal factors for uncertainty</b>	<b>STRONG need</b>
5.8. Use graphical displays for data	Moderate need

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### METHODS

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#### 6. Selecting Methods

6.1. Develop list of all important criteria	Moderate need
6.2. Ask unbiased experts to rate potential methods	Moderate need
6.3. Use structured forecasting methods rather than unstructured	Weak need
6.4. Use quantitative methods rather than qualitative methods	Weak need
6.5. Use causal rather than naïve methods	Weak need
6.6. Select simple methods unless evidence favors complex methods	Weak need
6.7. Match forecasting method(s) to the situation	Weak need
<b>6.8. Compare track records of various methods</b>	<b>STRONG need</b>
6.9. Assess acceptability and understandability of methods to users	Moderate need
6.10. Examine value of alternative forecasting methods	Common sense

#### 7. Implementing Methods: General

7.1. Keep methods simple	Weak need
7.2. Provide a realistic representation of the forecasting situation	Moderate need
7.3. Be conservative in situations of uncertainty or instability	Moderate need
7.4. Do not forecast cycles	Moderate need
<b>7.5. Adjust for expected events in future</b>	<b>STRONG need</b>
<b>7.6. Pool similar types of data</b>	<b>STRONG need</b>
7.7. Ensure consistency with forecasts of related series	Common sense

#### 8. Implementing Methods: Judgment

8.1. Pretest questions used to solicit judgmental forecasts	Common sense
8.2. Use questions that have been framed in alternative ways	Weak need
8.3. Ask experts to justify their forecasts	Moderate need
8.4. Use numerical scales with several categories	Weak need
8.5. Obtain forecasts from heterogeneous experts	Common sense
8.6. Obtain intentions or expectations from representative samples	Common sense
8.7. Obtain forecasts from sufficient number of respondents	Weak need
8.8. Obtain multiple estimates of an event from each expert	Moderate need

#### 9. Implementing Method: Quantitative

9.1. Tailor the forecasting model to the horizon	Moderate need
9.2. Match model to underlying process	Moderate need
9.3. Do not use fit to develop a model	Weak need
9.4. Weight the most relevant data more heavily	Weak need
9.5. Update models frequently	Weak need

#### 10. Implementing Methods: Quant Models with Explanatory Variables

10.1. Use theory and domain expertise to select causal variables	Moderate need
10.2. Use all important variables	Weak need
10.3. Use theory and domain expertise to specify directions of relationships	Moderate need
10.4. Use theory and domain expertise to estimate/limit relationships	Moderate need
<b>10.5. Use different types of data to estimate a relationship</b>	<b>STRONG need</b>
10.6. Forecast for at least two alternative environments	Common sense

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10.7. Forecast for alternative interventions	Common sense
10.8. Apply the same principles to the forecasts of explanatory variables	Moderate need
<b>10.9. Shrink forecasts of change if uncertainty in explanatory variables</b>	<b>STRONG need</b>

### 11. Integrating Judgmental and Quantitative Methods

11.1. Use structured procedures to do the integration	Weak need
<b>11.2. Use structured judgment as inputs to models</b>	<b>STRONG need</b>
<b>11.3. Use prespecified domain knowledge as input in selecting, weighting, and modifying quantitative methods</b>	<b>STRONG need</b>
11.4. Limit subjective adjustments of quantitative forecasts	Weak need
11.5. Use judgmental bootstrapping instead of expert forecasts	Moderate

### 12. Combining Forecasts

12.1. Combine forecasts from approaches that differ	Moderate need
12.2. Use many approaches (or forecasters), preferably at least five	Weak need
12.3. Use formal procedures to combine forecasts	Weak need
12.4. Start with equal weights	Weak need
<b>12.5. Use trimmed means</b>	<b>STRONG need</b>
<b>12.6. Use evidence on each method's accuracy to vary the weights on the component forecasts.</b>	<b>STRONG need</b>
<b>12.7. Use domain knowledge to vary the weights on the component forecasts</b>	<b>STRONG need</b>
12.8. Combine when there is uncertainty about which method is best	Weak need
12.9. Combine when uncertainty exists about situation	Weak need
12.10. Combine when it is important to avoid large errors	Common sense

## EVALUATION

### 13. Evaluating Methods

13.1. Compare reasonable methods	Weak need
13.2. Use objective tests of assumptions	Moderate need
13.3. Design test situation to match the forecasting problem	Moderate need
13.4. Describe conditions associated with the forecasting problem	Common sense
13.5. Tailor the analysis to the decisor	Common sense
13.6. Describe potential forecaster biases	Weak need
13.7. Assess reliability and validity of the data	Weak need
13.8. Provide easy access to the data	Common sense
13.9. Provide full disclosure of methods	Weak need
13.10. Test assumptions for validity	Common sense
13.11. Test client's understanding of the methods	Weak need
13.12. Use direct replications of the evaluations to identify mistakes	Moderate need
13.13. Use replications of the forecast evaluations to assess reliability	Weak need
13.14. Use extensions of evaluations for generalizability	Weak need
13.15. Conduct extensions of evaluations in realistic situations	Moderate need
13.16. Compare forecasts generated by different methods	Moderate need
13.17. Examine all important criteria	Common sense
13.18. Specify criteria prior to analyzing the data	Weak need
13.19. Assess face validity	Weak need

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13.20. Use error measures that adjust for scale	Weak need
13.21. Ensure error measures are valid	Common sense
13.22. Use error measures insensitive to degree of difficulty in forecasting	Common sense
13.23. Avoid biased error measure	Common sense
13.24. Avoid error measures with high sensitivity to outliers	Common sense
13.25. Use multiple measures of accuracy	Weak need
13.26. Use out-of-sample ( <i>ex ante</i> ) error measures	Moderate need
13.27. Use <i>ex post</i> accuracy test to evaluate effects	Common sense
13.28. Do not use adjusted R-square to compare models	Moderate need
13.29. Use statistical significance only to compare the accuracy of <i>reasonable</i> methods	Moderate need
13.30. Do not use root-mean-square errors to make comparisons	Weak need
13.31. Base comparisons on large sample	Weak need
13.32. Conduct explicit cost-benefit analyses	Common sense

### 14. Assessing Uncertainty

14.1. Estimate prediction intervals (PI)	Moderate need
14.2. Use objective procedures	Moderate need
14.3. Develop PI using realistic representation of situation	Moderate need
<b>14.4. Use transformations when needed to estimate symmetric PIs</b>	<b>STRONG need</b>
14.5. Ensure consistency over forecast horizon	Moderate need
14.6. List reasons why forecast might be wrong	Weak need
14.7. Consider likelihood of alternative outcomes in assessing PIs	Moderate need
14.8. Obtain good feedback on accuracy and reasons for errors	Weak need
<b>14.9. Combine PIs from alternative methods</b>	<b>STRONG need</b>
<b>14.10. Use safety factors for PIs</b>	<b>STRONG need</b>
14.11. Conduct experiments	Moderate need
14.12. Do not assess uncertainty in a traditional group meeting	Weak need
<b>14.13. For prediction intervals, incorporate the uncertainty associated with the prediction of the explanatory variables</b>	<b>STRONG need</b>

### USING FORECASTS

#### 15. Presenting Forecasts

15.1. Provide clear summary of forecasts and data	Common sense
15.2. Provide clear explanation of methods	Common sense
15.3. Describe assumptions	Common sense
15.4. Present point forecast and prediction intervals	Common sense
<b>15.5. Present forecasts as scenarios</b>	<b>STRONG need</b>

#### 16. Learning

16.1. Consider use of adaptive models	Moderate need
16.2. Seek feedback about forecasts	Common sense
<b>16.3. Use a formal review process for forecasting methods</b>	<b>STRONG need</b>
16.4. Use a formal review process for use of forecasts	Common sense

For detailed description of each principle, see section 20 in <http://www.forecastingprinciples.com/tofc.html>