Modern Methods of Prediction

Subjects: Social Sciences, Mathematical Methods Contributor: Patrick Moriarty

Humans have always wanted to know what the future holds in store for them. In earlier centuries, people often sought clues to the future from sacred texts. Today, more secular approaches are increasingly used, although the older approaches to the future persist. Modern methods for prediction include trend extrapolation, the Delphi method, mathematical modeling, and scenario analysis, including backcasting. Extrapolation was only possible when reliable past data became available. The Delphi method relies on the judgement of experts in the subject matter. Mathematical modeling has been very successful in the physical sciences, and, in the form of integrated assessment models (IAMs), has been applied to problems such as assessing future energy use. Scenario analysis looks at a number of possible futures and develops internally consistent story lines around each. It is often used in conjunction with IAMs. Each of the four methods, including both their strengths and weaknesses, are discussed in turn. Finally, this entry looks at the future of prediction, and concludes that despite progress in each of the four approaches treated, predicting the future, never easy, is now harder than ever.

Delphi method trend extrapolation future prediction methods assessment

mathematical modeling scenarios

There has never been any shortage of predictions about what the future will hold. Such forecasts have always been popular because humans have an urgent need to know what is in store for them, and because our actions today are guided to a large extent by our 'image of the future', to use the term introduced many decades ago by Dutch writer Fred Polak ^[1]. Two books on the future from the US, Alvin Toffler's *Future Shock* ^[2] and John Naisbitt's *Megatrends* ^[3]; each sold many millions of copies.

For many situations, we do not need to forecast, but can simply plan, such as what shows we will watch on TV this evening. We can even plan further ahead, as shown, for example, by publication of the dates for football matches for the coming year. Although, as the COVID-19 pandemic and ensuing lockdowns with the cancellations or postponement of sporting events (including the 2020 Tokyo Olympic Games, postponed until 2021) showed, these attempts to 'fix' the future, even the near future, can come unstuck.

Many pre-modern predictions are religion-based and often concern the date for the world's end or the second coming ^[4]. Nevertheless, many of these types of forecasts were still being made in the 20th and 21st centuries. These include those made by the late Howard Camping, who used the bible to calculate the exact date for the end of the world, or Judgement Day, with (fortunately, all incorrect!) forecasts dating back to 1994. His last forecast, made shortly before his death, prophesied that the end would occur on 16 October 2011, following the rapture on the 21 May 2011, predictions no more accurate than his earlier ones.

Yet even more recent predictions supposedly based on science and reason can get it badly wrong ^[5]. Very few economic forecasters foresaw the 2008 global financial crisis, and the 2019 COVID pandemic was similarly unforeseen, although pandemic specialists had warned years before that such an event could occur ^[6]. Where are the undersea settlements, the human settlement colonies on the moon, or flying cars?

Because of the poor accuracy record of earlier forecasts, modern methods of prediction owe little to these earlier approaches, where the terms prophecy and prediction were used interchangeably. Modern methods include trend extrapolation, the Delphi method, mathematical modeling, and scenario analysis, including backcasting. For modern forecasting, the passing of forecast date enables predictions made a decade or more ago (especially if numerical) to be evaluated for accuracy. Many papers are now published on evaluations of past forecasts, facilitating a check on the efficacy of the various approaches, helping to improve prediction (see, e.g., ^{[7][8][9][10][11]}). (One recent set of forecasts which cannot be assessed for accuracy is by the well-known late futurologist Graham Molitor ^[12], who published forecasts for the entire third millennium. The leisure era was supposed to commence in 2015, and a new space age 'commencing around 2500–3000').

Figure 1 shows annual papers in the Scopus database with each of the terms 'Delphi method', 'Integrated Assessment Models', and 'scenario analysis' in the title, abstract or keywords, for the years 1995 to 2022. Extrapolation was not included, because the terms 'extrapolation', 'extrapolation AND trend', and 'trend extrapolation' on inspection showed that many papers were not concerned with forecasting.



Figure 1. Annual papers in the Scopus database with each of the terms 'Delphi method', 'Integrated Assessment Models', and 'scenario analysis' in the title, abstract or keywords, 1995–2022.

The figures show far more annual papers on scenarios and Delphi approaches than for IAMs in recent years. The growth of the first two is roughly exponential, while that for IAMs is only roughly linear. The main reason is the far greater range of applications for these two methods. As **Figure 1** also makes clear, it is not possible to include more than a small fraction of even post-1995 papers for discussion in this Entry.

An obstacle for forecasting by any approach, particularly in the social sciences, is the existence of self-fulfilling and self-negating forecasts ^[13]. The classic example of the former is if the likelihood of a bank failure becomes general knowledge. A subsequent run on the bank will make failure more probable. A modern example comes from the UK. Under the 'predict and provide' model, road interests forecast high levels of future traffic, which were used to justify ambitious road construction programs. The additional road space induced more traffic ^[14]. An example of a self-negating prediction is when warning of a disease outbreak causes the public to take precautionary measures such as vaccination, which can greatly lessen infection rates. Today, there is such a plethora of scenarios to choose from, especially on the topics of future energy and climate change, that it is doubtful if they will lead to either self-fulfilling or self-negating forecasts. Yet nearly all but a few scenarios forecast continued economic growth, and both the public and policy makers act as if economic growth can continue indefinitely.

The main findings are that improvements have been made in each of the four approaches mentioned. At the same time, the rapid changes in both the biophysical and the socioeconomic worlds have made forecasting the future far more difficult. Nevertheless, despite these difficulties, we must attempt to forecast the future, even if we must abandon long-term forecasts; we have no alternative.

References

- 1. Polak, F. The Image of the Future; Elsevier Scientific Publishing Company: London, UK, 1973.
- 2. Toffler, A. Future Shock; Random House: New York, NY, USA, 1970.
- 3. Naisbitt, J. Megtrends: Ten New Directions Transforming Our Lives; Warner Books: New York, NY, USA, 1984.
- Wikipedia. Predictions and claims for the Second Coming. 2022. Available online: https://en.wikipedia.org/wiki/Predictions_and_claims_for_the_Second_Coming (accessed on 11 March 2023).
- Fast Company. Timeline of Failed Predictions (Part 1). 2010. Available online: https://www.fastcompany.com/1706712/timeline-failed-predictions-part-1 (accessed on 1 March 2023).

- 6. Moriarty, P.; Honnery, D. Switching Off: Meeting Our Energy Needs in a Constrained Future; Springer Briefs on Energy; Springer: Berlin, Germany, 2022; p. 90. ISSN 2191-5520.
- 7. Castle, J.L.; Hendry, D.F.; Martinez, A.B. Evaluating Forecasts, Narratives and Policy Using a Test of Invariance. Econometrics 2017, 5, 39.
- 8. Granger, C.W.J.; Newbold, P. Some comments on the evaluation of economic forecasts. Appl. Econ. 1973, 5, 35–47.
- 9. Hurley, K. A guide to evaluating forecasts. Bus. Econ. 1976, 11, 40–44. Available online: https://www.jstor.org/stable/23481497 (accessed on 24 March 2023).
- 10. Makridakis, S.; Hyndman, R.J.; Petropoulos, F. Forecasting in social settings: The state of the art. Int. J. Forecast. 2019, 36, 15–28.
- Scoblic, J.P.; Tetlock, P.E. A better crystal ball: The right way to think about the future. Foreign Aff. 2020, 99, 10–18. Available online: https://www.foreignaffairs.com/articles/united-states/2020-10-13/better-crystal-ball (accessed on 24 March 2023).
- Molitor, G.T. From my perspective: Five economic activities likely to dominate the new millennium.
 VII: Principles and patterns of economic era development. Technol. Forecast. Soc. Chang. 2005, 72, 85–99.
- 13. Sabetta, L. Self-Defeating Prophecies: When Sociology Really Matters. In Anticipation, Agency and Complexity; Poli, R., Valerio, M., Eds.; Springer: Cham, Switzerland, 2019; pp. 51–59.
- 14. Goulden, M.; Ryley, T.; Dingwall, R. Beyond 'predict and provide': UK transport, the growth paradigm and climate change. Transp. Policy 2014, 32, 139–147.

Retrieved from https://encyclopedia.pub/entry/history/show/98556