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## Forecasting

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## Forecasting –GREEN ENERGY

A broad range of quantitative and qualitative techniques and methodological approaches have been applied in the area of future studies, one of which is forecasting. Forecasting is often defined as the estimation of the value of a variable (or set of variables) at some future point in time. The terms “forecast,” “prediction,” “projection,” and “prognosis” are typically used interchangeably to describe forecasting. Risk and uncertainty are also central to forecasting and prediction.

The motivation for conducting future studies is to think about how firms and other actors might respond to a range of potential changes in the future. Preparedness (which is linked to agility) is therefore central to the value of futuring and forecasting as a methodological tool.

Forecasts may also be conditional i.e. if policy A is adopted then outcome C is likely, but if B is adopted then outcome D is more likely to take place. Forecasts are sometimes future values of a time-series e.g. the number of houses sold in a year, or the likely demand for electric cars. Forecasts can also be one-off events such as the opening of a new power station, or a new energy policy. Forecasts can also be distributions, such as the locations of wind farms or the installation of cavity insulation among different age groups. Forecasting also includes the study and application of judgment as well as of quantitative (statistical) methods.

Forecasting exercises are often carried out as an aid to decision-making and in planning the future. They typically work on the premise that if we can predict what the future will be like then we can modify our behaviour now to be better positioned for the future than we otherwise would have been. Example applications for forecasting include inventory control/production planning, investment policy and economic policy.

It is useful to consider the *timescale* involved in when classifying forecasting problems i.e. how far forward into the future are we trying to forecast? The usual categories are short, medium and long-term, but the actual meaning of each will vary according to the situation that is being studied. When forecasting energy demand in order to construct power stations for example, 5-10 years would be considered short-term and 50 years long-term.

Forecasting *methods* can roughly be classified into four methods:

- qualitative methods - no formal quantitative or mathematical model or numbers
- regression methods - an extension of linear regression where a variable is thought to be linearly related to a number of other independent variables
- multiple equation methods - where there are a number of dependent variables that interact with each other through a series of equations (e.g. economic models)
- time series methods - where a single variable changes with time and whose future values are related in some way to its past values

It is necessary to understand the different forecasting techniques and their relative qualities and so be able to choose which method to apply in a particular circumstance. The *accuracy* of forecasting is compared by measuring errors. This error measure should be the one that relates most closely to the decision being made. Ideally, it should also allow you to compare the benefits from improved accuracy with the costs of obtaining the improvement. This is seldom possible to

assess however, so you might simply use the method or methods that provide the most accurate forecasts. The selection of which measure to choose depends upon the *purpose* of the analysis. When making comparisons of accuracy across a set of time series for example, it is important to control the scale, the relative difficulty of forecasting each series, and the number of forecasts being examined.

Forecasting the future of technology can be a hazardous enterprise. There is often a shortsightedness, even among experts, that causes them to focus upon the future in terms of present conditions. One famous example is the call by the US Commissioner of Patents in 1899 to abolish the Patent Office on the grounds that there was nothing left to invent. Futures studies also sometimes suffer from being perceived as an attempt to forecast or foresee the future. Prediction is not their purpose however– their usefulness is in helping people and firms prepare for an uncertain future by producing a range of possible futures and identifying potential risks and opportunities in order to inform current decision making.

It is a general weakness of future-oriented methodologies in general that it is much more difficult to imagine a radically transformed future than to extrapolate current trends forward through time. This also partly explains the popularity of IT growth, education, sustainability and increased global competition within forecasting reports, as they are long-standing current preoccupations within government, firms and society more generally. This also highlights a paradox within many forecasting studies - they are often intended to help understanding and to deal with a rapidly changing world, but usually do so with reference to past and current trends and ideas. There is also debate as to what are 'good' and 'bad' forecasts, as well as whom they might be good and bad for. A highly regulated and standardised future energy sector may be able to produce environmentally efficient and functionally adequate energy, but what might be the impact on cost and functionality for consumers? How can potentially expensive energy efficiency measures for buildings, be reconciled with a perceived need to increase the productivity and profitability of building and construction work?

It is a common assumption that progression towards an envisioned future moves along an incremental path, and that incremental adaptation is required to keep pace with what changes are occurring. However, given both the variety of factors and the wide-sweeping nature of some such as climate change, as well as the possibilities for the same factors to produce significantly different outcomes, forecasting on its own may be insufficient. Multiple, irregular and potentially discontinuous paths might lead towards numerous futures, and more radical steps may be required in order to merely survive, let alone perform more effectively and productively.

Examples of recent forecasts include the UN, who report that millions of new jobs will be created worldwide over the next few decades by the development of alternative energy technologies, with those working in biofuels rising from one million today to 12 million by 2030. Another report from the American Solar Energy Society shows that as many as 1 out of 4 workers in the U.S. will be working in the renewable energy or energy efficiency industries by 2030. These industries already generate 8.5 million jobs in the U.S., and with appropriate public policy, it is forecasted that this could grow to even 40 million jobs by 2030.

See Also: Future generations, Innovation (environmental), Organizations, Risk Assessment, Uncertainty

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