The UK technology foresight programme: An assessment of expert estimates

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ABSTRACT

Since the early 1990s, 'Technology Foresight' exercises with special emphasis on the use of Delphi surveys have played an important role in science and technology (S + T) policy across Europe in an effort to focus resource allocation. Yet, none of the estimates made in the European Delphi surveys have been formally assessed in retrospect, while this process has been incorporated into the Japanese surveys since 1996. Taking the UK Technology Foresight Programme, this research sets out to assess the estimates of three of the fifteen panel Delphi surveys. Whilst on average 2/3 of Delphi statements were predicted to be realised by 2004, it will be shown that only a fraction of these statements had been realised by 2006. Based on the evidence collected from the published panel reports, the 'Hindsight on Foresight' survey conducted by OST in 1995 and interviews with panel members, it will be argued that the overwhelming majority of estimates were overly optimistic. While optimism and strategic gaming of experts is the most convincing explanation for these results, process factors were also explored, including the quality of expert panels used, the Delphi statements and the respondents of the Delphi questionnaire. It is argued that at least the issue of short-range optimism and strategic gaming of experts should be addressed in future Delphi exercises, as decision makers relying on expert advice cannot deal with this issue alone.

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1. Introduction

In the early 1990s many Western European countries experienced a "revival" of national 'technological forecasting' or 'foresight' initiatives in an attempt to focus resource allocation in S + T policy. Until then Japan was the country with the longest experience in this field, having conducted quinquennial 'Delphi' surveys since 1971 [1]. Consequently, the Europeans sought advice from the Japanese with the Germans translating the 5th Japanese Delphi survey and re-running it in Germany in 1993. Other countries such as France soon followed down that road [2]. However, not all European countries chose Delphi as their preferred method as especially smaller countries like the Netherlands used other approaches instead [2].

The UK embarked on their Technology Foresight Programme as recommended in the 1993 White Paper 'Realising our Potential', employing 15 expert panels representing the UK's commercial and technological base, supported by a large scale national Delphi survey. The survey was sent to 8384 experts in 1994, of whom 2585 participated, to generate estimates with a time horizon of 2015 or beyond [3]. However, across panels 2/3 of statements were predicted to be realised between 1995 and 2004 [3]. Thus, the main objective of this paper is to assess the 1994 estimates for their current status of realisation to see how realistic the expert estimates were.

This objective might be contested by some readers as they might argue that it is irrelevant whether the estimates have turned out to be correct, as the emphasis of the exercise should be on whether the estimates at the time have enabled good decision making [4]. Furthermore, the most accurate forecast is not necessarily the most useful one. Forecasts are at times most effective if they are self-fulfilling or self-defeating [5]. This is why it is not possible to measure the success of Delphi studies based on the share of realised statements. This is certainly true, and it is not the intention of this paper to judge the success of the UK Delphi survey as

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many more factors beyond the estimates determine the success of a Delphi. Nevertheless, there are a number of important questions to ask about future estimates:

1) Did the forecasted items come about?
2) If not, have the items still chance of occurring, or did they occur earlier than expected?
3) What items occurred that were not forecasted?

This paper only deals with the first category as to this date very few Delphi surveys conducted in Europe have been evaluated over the last decade. However, this should only be seen as the first step with need for future research addressing the other questions. This is important as recommendations and decision making were at least partially based on the UK Delphi estimates. If estimates turn out to be consistently over-optimistic or incorrect this should be taken into account or the method improved to reduce this bias. An important issue raised by this analysis, although contested, is the question what percentage of items one would expect to be realised i.e. what target level does one expect? As the future is uncertain a 100% realisation rate is unrealistic and undesirable. However, with few studies apart from the Japanese analysed from hindsight this is difficult to say. For this paper the realisation rates of the Japanese Delphis are used for comparison.

2. Use of Delphi in science and technology policy

The Delphi technique as conceived by the RAND Corporation in the 1940s and 1950s has spread widely into policy, industry and academia alike [6]. Because of its wide application and many variations, today most practitioners probably agree that the Delphi method has two irreducible elements: anonymity and feedback between rounds [7]. The method has therefore evolved substantially from its original form, where for example the importance of consensus judgements was emphasised with the 'Policy Delphi' first diverting from this original format [8].

The first (inter)national scale Delphi survey was conducted in the US in the 1960s [9]. The lack of application of results in the political system and oil crisis greatly reduced the perceived need for such future studies, which meant that the US has not conducted a national Delphi since [1]. Instead it was Japan who championed the Delphi method at a national scale in S + T policy, conducting surveys ever since 1971. With the renewed interest in 'technological forecasting' in Europe in the early 1990s, national technology Delphis spread in Europe. While Germany, France and the UK were the first to conduct national Delphi surveys, today the main interest lies in Central and Eastern Europe. Contrary to the originally designed purpose of generating estimates, the main reason for using national Delphis is often argued to be its role in connecting the various actors in the National Innovation System [6]. Nevertheless, most of the national surveys conducted, generate quantitative estimates usually on a range of variables. As this is the main purpose of Delphi surveys – the networking role is a secondary aspect which can be replaced by other methods such as standard surveys – it is useful to analyse the estimates in retrospect as the estimates are designed to support decision-making processes. Recently, it seems that there is some dissatisfaction with the results of Delphi surveys in the countries first adopting it. Germany, France and the UK have abandoned the use of national scale Delphis in their foresight exercises, with even Japan switching from the sole use of Delphi surveys and supporting its latest Delphi using scenarios, bibliometrics and other surveys [10]. Instead, most national foresights use a combination of methods, now, often focused on a specific topic, compared to the broad national Delphi surveys of the 1990s.

3. Brief introduction to the UK Delphi

In 1993 the Office of Science and Technology (OST) White Paper: 'Realising our potential' reaffirmed the need for priority setting to make the UK science base more responsive to industry needs [11]. As a result the first holistic overview of S + T priorities in the UK was attempted, embarking on the UK Technology Foresight Programme. The main goal of the programme was to identify future S + T areas, which could be exploited for wealth creation and improvements in quality of life (ibid). In addition new partnerships between industry and scientists were hoped to be forged [12].

Fifteen panels, representing the different UK industry sectors, were set up to produce a report on future S + T issues in their sectors. To do so panel members received basic training on the methods and concepts that they would be expected to employ during the main foresight stage, which were scenario-building, the use of a Trends and Issues survey, Delphi, and the use of prioritisation criteria [13]. The Delphi survey was used as it was felt that the necessary expertise was not accessible within panels of manageable size [12]. Furthermore, to ensure that the findings would be implemented afterwards it was deemed necessary to engage "with the widest possible cross-section of experts in the UK" [12]. The Delphi survey was therefore also intended as a "communication" tool, rather than merely predicting variables on future generic technologies.

Nevertheless, Georghiou stated that the survey was conducted to inform the panels' views about future developments based on estimates by the relevant expert communities [12]. Therefore each panel developed eighty statements grouped into several sub-sectors, which experts were asked to make estimates about. While the statements were developed based on a separate survey, as well as regional workshops in the case for some panels, an unstructured round conducted with the later response group to generate the statements was not part of the methodology. The original questionnaire was of the following format. Experts were asked to rate their level of expertise on a scale from one to five for each of the statements. One representing a level of expertise defined as "Unfamiliar" and level five as "Expert". Exact definitions of each level were specified on the questionnaire [3]. Respondents were further asked to make estimates in regard to (1) the expected impact on wealth creation and quality of life,