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The suitability of technology forecasting/foresight methods for decision systems and strategy A Japanese view

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Abstract

This paper evaluates technology forecasting and foresight (TF/F) methods in relation to users' decision systems for science and technology (S&T) strategies. As TF/F is an aid to decisions for attaining S&T goals, we examine the serviceability or suitability and acceptability of the methods and outcomes of TF/F for decision systems and S&T strategies. The focus is on extrapolation and Delphi methods because they are so widely used in technology forecasting (TFC). Based on the complaint analysis of TFC that revealed inaccuracy as the most serious obstacle to its acceptance, this paper especially analyses the meaning of accuracy. Learning from the experiences of TFC, the suitability of technology foresight (TFS) to cognitive structures in users' decisions is discussed. Finally, some lessons from TFC are presented for TFS.

Keywords: Technology forecasting; Technology foresight; Extrapolation; Delphi; Decision system; Strategy

1. Introduction

Technology forecasting (TFC) itself is not new. Out of curiosity, people have long forecast future lives, science and technology (S&T) and other areas. In the beginning of the 20th century, the media forecast the change of life resulting from new inventions such as the flying machine. The scenarios by distinguished scientists and journalists were later found quite accurate. David Hilbert, a leading mathematician, presented 23 problems likely

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to be solved in the 20th century. Indeed, most of these problems were solved within the century. However, the idea of TFC for practical policy suddenly came to the Japanese government and industries in 1969, when Dr. R. Shirane and others told them the news [1] that the success of the Apollo project was accurately forecast by Delphi [2]. For many people, this news was as surprising as the Copernican or Darwinian theories. So was the idea of technology assessment (TA), which was also brought to their attention by the Shirane group [1].

In countries less advanced or lagging in S&T, the strategy is often to follow the S&T of advanced countries and, therefore, they do not need TFC. In Japan, until the 1960s, a few theoreticians were interested in the historical law of S&T development at a macroscopic level (e.g., Refs. [3–7]) but not in the predictability of breakthroughs at a microscopic level for operational decisions. As the S&T strategy of Japan was to follow that of advanced countries, those who worked on theories about S&T were suspected as criticising the policy and were often arrested. In fact, the famous S&T philosophers, Tosaka and Miki, died in prison in 1945, respectively, 1 week before and 6 weeks after the end of World War II. Except for such few, no expert was trained in theories about S&T, including TFC. S&T was believed to advance itself as the blind piecewise extension of the existing state in a zigzag way.

The postwar reform of Japan scarcely changed the situation. Educational reform was not intended to promote S&T creativity. Engineering colleges inhibited students from paying attention to general theories on, or forecast of, S&T. Technological manpower was assigned to factories. In the late 1960s, when the steel industry of Japan led all industries, the State of Japan was said to stand on steel. The validity of the idea of a steel state was believed to last forever. In such an expected stability, there was no demand for TFC.

The success of Delphi for the Apollo project moved the Ministry of International Trade and Industry (MITI) and Science and Technology Agency (STA) of Japan toward its use. Works on Delphi (e.g., Refs. [8–10]) were introduced. After a Delphi study of limited scale by the Agency of Industrial Science and Technology (AIST) under MITI, STA made a larger-scale study comprising all technological areas in 1971. At first, this attracted public attention and was accepted by other ministries and industry. Delphi took a central position in technology management in Japan [11]. It was also applied to social issues (e.g., Refs. [12–14]). Encouraged by such diffusion, STA has continued Delphi studies since then, meanwhile neglecting relatively sophisticated methods such as the cross-impact analysis [15] and qualitative methods [16]. Lately, however, STA seldom mentions its own Delphi studies in the publications, such as S&T White Papers. Following other countries [17–22], STA adopted technology foresight (TFS). After the merge of STA with the Ministry of Education to set up the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in 2001, its National Institute of Science and Technology Policy (NISTEP; formerly a part of STA) started up Kagaku Gijutsu Doko Kenkyu (the literal translation: S&T trend study, but the English name: S&T foresight) Center as a section of NISTEP. The Delphi study is now conducted by NISTEP (under a ministry) instead of STA (a ministry equivalent) and will constitute part of the comprehensive TFS study as in other countries [23,24].