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Technology Forecasting: An Overview

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Commentary

Technology forecasting is to foresee the characteristics of relevant technical machines, procedures, or techniques in the future. Based on historical experience and current technical breakthroughs, researchers produce technology projections. Technology forecasting, like other projections, may assist public and commercial organisations make informed decisions. The forecaster can improve judgments by examining future opportunities and dangers in order to maximise benefits. Most countries are currently undergoing significant social and economic transformations, which are strongly reliant on technological advancement [1]. Government and economic entities could plan for future developments by examining these changes. However, historical data alone cannot be utilised to anticipate technology; forecasters must also apply modern technology and quantitative modelling based on expert research and findings. Technology forecasting has existed for over a century, but it did not become a well-established subject until after World War II, when the American government began to see a technology development pattern in the military field [2].

The United States Army Air Forces published a paper called Toward New Horizons in 1945 that reviewed technological advancements and highlighted the need of future research. The paper serves as a precursor to the start of current technology forecasting. The Delphi Technique was developed by RAND Corporation in the 1950s and 1960s, and it is now widely accepted and utilised to make informed future evaluations [3]. The Delphi Technique's applications mark a watershed moment in the history of technology forecasting since it has proven to be an effective tool for knowledge creation and decision-making, particularly in the areas of social policy and public health. Technology forecasting was widely adopted by the business sector and government agencies outside of the military in the 1970s, which helped to broaden the users and applications. Advanced computer hardware and software enhance the process of data sorting and analysis as computing technology advances [4]. Data access and data transfer are further aided by the advent of the Internet and networking. Since 1990, a technology opportunities analysis has been conducted. Improved software can assist analysts in searching and retrieving data from large, complex databases, and then graphically representing interrelationships. Since 2000, new requirements and challenges have led to the modernization of technology forecasting, including prediction markets, alternate reality games, online forecasting communities, and obsolescence forecasting.

A technological forecast primarily deals with technological characteristics such as levels of technical performance, such as the speed of a military aircraft, the power in watts of a future engine, the accuracy or precision of a measuring instrument, the number of transistors in a chip in 2015, and so on [5]. It is not necessary to describe how these attributes will be accomplished in the forecast. Second, technology forecasting typically focuses on only the most valuable machines, procedures, or approaches. This is to keep commodities, services, and processes designed for luxury or entertainment out of the realm of technology forecasting. Finally, in technological forecasting, feasibility is a critical factor. Forecasters should think about how much it will cost and how tough it will be to fulfil one's desires. For example, the computer-based approach "Pattern" is an expensive forecasting method that should not be employed in circumstances when funds are limited. The Delphi approach, prediction by analogy, growth curves, extrapolation, and horizon scanning are some of the most commonly used technology forecasting methodologies and tools. Relevance trees, morphological models, and mission flow diagrams are examples of normative technology forecasting methodologies. Because of its flexibility and ease, the Delphi technique is commonly employed in technology forecasting.

The Delphi technique, on the other hand, may have the disadvantage of requiring consensus. With enough useful historical data, extrapolation can be beneficial. Forecasters prolong the past development trend by evaluating historical data in order to extrapolate relevant future results. One of the most common reasons why a forecast goes wrong, according to studies of previous forecasts, is that the forecaster ignores connected sectors. Because it was supplanted by another technological approach that the forecaster missed, a particular technical approach may fail to achieve the degree of capability predicted for it. Another issue is the lack of consistency in forecasts. The differences in forecasts are due to the various locations and times used in the controlled experiment. It frequently provides imprecise and untrustworthy data, resulting in erroneous insights and predictions. Due to these issues, it is frequently required to aggregate forecasts from various technologies. Furthermore, employing more than one forecasting method frequently provides the forecaster with a better understanding of the processes at work that are responsible for the technology's progress. When compared to a single forecast, combining forecasts can reduce mistakes. When researchers are unable to choose a standard forecast method, combining forecasts is always the best option. Data is used widely in technology predictions, and data contributes to manufacturing and Industry 4.0.

In the post-Industry 4.0 Era, the Internet of Things system provides a solid platform for predictive analysis. Advanced technologies will improve predicting accuracy and consistency. As IoT technology advances, more and more sectors will be outfitted with sensors and monitoring. The appearance of factories has changed since the advent of modern industry. By gathering, tracking, and exchanging data, an IoT system assists managers in monitoring and controlling the production process. Data has a lot of power. Managers can also use marketing data to conduct business analysis. Information like client purchasing preferences and market demand could be gathered and utilised to estimate output. Manufacturing could benefit from trend analysis based on current growth assumptions. The study greatly aids in the reduction of manufacturing process cycle time and energy consumption. In this situation, contemporary technology improves both output and economic efficiency.

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