Road-mapping for corporate strategy

A Japanese case study involving Delphi-scenario writing

Akio Kameoka

This article reviews the development of new technology and product foresight and assessment in Japan through a real case study in the home facsimile machine industry. The case shows that technology forecasting, technology assessment and product planning are integrated by roadmapping. Linking corporate business strategy with technology strategy plays an important role in a firm's success and contributes to a nation's healthy economic growth. Integrated technology roadmapping provides a practical instrument for middle and long-range technology development and corporate business strategy formulation by aligning internal and external resources and social marketing factors.

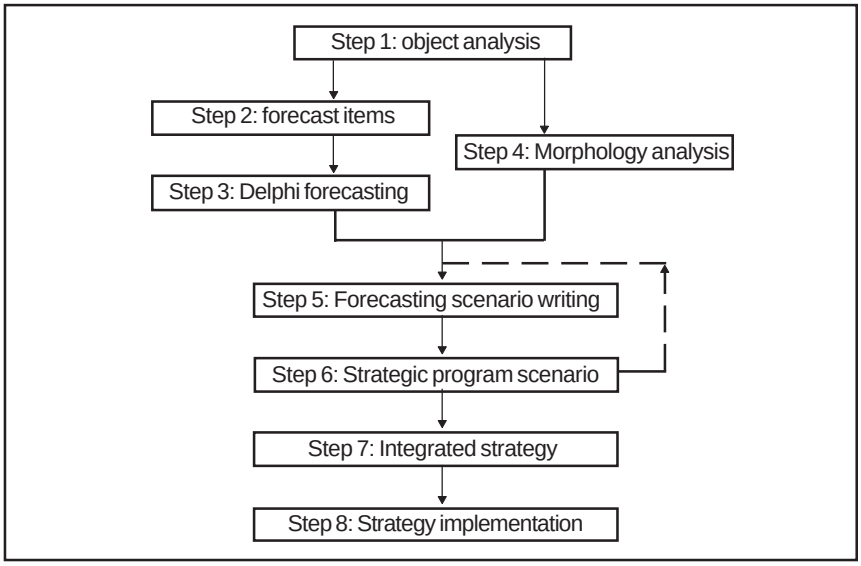
Dr. Akio Kameoka
Fellow, National Institute of Science and Technology Policy (NISTEP)
1-3-2, Kasumigaseki, Chiyoda-ku
Tokyo, Japan
Tel: (+81-3) 3581 0605
Fax: (+81-3) 3503 3996
and
Professor at the Graduate School of Knowledge Science, Japan Advanced Institute of Science and Technology (JAIST), 1-1 Asahidai, Tatsunokuchi
Ishikawa, Japan 923 1292
Tel: (+81 761) 51 1720
Fax: (+81 761) 51 1720
E-mail: kameoka@jaist.ac.jp

Introduction

Technology forecasting is always challenging work - whether for a firm, or for an industry or for a country. Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) embarked on science and technology forecasting at the national level in the early 1970s and MEXT continues to conduct regular Delphi surveys approximately every five years. Every survey aims at forecasting long-term trends in various fields of science and technology over the next thirty years.

At firm level, large companies started to use scientific methods in the late 1970s to help forecasting technology trends, while Japanese manufacturing industry as a whole enhanced its global competitiveness. A Delphi-scenario writing (DSW) method was developed during this period and is introduced in this article. In some industries, industrial associations or research consortiums coordinated efforts in formulating a variety of roadmaps as important documents to support firm-level technology strategy and planning. Roadmapping was also widely used by Japanese companies and industries. At first, it was simply used to provide short-term and long-term technology and innovation forecasting. Next it became a routine planning instrument for coordinating the innovation process within or among companies. More recently, roadmapping has been recognized as a powerful holistic device to improve the quality of technology

Figure 1: The procedure of the DSW method for roadmapping



management and the integration of various activities. This article reviews the development and application of a unique technology forecasting method, and proposes an integrated strategy development by using roadmapping technology.

Forecasting and roadmapping

Technology forecasting uses many different methods based on different theories and applications. Roadmapping, one of the forecasting techniques, is a process that contributes to the integration of business and technology and to the definition of technology strategy. It displays the interaction between products and technology over time, taking into account both short and long-term product and technology aspects. Roadmapping could be expressed in various forms: technology roadmapping, industry roadmapping, science roadmapping, and product roadmapping. But in recent times, many scholars have been suggesting that technology roadmapping could be an integrated technology forecasting process to regularly support strategic planning and integrate product development, innovation management and manufacturing as a coherent holistic process.

Good technology roadmapping can perform more generic technology management functions. These include: technology intelligence, strategy formulation, technology decision-making and strategic technology control. In the process, technology forecasting becomes an organizational learning process.

The case study

To explore an intelligent methodology for integrating technology seeds and social needs by articulating future demands with rapidly advancing technologies, I would like to introduce my personal experiences and first-hand observations on the development of facsimile machines in Toshiba Corporation. I believe this is an interesting and practical case to illustrate how integrated technology forecasting and assessment is processed and used in the real world.

DSW method

In the 1970s, Japanese organizations faced a problem when promoting office automation. The problem Japan encountered was how to handle Chinese characters, of which there are about 4,000 in Japanese daily use. The use of traditional Japanese typewriters required extensive training, and could normally be used only by professional typists. It was very difficult for ordinary people to use these typewriters, which made computerization difficult. The facsimile machine offered one of the easy solutions for office automation. It made it possible to directly transfer handwritten rather than typed documents from one office to another office through a telephone line.

We developed a strategy to promote small home-use facsimile by applying a new approach that we now call the DSW method. The method was first used in Toshiba Corporation 25 years ago to developing a strategy to promote facsimile use for the small office and home.

Forecasting comes before action. The Delphi method is a well-known intuitive method. The advantage of the Delphi forecast lies in its simplicity and convenience of use. The DSW method is an integrated method that provides a systematic approach to developing a strategic scenario for promoting the innovation process. The DSW method consists of eight steps (Figure 1). The first three steps, from first object analysis to Delphi forecasting, provide a Delphi needs/time chart, which gives preliminary information on the technology and the future services. The next two steps, from the fourth morphology analysis to foresight scenario writing, focus on clarifying the inter-relationships among the forecasted items. This generates a flowchart scenario, which leads to the next two steps, from strategic programme scenario writing to integrated strategy development. The last step of the strategy implementation provides a practical programme to promote the innovation, and the expected results, as, for example, the projected penetration curve of the product life cycle.

DSW for facsimile industry

The process we adopted in the development of our strategy for the small facsimile is briefly reviewed with reference to the eight steps in Figure 1. In Step 1, facsimile technology and services were analyzed in detail, side by side with competing media such as the telephone, mail, the telegraph, television, the newspaper and others.

In Step 2, 49 services expected to be provided in the future were identified; and in Step 3, Delphi forecasting was carried out using workforce members and some external members by scoring the importance of the needs and the time to start the services. Figure 2 shows the needs flowchart over time.

In the morphology analysis in Step 4, the 49 services were classified into four main categories and 13 medium groups by using the KJ (Kawakita Jiro)

method, a new finding of the two-dimensional portfolio matrix that consists of objectives (business *vs.* living) and means (communication *vs.* information). This matrix suggested that it is difficult to cross over from the business communication (BC) domain to the living communication (LC) domain, and it is necessary to pass through the business information services (BI) and living information services (LI) domains. In Step 5, foresight scenario writing is a process to integrate the results of Steps 3 and 4, and to generate a Delphi-scenario flow-chart (Figure 3), which describes the facsimile service innovation process in the four domains.

Small facsimile scenario

The foresight scenario for the small facsimile in 1977 was developed by the DSW method to promote the innovation, which outlines the processes in the four categories - BC, B, LI and LC. These innovation scenarios introduced new factors to enhance the process, for example, the facsimile commercial mail (CM) and direct mail (DM), or the public facsimile information and communication service terminals, similar to public phones. The new factors to induce development could be found in writing scenarios that require logical thinking, by specifying the relations between the forecasted items. This ability to find new related factors is one of the critical advantages of this method. The second advantage is the easy processes of scenario writing which does not require hard thinking by putting Delphi-forecasting into the pre-stage.

Enhanced diffusion scenario

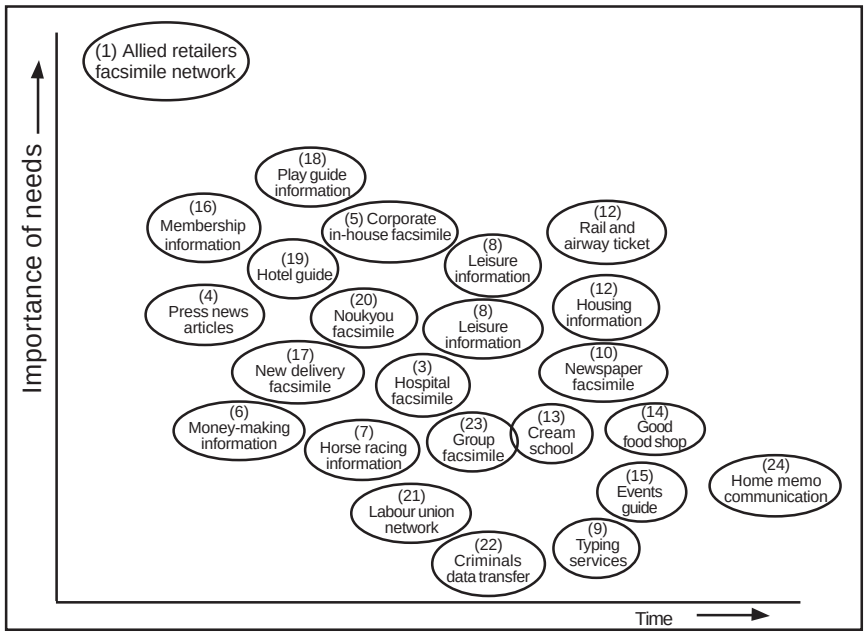
The next stage in this approach was to find key accelerating factors to promote penetration into home applications. The first factor was to spread business use facsimiles that could be promoted through the following five factors:

- Expansion of in-house business facsimile systems, to be connected to outside home-use facsimiles.
- Increase of information services to professional users in business offices that need to contact individuals at home.
- Information processing systems that support outsourcing of office works, such as conference management or typewriting services.
- Wholesaling and retailing of facsimile networks that extend to independent business offices.
- Information services directed to wholesale and retail sales and independent offices.

The next suggested target was to directly promote the diffusion of home facsimiles, intending to increase added values for individual subscribers at home or to reduce the costs for the services. The items derived from the scenario could be summarized as integrated information services providing coordination for all the services.

- A commercial angle to reduce costs;
- A simple charge-collecting system for information and service providers;
- Familiarization by demonstration and an open system, through introduction to restaurants, coffee shops and places of recreation;
- Shifting from office use to home use in small business offices and among retailers;
- Adding of new functions, for example, copying, game, and TV interfaces that could be provided with little modification; and
- A new lifestyle campaign that familiarizes audiences with the use of the new facsimile machine.

Figure 2: Needs chart of small facsimile services forecasted over time by the Delphi method

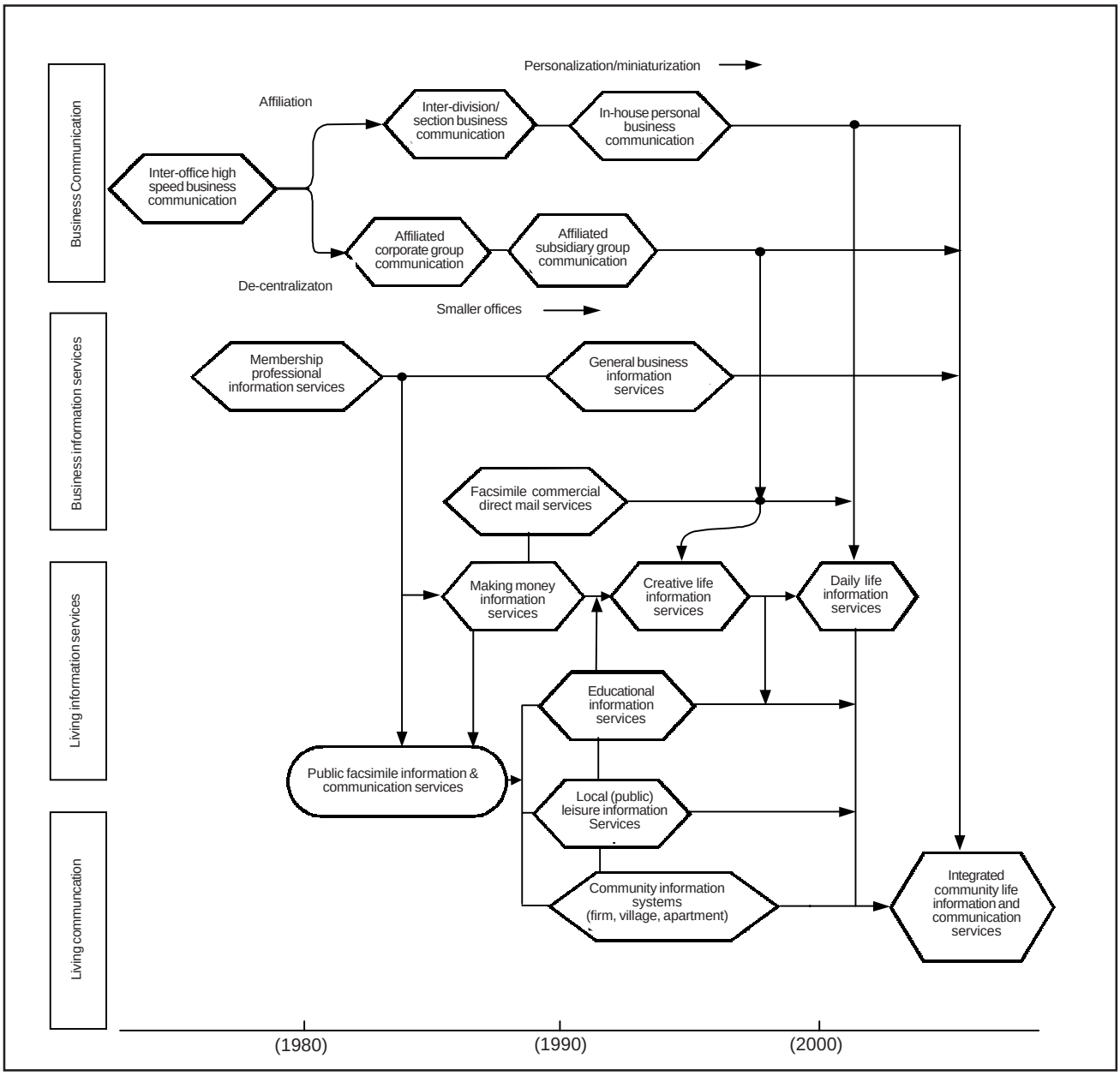


These counter measures were integrated to attain a higher performance by selecting the following six items: the establishment of a total information centre; business office facsimile promotion; a retailer/independent business office facsimile network; public facsimile distribution; community facsimile networks; and further cost reductions with improved functional performance.

Forecast *versus* performance

Continuous innovation in facsimile design and manufacture has been promoted by the Nippon Telegraph and Telephone Public Corporation in cooperation with Japanese industry for about three decades. This is how it successfully promoted the original innovation in Japan and then throughout the world.[1] Figure 4 shows the penetration curves projected in 1977 and the actual curve. The predicted innovation scenario was characterized by the simple four portfolio categories, which had suggested that the way to move directly to the LC domain from the BC domain was difficult due to the external network needed. Instead the suggestion had been to lead with the information services BI and LI domains to increase the number. In hindsight, it is clear that this insight was generally appropriate. The actual penetration curve was slow in starting up,

Figure 3: Delphi-scenario-based product/service roadmapping for small facsimile innovation



but the real growth rate was faster than the one the curve predicted. It could be interpreted that the external network was underestimated. Another point of departure from the original projection was that the facsimile innovation spread worldwide far more rapidly than expected. This was a good lesson from the case study.

This review of the growth of the small facsimile in Japan over the past 25 years and the DSW method to develop the innovation strategy lead to the conclusion that good quality foresight is possible, and that the DSW method as a practical instrument can effectively support long-range strategy development. The method provides a basis for more integrated and comprehensive strategy development.

Integrated roadmapping

Techniques of technology forecasting and strategy development have improved over time. For example, new technology roadmapping has advanced from first generation technology roadmapping, which focuses on technology forecasting, to second generation, aimed at technology strategy development, and then toward the third generation, which enables mutual communications among the stakeholders concerned. Integrated roadmapping is complicated, and a sophisticated methodology needs to be explored. Figure 5 shows conceptual mapping, which integrates the technology, product, manufacturing, and marketing processes. The essential process of roadmap integration is to find connections between

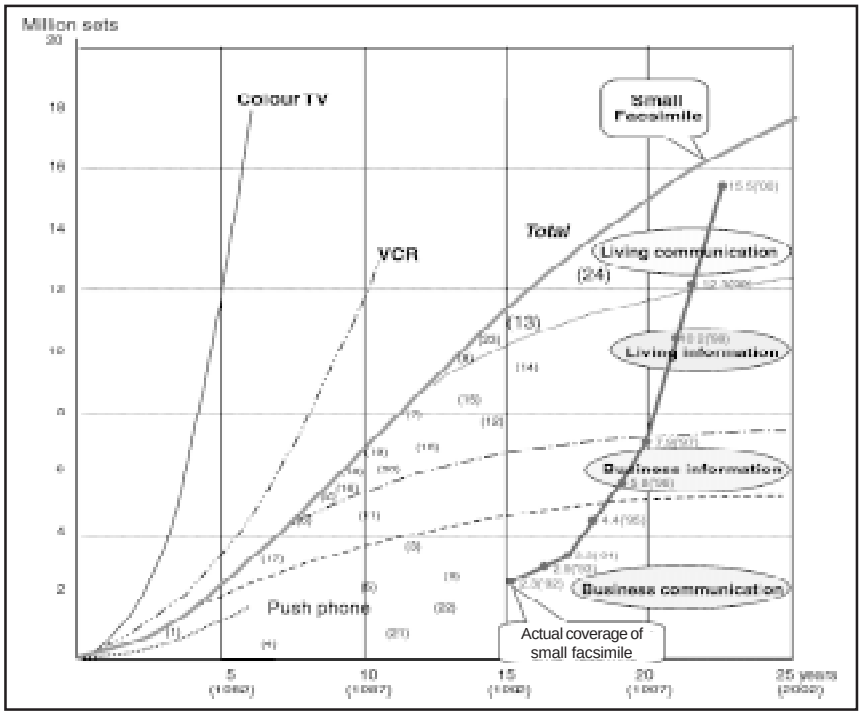
core objectives. Thus in Figure 5, the arrow ST 1 (science and technology) to PF 2 (product feature) indicates the connection between the science/technology core and the product feature core.

For small and medium-sized enterprises (SMEs), my suggestion is to be actively involved with organizations, such as industrial associations or global consortia, that undertake roadmapping. Such participation in roadmapping exercises would give good access to external resources, helping SMEs to understand future technology trends and integrate internal technology forecasting and planning with the entire value chain in the industry in which the SME is involved.

Conclusion

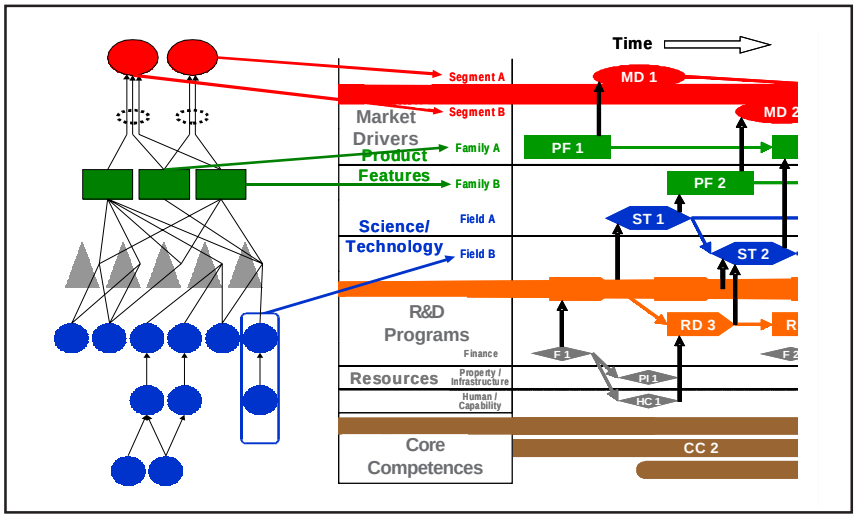
Technology foresight includes forecasting of emerging technologies, and assessing and communicating them among product providers, consumers and stakeholders. Any analysis of future technology is complicated in practice; and includes technology forecasting, technology foresight, technology intelligence, technology roadmapping and technology assessment. These approaches need to be integrated in order to achieve a comprehensive understanding of emerging technologies and their likely social impacts. Such an integrated strategic planning methodology should be explored before developing a complex innovation system. In particular, a definition of the various functions is essential to an integrated roadmapping process.

Figure 4: Penetration curve of small facimile: projection and reality



Source: Kameoka et al, 2003

Figure 5: Using the core innovation fields as basis for innovation roadmapping - integrating technology, product, manufacturing, and marketing processes



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