Introduction to
Patent Map Analysis

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Introduction to Patent Map Analysis

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1. Introduction

Patent information is one of the valuable benefits that the patent system provides to society in return for granting to the inventor "a monopoly of the relevant technology for a certain period of time." Active utilization of patent information is an inherent function of the patent system.

Patent information, such as the publication of unexamined patent applications, has various unique advantages as technical information: it covers a wide variety of technology including state-of-the-art technology, as well as information on overseas inventions in the reader's native language. Patent information also includes the contents of an exclusive right or an intellectual property right, which are inevitably a part of current economic activity. Furthermore, patent information is a useful indication for the technological development strategies or global strategies of individual enterprises in response to intensifying competition.

Consequently, multinational corporations, universities and research institutions use patent information at an early stage of their research and development in order to identify targets of research and development, to evaluate inventions, and actively use patent information in their management of intellectual property.

However, it is not always easy to use patent information.

This is partly because patent information intentionally uses abstract expressions due to its nature as information related to rights, and partly because the terminology involved is often not well-established because the technology is ground-breaking. In addition, a huge amount of patent information is published each year, and to use it, it is necessary to look back on past published information, making it very difficult to precisely access the information required.

On the other hand, some people see the huge amount of patent information as an advantage, not as a disadvantage. By using modern information-processing techniques, this patent information in a unified form is helpful for identifying new directions of technology or industry that otherwise could not be identified.

In this context, a particularly useful tool to analyze patent information is the so called "Patent Map" or "Patent Mapping." The dissemination of Patent Maps has not only created a new category of information use, but also made it easy for anyone to use patent information that previously only experts could afford to use.

2. What Is a Patent Map?

2.1. Fundamental Principles of a Patent Map

For a long time, patent information has been used mainly for patent document searches and patent clearance searches, including prior art searches and infringement searches. Patent search is aimed at finding patent documents that cover an invention which is deemed to be closest to the target technology, and so the fundamental policy has been to design the search process to sort the shortest possible list of patent documents. In this procedure, searchers have to examine these sorted patent documents to check whether they can be used as proof denying the novelty or inventiveness of an invention or can be used to determine whether an invention infringes the ones covered by the patent documents.

Although a patent document naturally includes a lot of information, by using multiple patent documents at the same time, it is possible to take new approaches which could reveal new information that would otherwise not be available.

One example of such an approach is a time-based approach to patent documents. In this approach, you withhold from the search relevant patent documents at some stage and read a certain number of patent documents as a cluster in the order in which the patent applications were filed. This can show the progress of technological development as if one had been personally engaged in the development projects.

Another example is an approach focused on the personal aspects of patent documents, including right-holders and inventors. In this approach, you sort collected patent documents by company and compare the sorted patent documents. This reveals the different technological development activities and strategies of companies.

This way of grasping patent information as a group (or cluster) is the principle of Patent Maping and creates new information.

2.2. Features of Patent Maps

In general, the term “Patent Map” is often defined as “Patent information collected for a specific purpose of use, and assembled, analyzed and depicted in a visual form of presentation such as a chart, graph or table.” Specifically, “Patent Map” can be defined as information that has all of the following features:

a) A Patent Map is based on patent information.

Patent information has various unique advantages such as early publication, a wide range of technical fields, and use of a unified format. By using patent information as the basis of Patent Maps, these advantages are available in Patent Maps without further development.

b) A Patent Map has a clear purpose of use.

One of the most important elements of a Patent Map is that it has a clear purpose use. Any patent map that has no clear purpose of use has no applicability.

c) A Patent Map consists of appropriate patent information for the purpose of use.

Collecting less "noisy" patent documents without omission would require a broad knowledge and experience of patent information, including the types and reading of patent information, how to access the patent information database, and search keys or patent classification. It is also time-consuming. "Patent information that is collected according to the purpose of use" means that the information is ready for immediate use.

d) A Patent Map contains organized patent information.

Generally, organizing patent information requires expertise in the relevant technical field. The fact that a Patent Map contains organized patent information means that the information has already been analyzed, divided into technical fields, indexed where necessary, and assembled in a suitable manner for the intended purpose of use.

e) A Patent Map presents information visually.

The most easily understandable feature of a Patent Map is that it is visual. This does not necessarily mean that it is presented as a graph or drawing. There are no particular limitations on the format for presenting a Patent Map. For example, a copy of an abstract page pasted into a Patent Map is a visual form of presentation. Patent Maps enable people who are not familiar with the intellectual property system and patent information to learn about technology trends, the spread of patent networks and strategic development areas of competitors.

In recent years, various software companies provide patent information analysis software called "Patent Map Software," which has made it even easier to create Patent Maps.

However, as mentioned above, a Patent Map also has other features in addition to its ability to visualize patent information. The most important feature is that the patent information contained in the map has been collected for a particular purpose and analyzed suitably for that purpose.

Consequently, an analyst who carries out a Patent-Map analysis not only requires knowledge in the art but also fundamental knowledge of and experience in handling patent information, including the way patent documents are read and how to access patent information, and an ability to analyze and present patent information.

2.3. Using a Patent Map in Business

A survey conducted by the Institute of Intellectual Property (IIP)(Tokyo) shows that 85% or more of major Japanese companies use Patent Maps in one way or another. The maps are used by all divisions of companies, including the corporate control department, technology development department, and intellectual property management department.

a) R&D section

The R&D section at companies uses a Patent Map to select themes for research and development, pick out new ideas, and gain an understanding of competitors' technology development. A Patent Map is also an important tool for grasping the market needs and analyzing patent information in order to avoid wasted investment in development.

b) Intellectual property management section

The intellectual property management section at companies, research institutes and universities

uses a Patent Map to acquire an "extensive and strong exclusive right." For example, drafting of a claim usually involves comparing and the relevant invention with relevant prior arts (patents), and a Patent Map is used to reveal the relationships between them.

When pursuing a patent with respect to a patent application, a Patent Map is used to review and respond to a notice of reasons for rejection from an examiner of the Patent Office. A Patent Map can be used instead of an unsophisticated patent information search to preclude other companies' rights that may obstruct your company.

c) Licensing section

In offering or introducing a patent to/from other companies, the licensing section at a company may use a Patent Map as an evaluation tool. This evaluation by Patent Maps reveals the position of the relevant patent overall, and the existence of other patents that could have a significant influence.

When offering a patent, a Patent Map may be used to identify a company that is most likely to accept the offer. A Patent Map can also be used to guarantee the patentability of the patent to be offered.

d) Section in charge of countermeasures against infringements

Counterfeit goods and infringing goods not only adversely affect the sale of genuine goods by the company that is the legitimate right-holder but also damage the business reputation of the company.

To prevent this, it is necessary to constantly look out for potential infringers, and a Patent Map is useful for this purpose. Patent Maps are effective for identifying competitors which develop, even if unintentionally, products that are likely to infringe the company's patent.

e) Corporate strategy section

Many companies face difficulties in pursuing a management strategy of targeting both overseas markets as well as local or domestic markets. When implementing such a strategy, a Patent Map is important for identifying the status of global networks of intellectual property, the status of new entrants, and key needs in local markets.

f) Human resources section

In the human resources department, a Patent Map is useful for staff training and performance evaluation of researchers.

In staff training, trainees are periodically instructed to draw a Patent Map for the art in their respective field. This ensures an accurate understanding of the art and competitiveness of one's company in the art. In evaluating the performance of researchers, a Patent Map can be used to compare the performance of researchers with their colleagues within the company as well as counterparts at other companies, which helps to ensure an objective appraisal.

g) Others

A Patent Map can also provide valuable information when designing policy and research studies at government organizations, think-tanks, research institutions and universities.

For example, the Japanese government often uses an analytical method based on Patent Maps when preparing the Annual Report on Japan's Economy (Economic White Paper) and Annual Report on the Promotion of Science and Technology (White Paper on Science and Technology).

The Japan Patent Office also uses Patent Maps for analyzing the direction of technological development and the spread of applications in Japan to ensure efficient, high-quality examinations.

2.4. Method of Patent-Map-Based Analysis

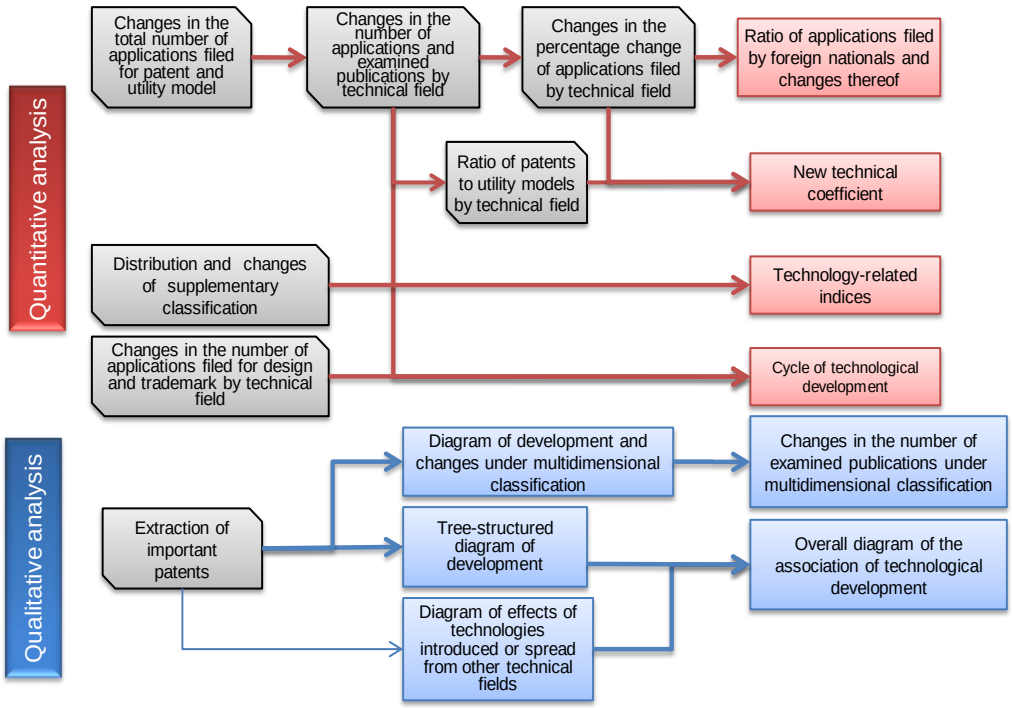
2.4.1. Analytical Method

Various methods of Patent-Map analysis have been developed, but their actual situation is not fully known. This is because companies have made their own important Patent Maps under strict security. If a company were to reveal why it makes a Patent Map and for what technology, it would be revealing its business strategy. If a competitor got hold of the Patent Map, it could use the map to carry out its own analysis.

Therefore, most of the common analytical methods for creating a Patent Map are developed by government organizations and government-affiliated agencies.

Almost 50 years ago, the Japan Patent Office (JPO) had a study group, mainly consisting of patent examiners, which had been studying analytical methods of building Patent Maps. **Figure 2-1** shows part of the method for analyzing patent information developed by the group of examiners at the Japan Patent Office some time ago.

Fig. 2-1 An Earlier Method of Patent Information Analysis



Source : RAPIT, "Patent and Information and Practical Use" Patent News (Research Institute of Economy, Trade and Industry,1974)

This analytical method was developed under the patent system and utility model systems of that time. The analysis was based on the Japan Patent Classification System (JPC) which was an industry-oriented classification system and had the concept of primary classification and subclassification. JPC was suspended 30 years ago. So it would not be suitable for a present-day

analysis without further development. However, the approach in which patent information is subjected to two types of analysis, qualitative analysis and quantitative analysis, could still be valid today when advanced text-mining techniques have become available.

This approach was used for the analysis in “Patent Map by Technical Field” published by the JPO and “Patent Distribution Support Chart” published by the National Center for Industrial Property Information and Training (INPIT).

2.4.2. Qualitative Analysis

A qualitative analysis is used to analyze the contents, such as the technical content, of individual patent documents and the results often contain relevant individual patent document numbers.

Although such an analysis involves detailed reading of individual patent documents and is time-consuming, a Patent Map made by an expert analyst could provide highly valuable information.

Typically, a Patent Map is presented as an illustration, graph, tree structure, table or matrix. The results of a qualitative analysis are rarely presented as a graph.

A Patent Map in the form of an illustration is used as an explanation for laypeople for the technology or others who are not familiar with intellectual property information.

A matrix is a basic form of presenting a Patent Map, and is vital for Patent Maps intended for experts.

A Patent Map in the form of a tree structure is used to indicate the development of technology, the spread of technology and the status of joint applications.

2.4.3. Quantitative Analysis

A quantitative analysis involves forming a cluster of patents as a parent population for a specific category of patents from the beginning, and then further segmenting or stratifying the patents for quantitatively analyzing them.

A quantitative analysis uses bibliographical information contained in patent documents, including the distinction of documents, document number, patent classification, nationality of applicant, name of applicant, address of applicant, name of inventor, number of inventions, etc. Other information such as retrieval information, prosecution information, and cited document information provided by the Patent Office is also used for quantitative analysis.

A detailed analysis would involve a separate complementary indexing in addition to analyzing the above information.

Similar to qualitative analyses, a variety of forms are used to present the results of a quantitative analysis, including illustrations, graphs, tree structures, matrixes, etc. Of these forms, a graph is the basic form of presenting the results of a quantitative analysis. Therefore, a newly developed graph form of presentation can be immediately applicable to a Patent Map.

2.4.4. Index Analysis

As computers have become widely used for analyzing patent information and as limitations on using information such as citation analysis have been removed, it has become possible to analyze by index the positioning of technology or companies. The results of an index analysis are presented in list form, and sometimes in graphical form.

Table 2-2 shows representative analytical methods and forms of presentation for Patent Maps.

Table 2-2 Analytical Methods and Forms of Presentation Used in the Main Types of Patent Maps

Patent Map	Major analytical method	Commonly used form of presentation
Element-based Map	Qualitative analysis	Illustration
Map of Technological Development	Qualitative analysis	Tree-structured form
Interpatent Relations Map	Qualitative analysis	Tree-structured form
Matrix Map	Qualitative analysis/ Quantitative analysis	Matrix/graph
Systematized Art Diagram	Quantitative analysis	Illustration
Time-Series Map	Quantitative analysis	Graph
Twin Peaks Analysis Map	Quantitative analysis	Graph
Maturation Map	Quantitative analysis	Graph
Ranking Map	Quantitative analysis	List/graph
Share Map	Quantitative analysis	List/graph
Skeleton Map	Quantitative analysis/ Qualitative analysis	Tree-structured form
Radar Map	Quantitative analysis	Graph

3. Representative Examples of Patent Map

3.1. Element-Based Map

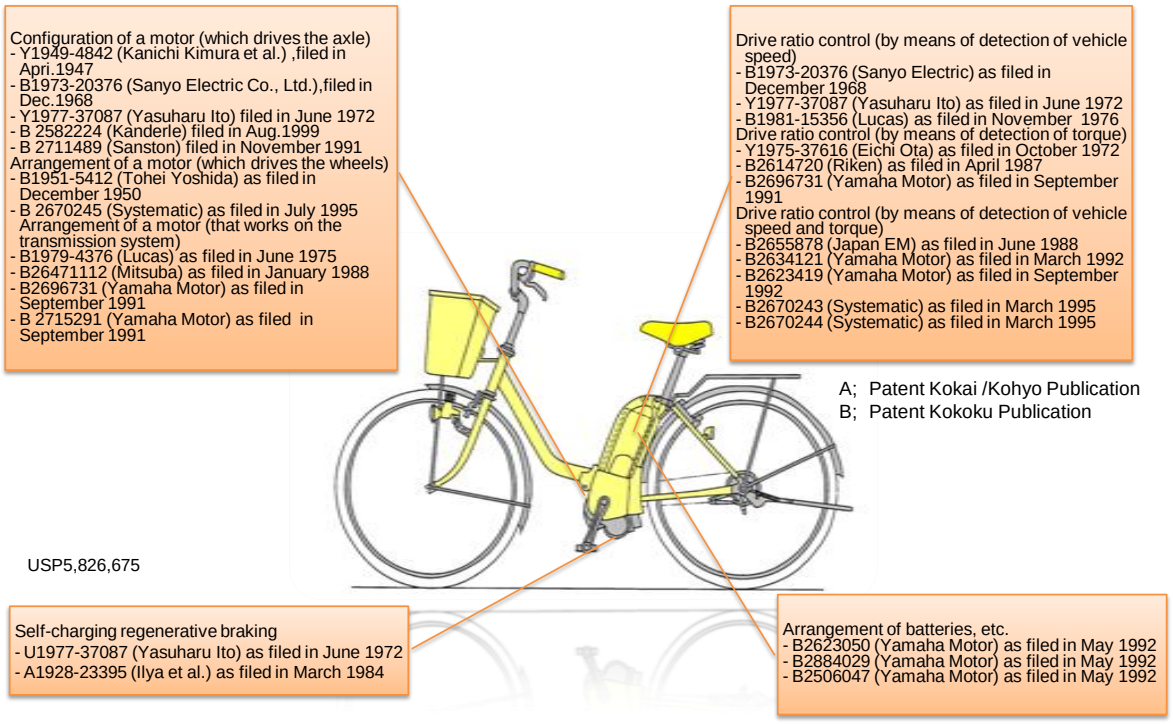
■ Overview

An "Element-Based Map" shows the distribution of patents organized by technical or functional elements and as corresponding to an illustration of a particular product. For a product intended for future development, this map shows what patents cover the product and who owns the patents.

■ How to Read the Map

Figure 3-1 is an example of an Element-based Map for key patents for an electrically-assisted bicycle.

Fig. 3-1 Example of Element-Based Map (Electrically-Assisted Bicycle)



Adapted from data in the "Patent Map by Technical Field: Machinery 9—Bicycle Technology" (Japan Patent Office (JPO),1999)

This bicycle is equipped with an electric motor which complements human power. The principle involves the following inventions that are not found in an ordinary bicycle: (i) An invention concerning the configuration of a motor (a driving system); (ii) an invention concerning the configuration of batteries, etc.; (iii) An invention concerning "driving ratio control" of driving power from the motor and that from the pedals; and (iv) an invention concerning self-charging regenerative braking. Various companies offer various driving systems. Regarding the configuration of batteries, Yamaha Motor Co., Ltd. owns a large number of key patents.

■ Example of Use

An Element-based Map is very useful for making a presentation to the top managers of your company or court judges who are not familiar with the patent system on a summary of the status of patents or relevant technologies. It enables people who are unfamiliar with patents or patent information to easily grasp the existence of relevant patents and the distribution of right-holders.

When launching a new project, top managers request R&D section and IP management section to provide a summary of relevant patents owned by other companies and the position of their own patents. Under the circumstance, an Element-based Map is used as important material for executives .

In a suit against appeal/trial decision or in an action for infringement, it is important that the court judge understands the right-holder's claims. An Element-based Map is used to show an overview of relevant technology, the positioning of one's own patent and its differences from existing patents. In some cases, an Element-based Map is used to provide an explanation to an appeal examiner (or appeal examiners in a collegial body) who takes charge of a wider technical scope than an examiner of examination division.

Alternatively, the human resources departments at companies use Element-based Maps for employee training.

■ Key Points When Using the Map

With many products, a vast number of patents cover the relevant technologies. Therefore, when making an Element-based Map, it is effective to cover only the key patents or important patents, not all relevant patents.

Although it is not easy to automatically pick out only the key or important patents, it is essential not to omit patents considered important by persons skilled in the art or patents of global importance.

As an Element-based Map is too small to include all bibliographical information, you can only include patent numbers or names of right-holders in accordance with the purpose of use.

If more detailed information is needed, a bibliographical list can be attached that includes the patent document number, name of right-holder, title of invention, abstract, representative drawings, etc. The patent number is the key to immediately accessing such information.

3.2. Diagram of Technological Development

■ Overview

Often, an invention is not made unexpectedly, but is based on technical improvements or problem analysis in previous years, or is made by developing a field of application for an existing invention.

A Diagram of Technological Development shows, for a certain patent, organized relations between prior patents and subsequent patents based on an analysis thereof. These relations are created by examining the relationship between these patents based on the analyst's expertise and experience and drawing connecting lines between them.

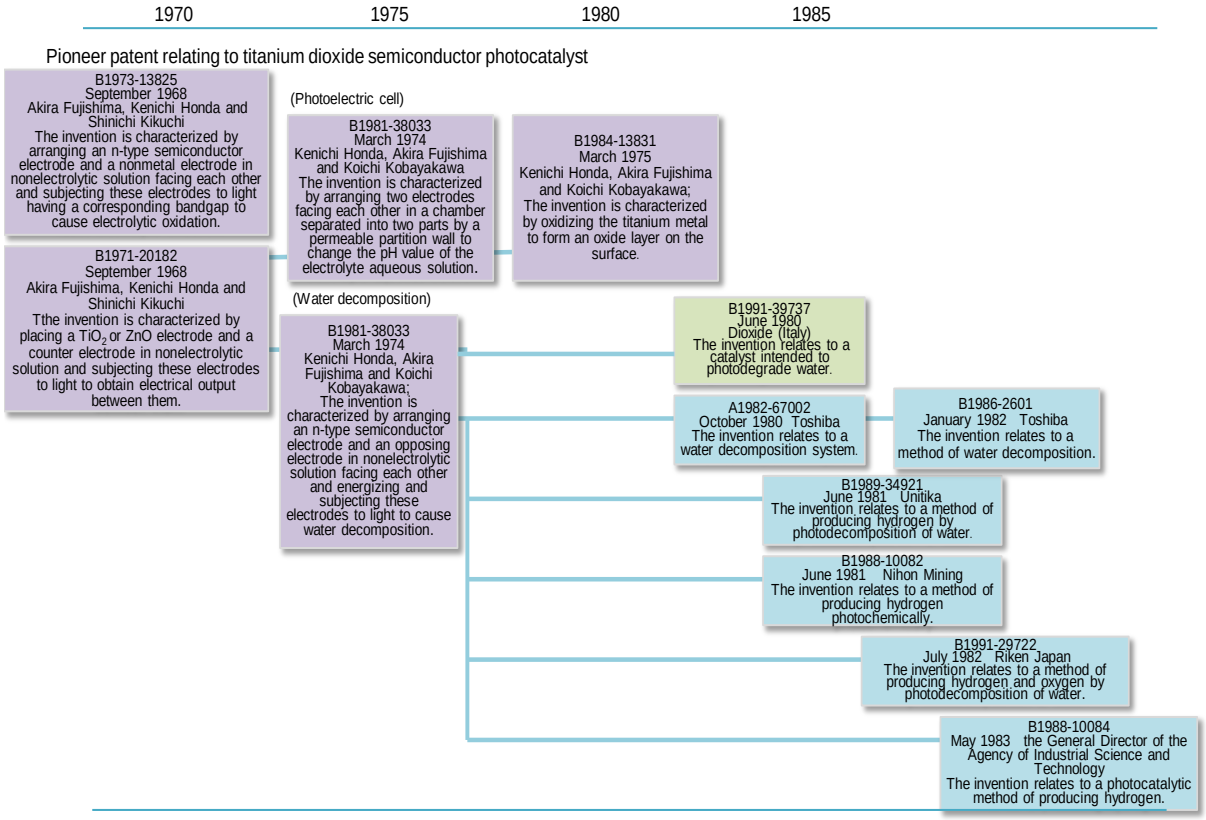
This map shows the history of technological development in a particular technical field and the existence of underlying patents, derived technical fields and/or specific influential right-holders in the technical field.

The retroactive nature of a Diagram of Technological Development makes it possible to access important patents which have expired.

■ How to Read the Map

Figure 3-2 shows a Diagram of Technological Development for photocatalyst technology.

Fig. 3-2 Example of Diagram of Technological Development (Photocatalyst)



Adapted from data in the "Patent Map by Technical Field: Chemical 23—Photocatalyst and its Application" (JPO, 2001)

This map shows that a pioneer patent concerning titanium dioxide semiconductor photocatalyst was developed by Prof. Kenichi Honda, Prof. Akira Fujishima and Prof. Shinichi Kikuchi, all at the University of Tokyo in September 1968 and was granted to them. It also shows that the invention of the pioneer patent developed into two different fields, photoelectric cells and water decomposition, with the latter leading to research carried out by Japan's leading research institutes, RIKEN, Japan and Agency of Industrial Science and Technology (National Institute of Advanced Industrial Science and Technology, AIST).

■ Example of Use

A Diagram of Technological Development is useful for checking the existence of pioneer patents that may stand in the way in exploiting development results and grasping the potential spillover effects of development results.

The diagram also provides researchers and the intellectual property management section with an essential overview from patent information of the technology for which they are responsible. Note that this advantage does not come from a detailed reading of a Patent Map made by experts, but, like a learning effect, from the process by which a researcher or manager personally makes a Diagram of Technological Development.

It is thought that the first Patent Map created by Japanese industry was a Diagram of Technological Development.

■ Key Points When Using the Map

Creating a Diagram of Technological Development involves reviewing and putting in sequence all patent documents. Including huge amounts of patent documents in the map would make it much harder to use.

Consequently, when creating a Diagram of Technological Development, people tend to extract important patents and then consider whether to include them, rather than including all relevant patent documents.

Important patents will include inventions that became blockbusters in markets, inventions that attracted acclaim in the academic community, and breakthrough inventions that have changed prior general technical knowledge. This extraction depends largely on the analyst's knowledge and experience.

In addition to this content-based evaluation, patents are often extracted automatically based on whether an international application has been filed for the relevant patent/application or whether the application was filed from abroad, whether an opposition (or a motion for trial for invalidation) has been filed for the patent/application, and whether the patent is often cited in subsequent applications.

Regarding relevance among technologies, a patent/application should preferably be analyzed not only in terms of identity of patent classification but also prior inventions that had some impact on it.

3.3. Interpatent Relation Map (Citation Map)

■ Overview

In the process of granting a right, several kinds of citation information (hereafter "Citation Information") are added to the patent document information.

Citation Information includes information that the applicant listed as prior art in the specification, information on related technology that included in a search report of patent offices, information on prior art that the examiner cited in the substantive examination, and information that a third party cited as prior art denying patentability in pursuing an opposition or a trial for invalidation.

Available Citation Information differs from one country to another due to differences in patent systems. In the U.S., where cited documents have long been included in the specification, Citation Information has made it possible to analyze patent documents not only in terms of how a patent or application cites other patent documents, but also how a patent or application is cited by other patent documents. Regarding EP patent applications and PCT patent applications to which a search report

is attached, information on prior art is available but may not be identical to the information that was actually cited.

In Japan, some of patent documents were indicated as reference information in the Patent Gazette from a relatively early stage. In the 1980s, all information cited by the examiner in the notification of reasons for refusal has been accumulated into a database and became generally available. Moreover, a legal amendment in 2002 stipulated that "a person requesting the granting of a patent" shall state "any invention(s) known to the public through publication at the time of filing of the patent application" in "the detailed description of the invention," thus greatly increasing the amount of information on prior art included in the Patent Gazette. However, information stated in the detailed description of the invention cannot be used without extracting it visually or through text retrieval, and so in practice it is not useful for data analysis.

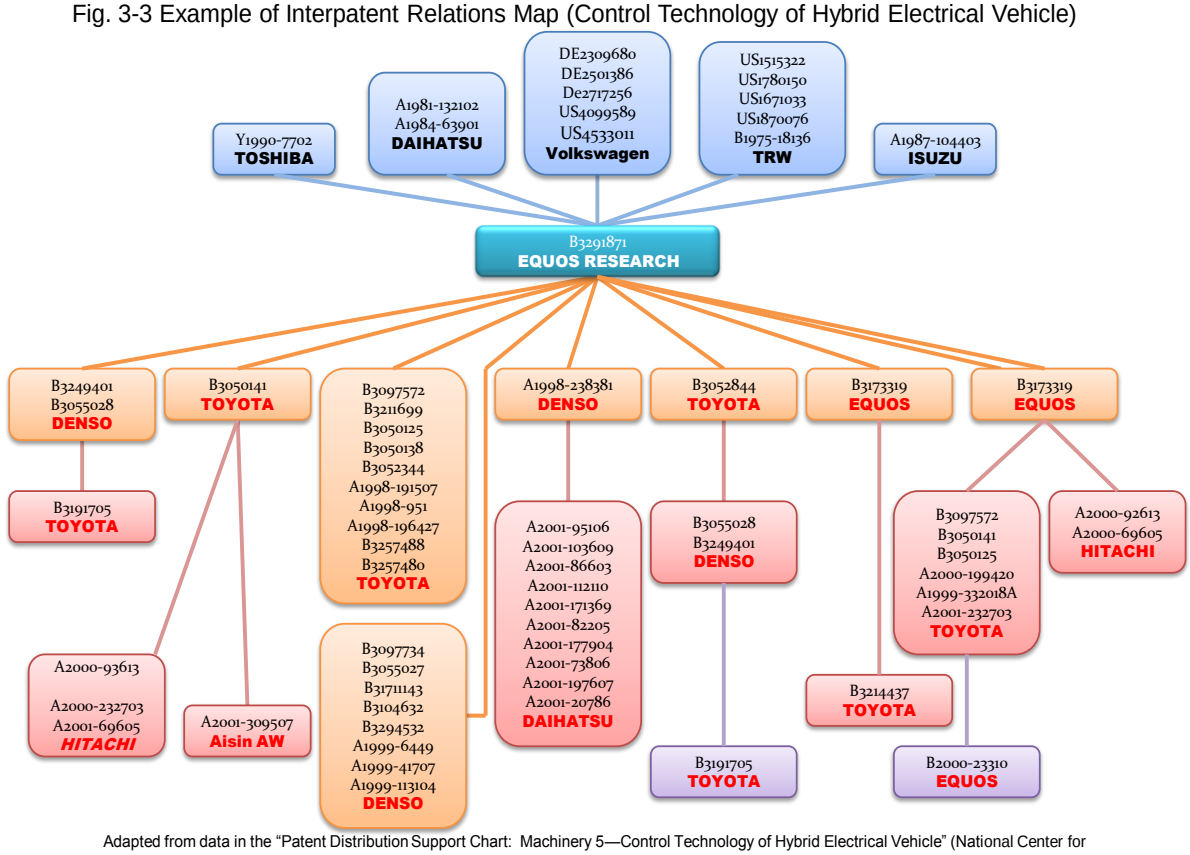
An Interpatent Relations Map shows the relationships in which an invention cites or is cited in other inventions based on a systematic analysis of Citation Information.

Recently, various computer-based forms of presentation such as graphs have become available.

■ How to Read the Map

Figure 3-3 shows part of a Patent Association Map for Patent No. 3291871 concerning hybrid vehicle control technology developed by Equos Research Co., Ltd., under the umbrella of the Toyota Group (hereafter "Patent 871").

Fig. 3-3 Example of Interpatent Relations Map (Control Technology of Hybrid Electrical Vehicle)



Adapted from data in the "Patent Distribution Support Chart: Machinery 5—Control Technology of Hybrid Electrical Vehicle" (National Center for Industrial Property Information and Training (INPIT) , 2003)

Usually, an Interpatent Relations Map covers prior art that existed before the patent was granted (patents indicated in the upper part of the Map) and related inventions made subsequently (patent as indicated below the name of the company). Patent 871 cites patents indicated in the blue boxes which are owned by Toshiba, Daihatsu, Isuzu, Volkswagen (US patents) and TRW. If the patent document cited relates to an art that is not patented or if it is an old or foreign patent document, the invention is deemed to be novel.

After being laid open, Patent 871 was cited by examiners and others in many related applications filed subsequently. Patent 871 is directly cited in the patent documents in the orange boxes, which include subsequent applications filed by Equos Research itself, as well as Toyota Motor and Denso in the same industry.

Moreover, citations may be in the form of second-generation citations. The patent documents in the pink boxes are second-generation citations of Patent 871, and those in the purple boxes are third-generation citations. Specifically, second-generation and third-generation citations are also found in patent documents filed by companies such as Hitachi, Ltd. outside the industry.

The fact that Patent 871 has been repeatedly cited by Equos Research itself and other companies within the same industry shows that the patent is an important art for Equos Research and the Toyota Group. In addition, the fact that companies outside the industry often cited the patent strongly suggests that the patent is an important one for the entire industry.

■ Example of Use

In introducing a patent, it is important when evaluating the patent to identify prior related patents and the status of citation of the patent in subsequent applications. In particular, the existence of a pioneer patent which would prevent the patent from standing on its own is likely to pose a serious problem. An Interpatent Relations Map is useful for understanding the relations between patents when carrying out such an evaluation.

Some companies use an Interpatent Relations Map to identify companies that are likely to infringe their patents. Some consulting firms in the U.S. even advise their clients to automatically offer a licensing agreement with large royalty terms or to issue warnings to potential infringers about the risk of infringement. In general, this advice is not reasonable and can cause major trouble.

Note that a patent is registered on the premise that it has novelty and inventive step, regardless of the existence of cited patent documents.

■ Key Points When Using an Interpatent Relations Map

The following should be noted when using Citation Information.

The first point is who cited the Citation Information. As stated earlier, citation in an application filed by the same right-holder (or applicant) has different implications from citation in an application filed by persons other than the right-holder. Drawing conclusions by analyzing high citation frequency solely based on the number of patent documents cited might lead to an incorrect evaluation of the patent. Citation of a patent by its applicant in patent documents relating to the applicant’s subsequent inventions yield different results from citation of the patent by an examiner or

a third party. Also, inventors tend to cite their own patents in patent documents for their subsequent inventions.

The second point is the category of prior art cited. The prior art stated in a PCT or EPC search report is broken into categories according to its relevance to the invention. These categories include: prior art that is directly related to the invention (so-called document X), prior art that involves a combination of more than one patent (document Y); and general technical information (document A). The positioning of citation of a patent under the category of document A as a highly relevant patent could mislead users.

Thirdly, it is important to consider how the information on prior art was actually used. Some documents are not used at all by the examiner in the notification of reasons for refusal. Other documents may provide grounds for rejection of an application or for elimination of corresponding claims. To understand the relevance to the invention, it is necessary to consider the prior art's effective relevance to the patents or patent applications, as mentioned above.

3.4. Matrix Map

- Overview

A patent document includes various information and aspects such as use, functions, raw materials, etc. In addition, patent documents also provide bibliographical information such as the name of the applicant and name of the inventor as well as information on technical content.

In the current patent information retrieval system, a combination of these information items provides pinpoint access to required information, such as with a hybrid system. In building a Patent Map which treats patents in a cluster, by considering patent information from multiple aspects, you can refine your search and analyze patent trends based on a more detailed understanding of patent networks.

A Matrix Map clearly shows the spread of patent networks by a combination of multiple aspects.

Aspects used for Matrix-Map analysis include the field of industrial application, use, technical element, functional element, problem to be solved by the invention, means for solving the problem, etc. In addition, bibliographical information such as the name of the applicant and filing date of the application may be used.

Most Matrix Maps deal with two aspects because Patent Maps are typically built for two-dimensional display, such as on paper or screen. A Matrix Map is built by arranging these elements in a matrix and shows the positioning of a specific patent or the status of concentration or dispersion of patent rights. Attempts have been made to create three-dimensional Matrix Maps that deal with three elements.

- How to Read the Map

Figure 3-4 shows part of a Matrix Map for LED lighting technology.

This Map uses “problem to be solved by the invention” and “means for solving the problem” as aspects. Specifically, the Matrix Map shows the positioning of relevant key patents, together with their right-holder (or applicant) and the corresponding patent number, for a set of problems to be solved by the invention, in combination with a set of means for solving the problems. The former set of problems includes: improvement of optical property; performance improvement of illuminated ray; improvement of manufacturability; and other performance improvements. The latter set of means for solving the problem includes: development of LED materials and structures; development of methods for packaging; development of methods for manufacturing LED lamps; and development of driving circuits.

Fig. 3-4 Example of Matrix Map by Use of Patent Number (Lighting LED)

Means for solving the problem and problem to be solved by the invention	Improvement of optical property	Improvement of performance of illumination light	Improvement of manufacturability	Improvement of other performance
Development of LED materials and structure	■Koninklijke Philips Electronics (NL) A2000-509912 ■Nichia B2927279 ■Nichia B2998696			
Development of method of packaging and manufacturing	■Kyocera A2002-232017		■Rohm A2002-344029 ■Matsushita Electrics Industry B3309440	
Improvement of installation of LED lamp	■Mitsubishi Chemical B3102144		■Stanley Electric A2002-344029	
Development of drive circuit				■Toko A2001-215913
Development of applied product		■Omron B 3151830 ■Seiko Epson A 1998-260404 ■Sony A 2002-75038	■CSS B 2975893 ■Stanley Electric B3352989 ■Mannesmann VDO AG (DE) A1999-271100	■Seiko Epson B3585097 ■Director General of Agency of Industrial Science and Technology B3048353 ■Director General of Agency of Industrial Science and Technology B3159968 ■Mitsubishi Rayon A1995-27137 ■Nitto Chemical/Ciberk A 2001-42431 ■Fuji Xerox A1999-32278

Adapted from data in the “Patent Distribution Support Chart: Electric 19—Lighting LED Technology” (INPIT, 2006)

Generally, inventors are prompted to make an invention by problems to be solved by the invention and means for solving the problem. By using these two aspects for analysis in a Matrix Map, it is possible to carry out a meaningful analysis of information on patent rights as well as technical information.

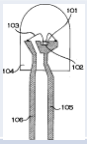
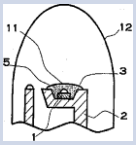
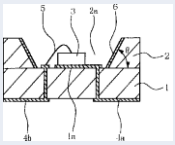
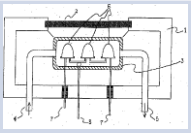
A Matrix Map highlights the right-holder who owns a patent and holds a dominant position with respect to relevant art. This Matrix Map shows that improvement of the optical property, which is the most fundamental aspect of LED lighting, came from the successful development of LED materials and structures by Philips and Nichia Corporation, both of which hold patents relating to the art. On the other hand, regarding improving manufacturability, Rohm, Matsushita Electric Industrial

Co., Ltd. and Komatsu Electronics hold patents in the art, suggesting highly-advanced development. On the other hand, with respect to art where no patent exists, one may consider the possibility of one's own entry including technical feasibility studies.

A patent summary list is attached to this Matrix Map that contains the filing date as the initial date of reckoning for the expiry date of the term of right, abstract, representative drawing, etc.

Figure 3-5 shows part of a patent summary list cited in this Patent Map.

Fig. 3-5 Example of Summary List (Lighting LED)

Document No.	Filing Date	Inventor/Title of Invention	Brief Summary	
A2000-509912	Mar. 3, 1997	Koninklijke Philips Electronics N.V., (NL) White light emitting diode	A light emitting diode that emits high-quality white light, comprised of a combination of a UV diode having a 300 nm ≤ λ ≤ 370 nm emission band, a blue light emitting phosphor having a 430 nm ≤ λ ≤ 490 nm emission band, a green light emitting phosphor having a 520 nm ≤ λ ≤ 570 nm emission band and a red light emitting phosphor having a 590 nm ≤ λ ≤ 630 nm emission band.	
B 2927279	July 29, 1996	Nichia Corp. Light emitting diode and display unit using the same	A light emitting diode comprised of nitride compound semiconductor, having an yttrium aluminum garnet phosphor with photoluminescence phosphor activated by cerium, characterized by the fact that the light emitting diode is less likely to be subject to decrease in light emitting efficiency or color drift.	
B 2998696	Sept. 28, 1993	Nichia Corp. Light emitting diode	A light emitting diode comprised of a first resin and a second resin which, in combination, fill the inside of the LED cup, characterized by the fact that the first resin contains wavelength conversion materials such as fluorescent material which is capable of converting wavelength or filter material which absorbs part of the light emitting wavelength, thereby improving the brightness and light-condensing efficiency and preventing color mixing.	
A 2002-232017	Jan. 30, 2001	Kyocera Package for housing light-emitting element and method for manufacturing the same	Package for housing a light-emitting element and method for manufacturing the package, the package having a through hole made in a ceramic window frame with its inner wall extending outward at an angle of 55-70 degrees with the top surface of the package and having the ceramic window laminated on the surface, characterized by the fact that the ceramic window frame is coated with a metal layer having an average center line roughness of 1–3 μm and a reflection coefficient of 80% or more.	
B3102144	June 16, 1992	Mitsubishi Chemical Forced cooled light emitting diode system	A high-power-driven light emitting diode system characterized by the fact that light emitting diode elements are housed in a cooling case situated inside an insulated casing and that the LED system is cooled by introducing therein a coolant such as liquid nitrogen.	

Adapted from data in the "Patent Distribution Support Chart: Electric 19—Lighting LED Technology" (INPIT, 2006)

Neither the "problems to be solved by the invention" nor "means for solving the problem" are included in bibliographical information contained. This information is only included in the specification on a conceptual basis. A person wishing to build a Map must read all relevant patent documents in order to organize properly the "problems to be solved by the invention" and "means for solving the problem."

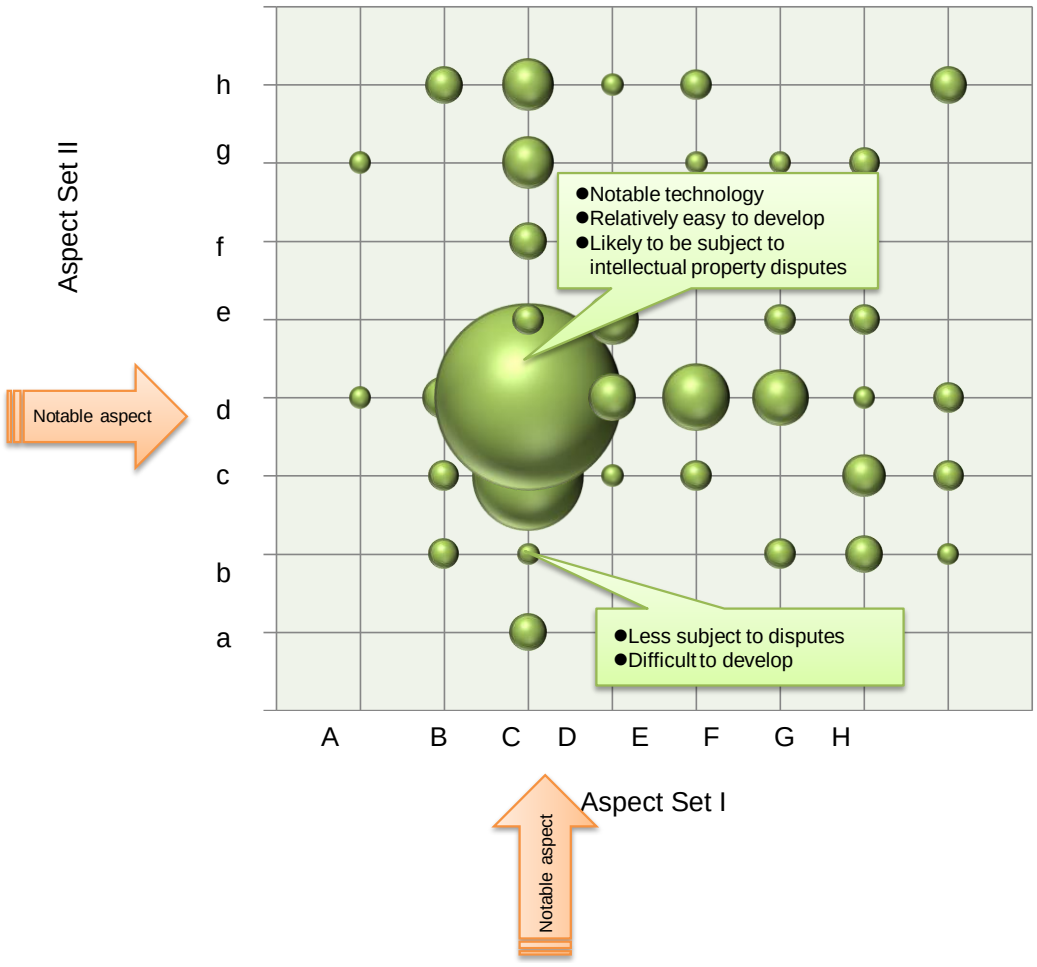
In general, "problems to be solved by the invention" can be categorized into those of principle that involve earlier stages of product development and those such as miniaturization, weight saving, improvement of manufacturability that involve the stage of commercialization of a product. An analysis approach driven solely by leading concepts would make the resulting Patent Map less useful, and so the analysis is designed to be driven by more specific problems that could be identified through hierarchically organizing these issues. Analysis of these problems provides an overview of the art and its present stage.

Similarly, “means for solving the problems” can be categorized into several categories, including: development of a new principle; use of new materials or change of materials; development of new structures; addition of auxiliary members; improvement of control and/or process, etc. To build a useful Patent Map, it is necessary to consider the characteristics of the individual art as well as generally available means for solving the problems. As is the case with problems to be solved by the invention, means for solving the problems are, from time to time, designed as a detailed system with multiple strata based on characteristics of the art.

A Matrix-Map analysis can be presented in graphical form as well as in matrix form.

Figure 3-6 shows a conceptual diagram of a Matrix-Map comprised of a bubble graph.

Fig. 3-6 Conceptual Diagram of Quantitative Matrix Map



This Map segments the relevant art by combinations of Aspect Set (I) and Aspect Set (II). The number of patents that fall into a combination is counted and expressed by the size of a bubble. This sort of quantitative Matrix-Map enables you to recognize at a glance problems, means for solving the problems and technical elements in which applications filed and technological development are concentrated. For example, this schematic diagram shows that many patent applications are concentrated in a combination of Aspect C and Aspect D.

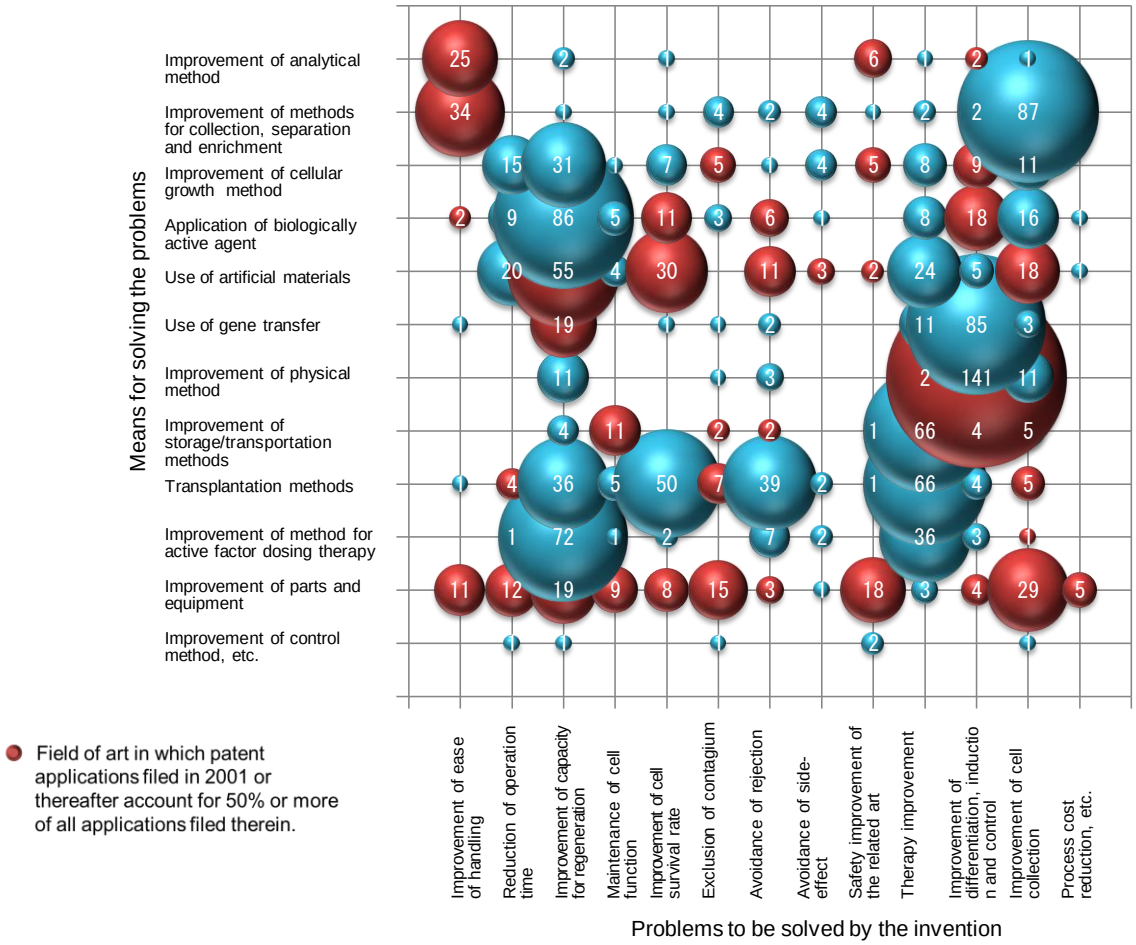
This Map also provides information on the possibility of new entry. It shows that the largest number of patent applications was filed in the art which involves Aspect C and Aspect D, with a

large volume of information disclosed, which makes R&D in the art relatively easy. There is also the likelihood of a specific company having exhaustively acquired patent rights in the art, with a large number of companies competing actively with each other. From this perspective, the map suggests that although the art is generally easy to develop technically, care regarding intellectual property issues is required.

In contrast, there are very few patent applications for art which involves Aspect C and Aspect B, so there is less chance that a company has exhaustively acquired patent rights in this art, leaving room for further development. In other words, the map shows that new entry is less likely to cause unnecessary problems over intellectual property. However, a small number of patent applications means that related areas are not well developed and patent information is limited, suggesting that the art is difficult to develop.

Figure 3-7 shows an example of a Matrix Map for the art of autologous cell renewal therapy.

Fig. 3-7 Example of a Matrix Map in Bubble Graph Form
(Autologous Cell Renewal Therapy Technology)



Adapted from data in the "Patent Distribution Support Chart: Chemical 31—Autologous Cell Renewal Therapy" (INPIT, 2006)

This Map also uses "problems to be solved by the invention" and "means for solving the problems" as aspects for analysis.

The Patent Map shows that technological development is concentrated on the art which involves "improvement of capacity for regeneration," "improvement of therapy," "improvement of differentiation, induction and control" and "improvement of cell collection."

On the other hand, the map includes "improvement of physical methods," "improvement of method of transplantation" and "use of gene transfer" as means for solving the problems. The art in which "improvement of physical methods" is used as the means for "improvement of differentiation, induction and control" and for which many patent applications were filed has attracted attention. However, it may be very difficult to enter this field as it has been covered by many patents.

The fact that very few patent applications have been filed in the art does not necessarily mean that the field of art is unpopular. Rather, it means that a company involved in development could enter this field without causing undue trouble. It could also be an opportunity for success in business if one can find a method for solving a particular problem which nobody has been able to find. A quantitative Matrix Map is useful for identifying such a field of art.

The Patent Map shown in **Figure. 3-7** makes it possible to distinguish the fields of art in which many patent applications were filed in the past from that in which many patents were filed more recently, by depicting bubbles in different colors.

This shows that more recent applications are concentrated on "improvement of physical methods" for "improvement of differentiation, induction and control." Also, "use of artificial materials" and "improvement of parts and equipment" are becoming widely used as a means for solving.

■ Example of Use

A Matrix Map is one of the most typical Patent Maps; a bare Patent Map could even be made from a Matrix Map. Matrix Maps are useful for all sections which need a Patent Map.

The Map allows an R&D Section to avoid wasting investment in developing an art for which many patent rights have been created, and helps it to identify a promising field of art in which there have been very few patent prosecutions. Even a field of art with a large number of patent applications will allow new entrants if the applicant is a company in the same industry or a research institution that has a good relationship with the right-holder.

A field of art with no or very few patent applications involved will bring new challenges.

The Map allows a Patent Management Section to assess the status of patent prosecution for the relevant art and hence to draft strong patent claims covering a wide range of art. It also allows the department to effectively carry out a search of prior art and related art in order to exclude competitors' patents that are likely to hinder economic activities of the relevant company.

The Map allows a Licensing Section to evaluate the potential effects of offering the relevant company's patents to the outside world or spillover effects of others' patents proposed for introduction.

The Map allows a Corporate Strategy Section to analyze the status of development of the art by competitors and their patent strategies in the art, thus providing a powerful tool for formulating business alliance strategies.

■ Key Points When Using the Map

The usefulness of a Matrix Map depends on the appropriateness of selection and combination of aspects for analysis. A Matrix Map with inappropriate aspects for analysis will be virtually useless.

In many cases, these aspects for analysis are not directly available from patent documents as bibliographical information and would therefore require a complementary analysis by an expert and creation of a database. The quality of the database would also affect the usefulness of a resulting Matrix Map.

One of the most effective tools to minimize the need for additional analysis is patent classification. To use the tool effectively, an accurate understanding of the underlying rules of patent classification is needed.

People who are unfamiliar with patent information often incorrectly assume that a plurality of patent classifications for a patent document means classifications based on multiple aspects. For example, if a patent has a classification for "textile" and a classification for "tire," interpreting this to mean that the patent is related to the fibrous structure of tires would clearly be a misuse of patent classifications. The international patent classification system is based on the principle of classifying the relevant subject matters as a whole. Unless otherwise specified, the fact that a patent has a plurality of classifications does not mean that the patent involves two or more aspects.

Likewise, an expert in patent information analysis should refrain from using key words; a key word is intended to indicate an element involved in the patent, not to cover the whole of the relevant art.

3.5. Systematized Art Diagram

■ Overview

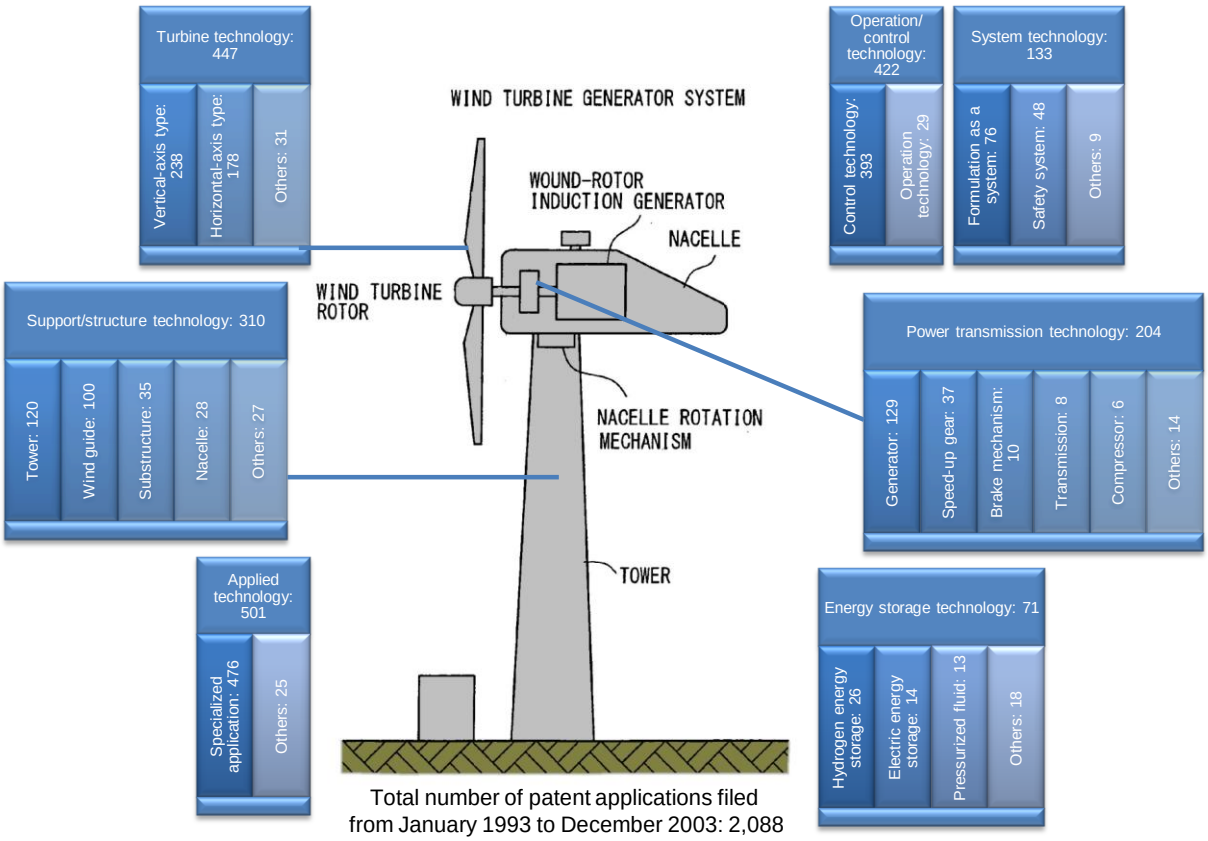
A Systematized Art Diagram shows the system of arts based on patent information as well as the number of patents granted according to the technical elements included. The Diagram seldom includes specific patent numbers, although it sometimes includes the document number for a key patent to supplement the technical contents.

■ How to Read the Map

Figure 3-8 is an example of a Systematized Art Diagram for a wind-turbine generator system.

A wind-turbine generator involves: (i) blade technology that is used to convert wind power into rotational kinetic energy; (ii) power transmission technology that is used to transmit the rotation of turbines to a power generator; (iii) support/structure technology; (iv) operation control technology; (v) system technology; (vi) energy storage technology; and (vii) applied technology.

Fig. 3-8 Example of Systematized Art Diagram (Wind-Turbine Generator)



Adapted from data in the "Patent Distribution Support Chart: Machinery 15—Wind- or Wave-power Engine" (INPIT, 2006)

With respect to the arts relating to the main unit of the wind turbine generator system, applied technology, which involves application to railroad vehicles, has attracted the largest number of patent applications, accounting for a quarter of the total. The greatest number of patent applications involved blade technology, followed by operation/control technology. These two arts combined account for 55% of all patents relating to the main unit. With respect to blade technology, vertical-axis-type blade technology attracted many more patent applications than horizontal-axis-type blade technology.

■ Example of Use

Given that a Diagram of Technological Structure shows the total volume of patents relating to a specific range of art, the diagram is usually used to summarize intellectual property-related activities at governmental organizations and universities or to show the technological structure as viewed from a patent perspective rather than for patent management at companies.

Governmental organizations and universities sometimes include a Diagram of Technological Structure in their technical reports to compare their intellectual property-related activities with those of competitors in the private sector.

■ Key Points When Using the Map

A qualitative analysis, including a Systematized Art Diagram, must meet the requirement that the underlying patent document (or patent documents as the parent population) is as free as possible from omissions and that the document(s) does not include "noise" or irrelevant information.

Specifically, given the differences in the underlying classification concept between industrial nomenclature or classification of goods and patent classification (particularly international patent classification), in order to collect relevant patents without omission, it is important to visually check the basic data. If an important patent is found to be omitted, it may be necessary to perform retrieval again.

3.6. Time Series Map

■ Overview

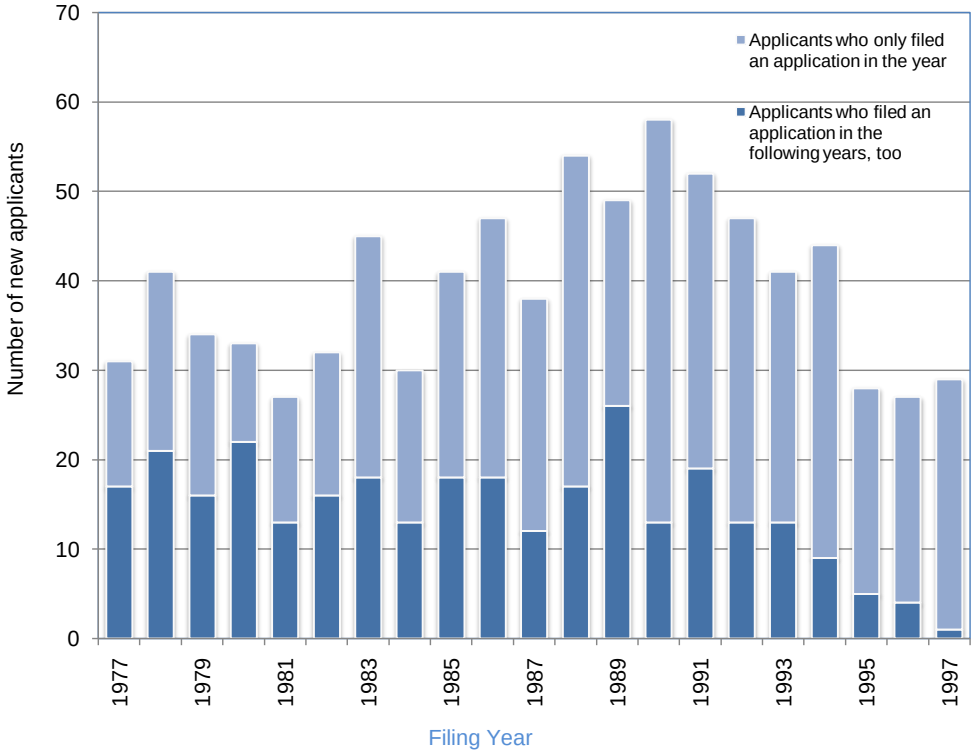
One of the most basic Patent Maps is to collect patent documents for a particular right-holder, arrange them by year of filing of patent application, and plot the number of patents or patent applicaitons. This is called a Time Series Map and is easily created by anyone.

■ How to Read the Map

A Time Series Map is used to analyze the trends of applicants or inventors as well as the number of patent applications filed and patents issued.

Figure 3-9 shows changes in the number of applicants who newly filed applications for patent relating to CPU technology in the year.

Fig. 3-9 Example of Time Series Map (New Applicants for Patent Relating to CPU Technology)



Source: "Patent Map by Technical Field: Electrical Machinery 17—CPU Technology" (JPO,2000)

The Map reveals that the number of applicants who newly entered this field of art increased between 1987 and 1994 and then remained unchanged at around 15 per year.

■ Example of Use

A Time Series Map is often used for a background analysis before a detailed analysis of the relevant patents. However, a conclusion drawn based solely on a Time Series Map without individual analyses is likely to mislead the user.

■ Key Points When Using the Map

A Time Series Map will have different meanings depending on the year selected as the reference axis.

The reference axis most frequently used is “the filing date” which is generally a long time after “the date on which the relevant invention was made.” For an application from abroad, or an application claiming internal priority or priority based on conversion of application, the priority date is extensively used.

On the other hand, people who are unfamiliar with the patent system are likely to misunderstand that an analysis by filing date is an analysis based on old data. In this case, the year of publication of unexamined applications may be used as the reference axis.

Some technical experts often use patent information analysis to verify his hypothesis If the results of patent information analysis disagree with the prevailing perception of the industry, they will highlight the problems of patent information analysis.

Patent information analysis is not used for supporting existing doctrine but for independent analysis.

3.7. Twin Peaks Analysis Map

■ Overview

A map built on twin peaks analysis is commonly used and compares favorably with a Time Series Map in terms of capacity. Twin peaks analysis involves dividing up a cluster of patents as the parent population according to some aspect and can reveal some new aspect that would otherwise remain hidden. The simplest way is to divide up a cluster of patents by applicants, and to use technical elements and patent classification as aspects for the analysis.

■ How to Read the Map

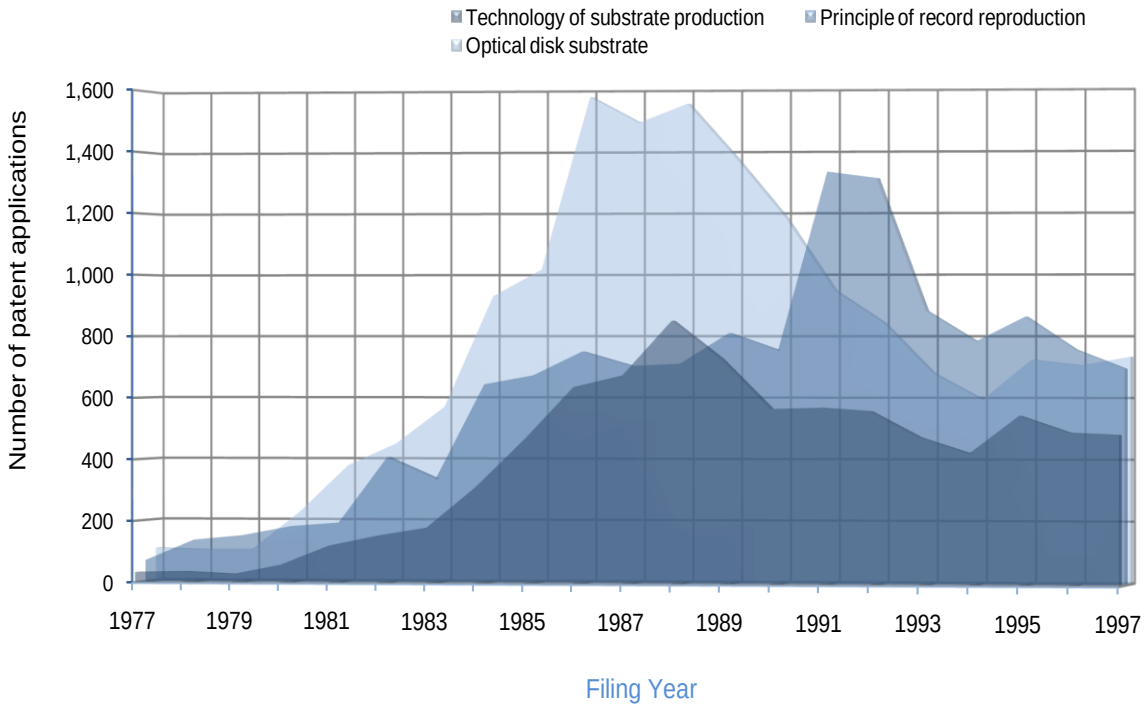
Figure 3-10 is a Twin Peaks Map for optical disk technology.

Patent applications relating to optical disk technology started to be filed in the 1970s, with the number filed growing slowly until the early 1980s.

First, there was an increase in the number of patent applications relating to “optical disk substrate” or technology related to the recording layer, substrate materials and substrate structure.

Then, in 1982, there was an increase in the number of patent applications relating to the “principles of record reproduction” including data access and data processing involved in retrieving data from an optical disk substrate.

Fig. 3-10 Example of Twin Peaks Map (Optical Disk Technology)



Adapted from data in the "Patent Map by Technical Field: Electrical Machinery 13—Optical Disk" (JPO, 2000)

Thereafter, the number of patent applications relating to "optical disk substrate" and the "principles of record reproduction" continued to increase, with the number of patent applications relating to "technology of substrate production" including forming the layers of an optical disk substrate, substrate molding, stamper, etc., rising, albeit slowly, and then accelerating in 1984 and reaching its peak in 1988.

A Twin Peaks Map highlights the time lag between the period of a rapid increase and the peak period with respect to technological development of the relevant art.

Although the causes of such a time lag can be found by analyzing the contents of applications filed at the peak period, the pattern of development starting from the development of principles and equipment in which the relevant invention is utilized and evolving into the development of substrate and further, into the development of technology of substrate production, could represent a feature of technological development. Specifically, the development of optical disk technology has led to various global technology standards including the laser disk (LD), CD-ROM, CD-ReWritable, MO or MD, and DVD. The development of these technology standards and substrate production technologies has followed a single pattern of development.

■ Example of Use

A Twin Peaks Map shows the preceding or lagging nature of technological development under way at one's company under the corporate strategy. It also shows a country's delay in gaining an

international competitive edge in a specific art. Therefore, the map is commonly used by government organizations, think-tanks and universities in their economic analysis reports and white papers rather than by companies for their own analysis.

Although the map may have limited use in creating corporate strategies, it is an essential tool for comparing your technological development with that of domestic and overseas competitors.

■ Key Points When Using the Map

The key to a successful twin peaks analysis is depending on the selection of appropriate aspects for analysis. If feasible, it is important to try various aspects so that a distinct time lag can be found.

3.8. Maturation Map

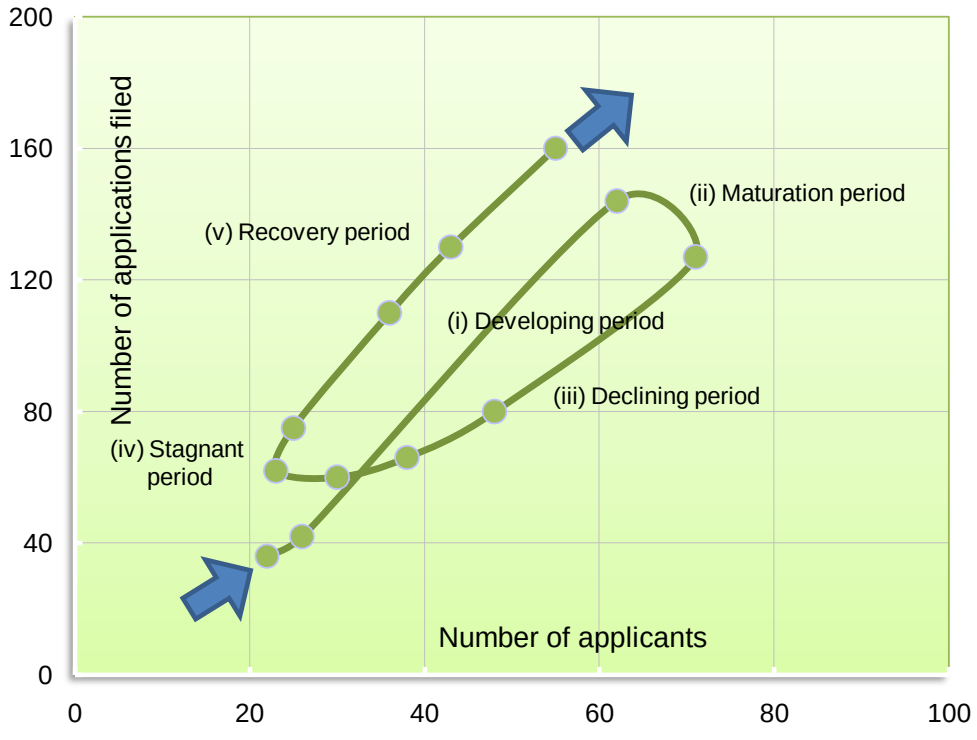
■ Overview

A quantitative analysis usually counts the number of patents issued or applications filed, as well as the number of applicants or right-holders. The number of applicants indicates the level of interest in the relevant technology in industry or in the market. Some analyses focus only on the total number of applicants or the number of new entrants.

A “Maturation Map” or “Technological Maturation Map” plots the number of applicants and the number of applications filed by year of filing of patent applications.

Figure 3-11 shows a conceptual diagram of a Maturation Map.

Fig. 3-11 Conceptual Diagram of a Maturation Map



In this map, the x-axis and y-axis represent the number of applicants and the number of applications

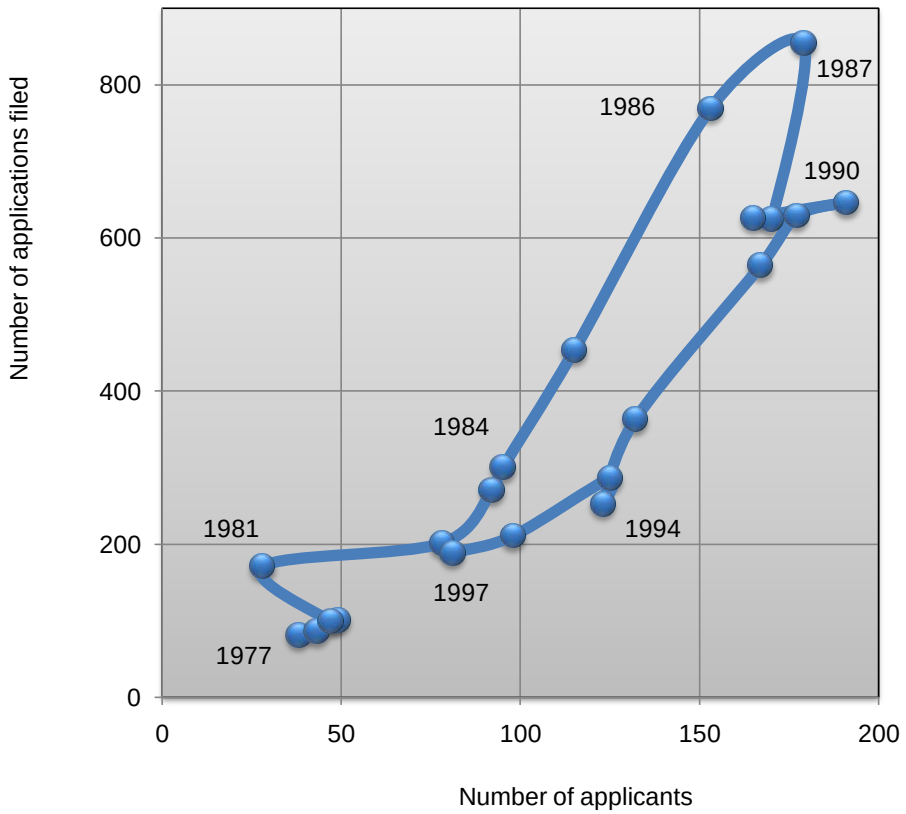
filed, respectively, and plots the count for the relevant year of application filing for the corresponding place.

Generally, there are few early applications involving a limited number of entrants. Thereafter, the number of applications increases rapidly as new seed technology is developed and/or society's demand for the relevant art grows. This represents the developing period shown by (i), and is indicated by a sharp increase in the number of applications filed or the number of applicants. This is followed by a period in which the number of applications sharply increases, but this increase is rarely long-lasting. After a while, the maturation period shown by (ii) comes, soon followed by a decline period as shown by (iii). In the decline period, former entrants withdraw from the field, with the number of applications decreasing. The transition from the declining period to the recovery period may be triggered by various factors, and causes the number of applications filed and the number of applicants to increase once again.

■ How to Read the Map

Figure 3-12 shows an example of a Maturity Map for spattering technology.

Fig. 3-12 Example of Maturation Map (Spattering Technology)



Adapted from data in the "Patent Map by Technical Field: Chemical 16—Physical Vapor Deposition" (JPO, 2000)

Up to around 1980, spattering technology attracted few applicants and few applications, with the former at approximately 50 and the latter at 100. A sign of a change in the situation appeared when the number of applicants fell in 1981, yet the number of applications filed increased. In that year, the

number of applicants was half that of the previous year, yet the number of applications almost doubled.

In 1982, the number of applications filed did not substantially increase, but the number of applicants was three times that of 1981 and twice that of the 1970s. This increase in the number of applicants indicated industry's rising interest in the art. Thereafter, a developing period (or a period of growth) came, during which both the number of applicants and the number of applications filed increased.

This increase in the number of applicants (companies) engaged in development in this field and in the number of applications filed continued until 1987 and then stabilized. Then, the number of applications filed dropped sharply. Thereafter, the number of applications stayed at around 600 for some time, with some 170 companies involved as applicants. After that, a gradual period of decline arrived, in which both the number of applications filed and the number of applicants decreased. There was no sign of recovery up to 1997, the last year covered by the analysis based on this Map.

■ Example of Use

A Maturation Map is used to grasp industry trends when planning to enter a field of technology. Importantly, it allows a company to gain an advantage in economic activities by immediately detecting signs of a developing period and entering the field ahead of competitors. During the later stages of the growth period, it is important to continuously monitor for any decrease in the number of applications filed or the number of new entrants. In addition to this, it is naturally important to evaluate, as alternatives, a withdrawal plan and a response plan in the case of a recovery period by using patents owned by companies that exited the relevant technical field.

As Maturation Maps reflect industry trends, government organizations and research institutes sometimes use them to prepare reports or for industry/market analysis.

■ Key Points When Using the Map

A Maturation Map is used to detect signs of change in the number of applicants or the number of applications filed. In fact, such signs of change vary with the technical field, and hence, both cases hold true.

A Maturation Map will increase your awareness of the handling of applications filed by foreign applicants. In principle, a foreign applicant files an application with the Japan Patent Office through due formalities under the Japanese Patent Act or through specified formalities under the Paris Convention or PCT guidelines. Many applications filed under the PCT guidelines take a long time before being published. Therefore, when conducting an analysis based on the Map, you must check the date up to which applications covered by the map were filed.

3.9. Ranking Map

■ Overview

A Ranking Map presents the ranking of the number of patents filed by technical element or by right-holder or applicant.

An analysis based on the ranking of the number of applications filed by right-holder or applicant reveals the degree of technological strength of the right-holder or applicant or the influence of the relevant intellectual property in the relevant technical field. It is important to note the existence of any company with no experience in the production or distribution of a product that ranks high in the map.

A time-series Ranking Map that takes time factors into account may accurately indicate a change in leading companies in the technical field. Although such a change bears no immediate relationship with changes in market share, a leading technical edge of a company may indicate its dominant position in an emerging market.

■ How to Read the Map

Figure 3-13 is a Ranking Map for continuously variable transmission technology. It shows trends in technological development by automobile manufacturers and parts manufacturers in this technical field.

Fig. 3-13 Example of Ranking Map (Continuously Variable Transmission Technology)

	Applicant	1993-2003	1998	1999	2000	2001	2002	2003
1	Nissan Motor Co. Ltd.	603	80	53	48	54	50	38
2	NSK Ltd.	564	41	62	48	105	84	99
3	Toyota Motor Corp.	268	5	8	32	33	58	113
4	Honda Motor Co., Ltd.	213	20	22	48	22	23	50
5	JTEKT Corp.	93	1	9	19	20	10	25
6	JATCO Ltd.	77	3	0	5	8	39	15
7	Bando Chemical Industries Ltd.	75	13	13	8	9	8	5
8	Fuji Heavy Industries Ltd.	61	3	2	12	4	10	11
9	LuK GmbH & Co. (Germany)	59	10	15	7	7	4	5
10	Daihatsu Motor Co., Ltd.	47	1	3	7	17	6	13
11	VDT (Holland)	47	6	6	10	9	4	0
12	Isuzu Motor Limited	45	6	3	0	0	0	0

Source: “Patent Distribution Support Chart: Machinery 16—Continuously Variable Transmission” (INPIT)

Over time, Nissan Motor Co., which had filed the largest number of applications, started to file fewer applications after the peak in 1998. In contrast, the number of patent applications filed by Toyota Motor Corp. grew rapidly. Such a change in the number of applications filed by a company often mirrors its technological development strategy.

■ Example of Use

A Ranking Map by applicant provides a company with valuable information about the moves of its competitors.

■ Key Points When Using the Map

As mentioned earlier, a corporate-based analysis would require you to take into account such changes as mergers, acquisitions, divestitures and corporate name changes at the companies engaged in the technical field.

3.10. Share Map

■ Overview

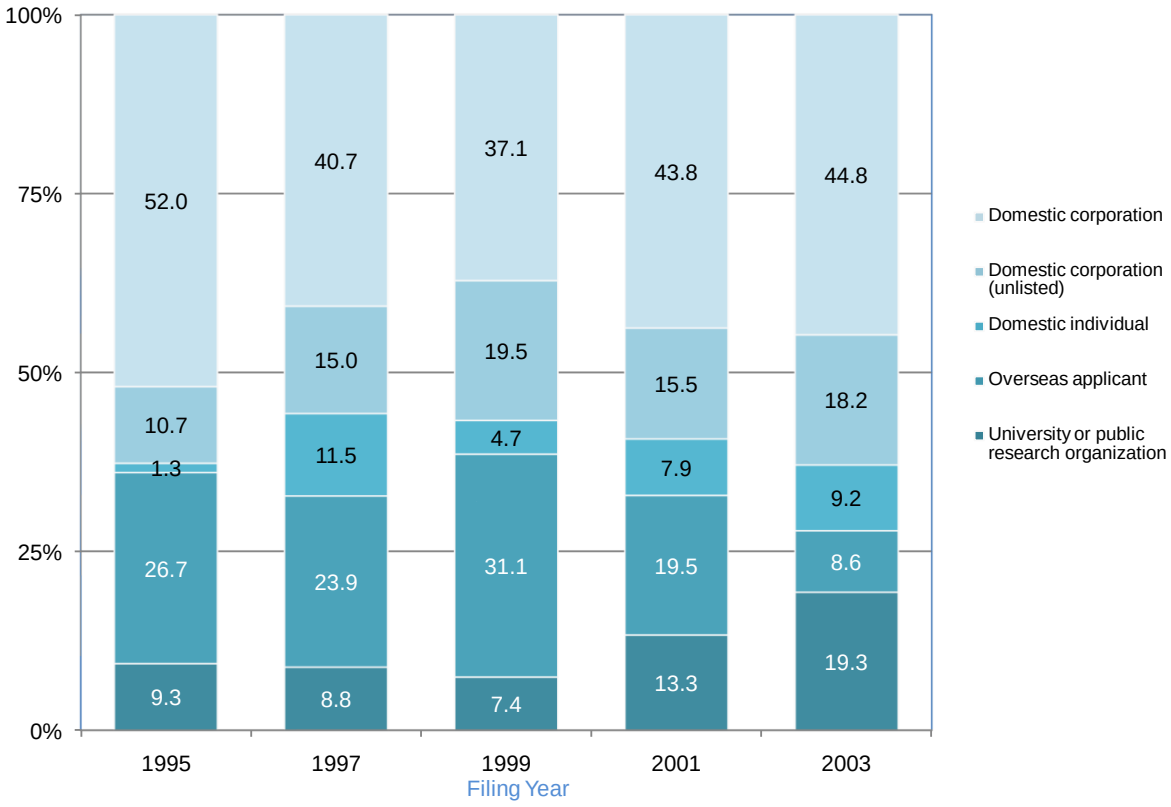
A Share Map shows who filed an application for a patent relating to a specific technology. It is also used to indicate the distribution of applications filed by technical element which the applications relate to.

A Share Map is usually presented in the form of a pie chart distributed by percentage. However, to indicate changes over time, a Share Map may also be shown as a bar graph or band graph.

■ How to Read the Map

Figure 3-14 shows changes in the share of applicants for patents relating to nano-particle formation technology.

Fig. 3-14 Example of Share Map (Nanoparticle Formation Technology)



Adapted from data in the "Patent Distribution Support Chart: General 18—Nanoparticle Formation Technology" (INPIT)

Japanese listed companies used to account for a share of 50% or more, but their share has remained substantially below 50% for some time. In contrast, universities and public research organizations have increased their shares.

■ Key Points When Using the Map

A Share Map by right-holder or applicant may be affected by the handling of joint applications. If the total number of patents issued is assumed to represent the total number of applications filed, the share of applications filed by a single applicant will be underrepresented. However, if applications filed jointly are distributed proportionately, each share will not add up to the actual number of applications filed.

This is also true when using a Share Map by technical element. If the relevant invention is assumed to include other patent classifications than that included in the first invention information, the total number of patent classifications will exceed the actual number of patent documents.

3.11. Skeleton Map

■ Overview

A "Skeleton Map" is so named because of its fishbone shape in which a technology diversifies and diverges over time. One feature of this map is that divergence of a technology is assumed to take place at the time when a patent application for the technology was filed. This feature could provide an accurate and objective measure of the time of divergence that otherwise would not be available because, unlike the time of release of a product enabled by an invention, the time at which a patent application was filed is likely to be closer to the actual date on which the invention was made and can be easily identified regardless of the sale of such product.

A diagram showing the number of applications filed in the year of divergence and thereafter shows the extent to which the technology spread after divergence occurred. In some cases, the map may conceptually indicate the time of divergence without showing the specific year in which the patent application was filed.

■ How to Read the Map

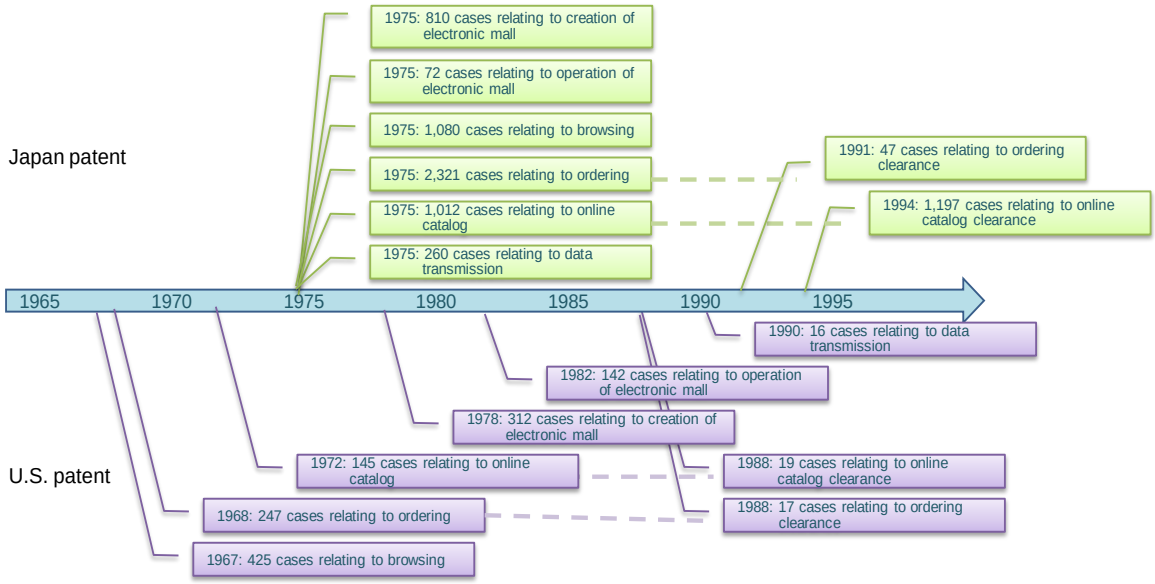
Figure 3-15 is an example of a Skeleton Map showing the development of technology relating to online shopping.

The upper part of the map shows the time when patent applications related to the technology started to be filed in Japan, with the lower part showing that in the U.S.

The map indicates that in the U.S., patent applications relating to online shopping started to be filed in the late 1960s, whereas in Japan, patent applications relating to electronic malls, browsing, ordering, online catalogs, etc. were filed in 1975 all at once. It follows that patent applications relating to electronic malls and online catalogs were published in Japan earlier than in the U.S.

It also shows a slight difference in the extent to which the filing of patent applications relating to the relevant technology spread in subsequent years in Japan and the U.S. For example, ordering technology drew the largest number of patent applications in Japan, while browsing technology attracted many patent applications in the U.S., with the first of them filed in 1967.

Fig. 3-15 Example of Skeleton Map (Online Shopping)



Note: The number of cases denotes the number of applications filed from 1977 to 1999, both inclusive, with respect to Japan patents and the number of patents granted from 1969 to 1998, both inclusive, with respect to U.S. patents.

Adapted from data in the "Patent Map by Technical Field: Electric 19—Electronic Commerce and Financial Business in the Internet Age" (JPO, 2000)

■ Example of Use

A Skeleton Map is often used to gain a comprehensive understanding of the spread of technological development. The map derived from patent information covers a wide variety of technological development under way in various industries that could not easily be covered by information from any other source, and shows at a glance how a particular technology has developed and spread. For example, in the case where a basic seed technology is developed, examining how the field of use has developed will help you to consider the potential of entering the field and possible directions of your own future technological development.

Meanwhile, for academic research, it allows you to carry out a precise analysis based on complete information on technological development.

■ Key Points When Using the Map

A Skeleton Map shows the time when patent applications for a specific technology started to be filed, not the time when the invention was completed. Given that many inventions are not successfully commercialized and development ceases, it may be necessary to conduct a separate analysis on the timing of commercialization.

3.12. Radar Map

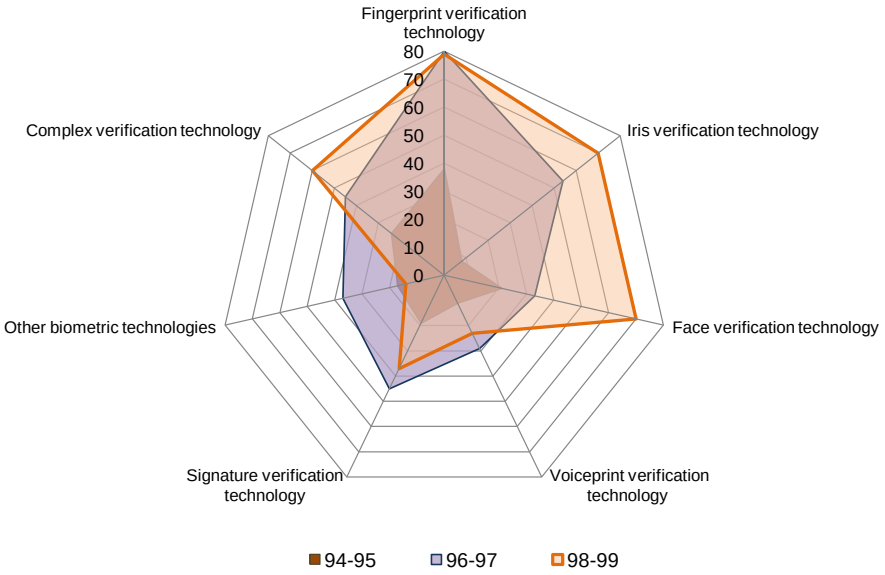
■ Overview

A "Radar Map" or "Radar Chart" is a Patent Map based on a radar-like graph that is used to analyze differences in intellectual property strategy between individual companies, changes in subjects of technological development over time and international differences in patents held.

■ How to Read the Map

Figure 3-16 is an actual example of a Radar Map for biometrics technology.

Fig. 3-16 Example of Radar Map (Biometrics Technology)



Adapted from data in the "Patent Distribution Support Chart: Electrical 3—Biometrics" (INPIT)

This Map reveals changes in technological development relating to key fields of biometrics technology including "fingerprint verification technology," "iris verification technology," "face verification technology," "voiceprint verification technology" and "signature verification technology" for the period from 1994 to 1999.

In the 1994-95 period, the total number of patent applications filed was limited in the whole of biometrics technology, with patent applications tending to focus on fingerprint verification technology. In the following 1996-97 period, there was an increase in the number of patent applications filed relating to iris verification and other biometrical technologies which had only drawn a limited number of patent applications. And in the 1998-99 period, there was a rapid increase in the number filed relating to face verification technology, with a decrease in the number relating to voiceprint verification, signature verification and other biometric technologies, reflecting a narrowing of the focus of technological development.

■ Example of Use

Although **Figure 3-16** compares the timing of filing a patent application for various biometrical technologies, a Radar Map is most commonly used to analyze research and development strategies and patent strategies pursued by companies. Building a Radar Map on an applicant basis reveals in what technical field individual companies or research institutions have concentrated funding and labor on a particular technology.

A Radar Map is also useful for comparing the international competitiveness of companies on the basis patent information.

4. Creating a Patent Map

4.1. Procedure for Creating a Patent Map

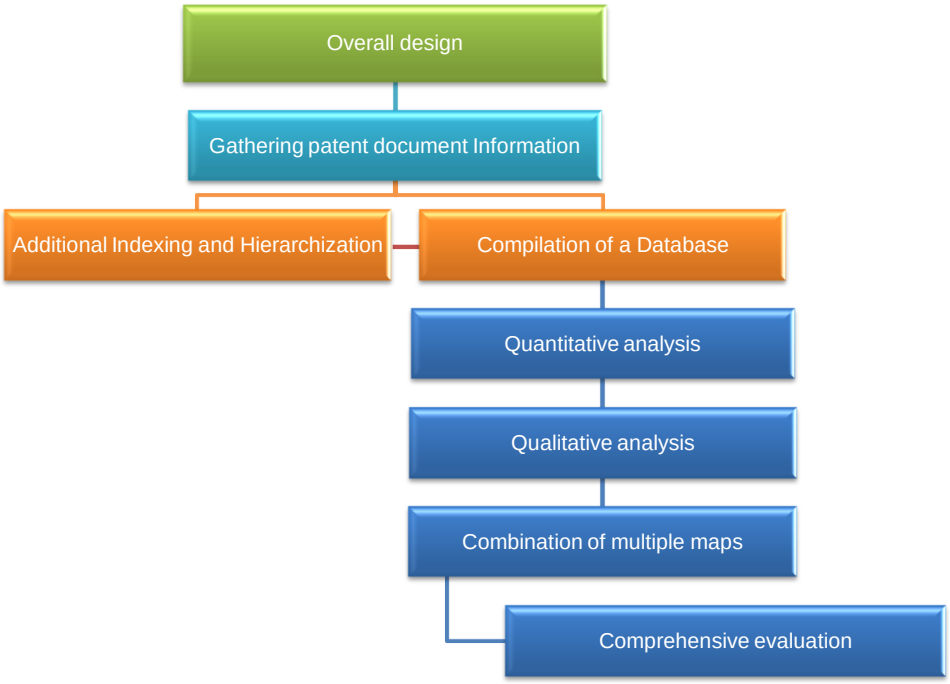
Anyone can build a Patent Map after obtaining the required set of information and with a minimum knowledge of Patent Maps.

Now that most patent offices around the world provide IPDL services, it is not difficult to obtain the required patent information. In some countries, the patent office even provides free software that can be used for building a Patent Map.

Nevertheless, it may not be easy to create an effective Patent Map, because systematic procedures for building Patent Maps are not defined.

Figure 4-1 shows a common procedure for creating a Patent Map.

Fig. 4-1 Procedure for Building a Patent Map



(1) Overall Design

Creating a Patent Map starts with defining its intended use, then studying the scope of patent information, the organization and the period.

(2) Gathering Patent Information

Next, patent information must be gathered. Complete and less noisy patent information, together with a well-defined purpose of use, are the minimum requirement for creating an effective Patent Map.

(3) Additional Indexing

Patent information includes large amounts of bibliographical information, much of which is available from the patent office as standardized data. However, this information is usually

insufficient to create a Patent Map, and additional indexing of patent documents is required to cover the insufficiency.

(4) Constructing a Database

Bibliographical information in gathered patent documents and information obtained from additional indexing s are then merged into a database. This database can be made by using commercially available spreadsheet software, or simply listing the data on paper without using full-scale database software or patent map software.

(5) Mapping

Mapping is carried out by extracting information from this database from various perspectives. Mapping may follow any procedure; one effective way is to start with a quantitative analysis of all the data covered, followed by definition of notable sign(s), technology or company, and then a qualitative analysis based on a detailed reading.

(6) Combination of Individual Patent Maps

Generally, it is difficult to analyze trends or clarify the distribution of patent rights by using a single Patent Map. Therefore, more than one Patent Maps is selected and combined to draw a theoretical conclusion.

(7) Evaluation

Finally, the finished Patent Map is evaluated for suitability for its intended use, and the procedure is completed if no logical inconsistency is found.

Followings are the key points when performing specific operations for creating a Patent Map.

4.2. Overall Design

The final evaluation of a Patent Map depends on whether or not the map is suitable for its intended use. Often, a Patent Map is built by a different division from the one that will use it.

According to a survey by the Institute of Intellectual Property, half of the companies surveyed replied that their Patent Maps were created by the intellectual property management department, and some 20% replied that they were created by the research and development department.

In contrast, Patent Maps are mainly used by research and development departments (50%), but rarely used by the intellectual property management departments that usually build them (6%). Thus, Patent Maps are often used by departments such as operations and corporate planning which are unfamiliar with the workings of the intellectual property system.

Consequently, when you create a Patent Map, you must first consider who will use it.

For example, building a Patent Map for analyzing the trend of competitors' R&D activities would involve a quite different approach from a map for understanding overseas patent networks for expanding business overseas. Even if a Patent Map is created to meet a request for analyzing the trend of competitors' R&D, a different approach will be required depending on whether the request comes from the research and development department or corporate planning department.

Other parameters, including the scope of patent information required, mode of building, the period covered by the Patent Map, and image of the finished map can only be defined once the intended use and user are known.

4.3. Gathering Patent Document information

Once the intended use and user are known, you should first gather patent documents or patent information. Although the patent information gathered will directly affect the quality of the resulting Patent Map, systematic and efficient gathering must also be considered.

4.3.1. Patent Information Gathering with Patent-Owners or Applicants Specified

Often, the name of a specific company is used as a key for gathering patent information. If competitors have been identified and no new entries are foreseen, patent documents gathered in this manner could be used for refining the technological search.

Although patent information gathered by using patent-owners and/or applicants as keys is generally less noisy and has fewer omissions, such information may contain omissions in the case of a change of corporate name, merger and/or change of the family name of inventors. For patent applications filed by a foreign company, the applicant company name translated into Japanese may be notated differently. Commercial database services can help reduce this risk.

In recent years, as the formation of industries and company split-ups have increased, a company often transfers its patent rights to another company in the same industry, and so care is required to avoid omissions of patent information.

4.3.2. Gathering Patent Information with a Technical Field(s) Specified

Patent information is gathered more often by specifying a technical field than a corporate name as a key. However, it is extremely difficult to directly extract noiseless patent information relating to a particular technical field without omission from vast amounts of patent documents.

Generally, the following search keys are available for utilizing patent information.

a) Patent classification

   Patent classifications available as search keys include the International Patent Classification (IPC), File Index (FI) of Japan Patent Office, US Patent Classification (USPC), European Classification (ECLA), UK Patent Classification Key and others.

b) Indexing code

   Indexing codes available as search keys include those for the IPC and the F-term of the Japan Patent Office.

c) Controlled key words

   In some cases, thesaurus-controlled key words can be used as search keys with commercial database services.

d) Key words in natural language

   Key words in natural language include terms used in patent specifications and uncontrolled key

words in natural language that are available for IPDL searches.

The fundamental search key most commonly used by experts is the patent classification system, which has a history of more than 200 years.

The patent classification system is effective for analyzing patent information because a classification symbol(s) is assigned to the relevant invention as a whole, not to the technical elements of the invention. For this reason, the patent classification system assigns a single class to one invention in principle.

However, the patent classification system has a couple of problems. One is that it requires an accurate understanding of the rules for operation. A "Guide" has been established for using the International Patent Classification system, which requires you to pay attention when referring to a classification table. Under the U.S. Patent Classification, it is necessary to check the range of subject matter covered by respective classes by enormous amounts of the Patent Class Definitions.

The second problem with the patent classification system is the difficulty of refining the search due to the limited number of class headings.

To solve these problems, two highly reliable search tools, for the indexing code and the F-term, were developed, both of which indexed concepts covered by the patent classification system.

These indexing codes will only work if used together with the patent classification; they should not be used alone or outside the scope envisaged by the patent classification system.

Search by using technical terms contained in the text of patent documents, such as free words or natural words, is an important means as a tool for picking out patent documents that cannot be captured under the patent classification system. Unlike the patent classification, searching by technical terms contained in the text will pick out patent information regardless of the subject matters of inventions, and so the context in which technical terms are used must be considered. Specifically, hits will be made even if the technical term was used in the description of prior art. Conversely, hits will not be made if a technical term created recently was not used in a patent application filed before the terminology had become established.

Given these features of patent information search tools, patent information should be gathered step by step as follows. **(See Figure 4-2.)**

(1) Retrieval by using patent classification and indexing code

There are now 40 millions of patent documents available around the world. Information should be retrieved by using the patent classification, after specifying a target area, a target period and target kinds of documents.

As the patent classification system is not specifically designed for analyzing patent information, a single round of search refinement would pick out an enormous amount of information, requiring search refinement by using the indexing code and/or F-term.

Given that national (or regional) patent information has undergone primary by classification by the patent offices, the search should be refined using a different classification system from your choice. For example, when searching for Japanese patents, the FI or F-term is useful, whereas ECLA

is useful for European patents. The important point is that if a search produces an enormous number of patent documents, the subsequent search refinement for these patent documents should not use any key word. This is because using a key word is likely to eliminate a number of important patent documents from the parent population of patent information analysis.

(2) Retrieval by using auxiliary patent classification symbols

To complement information retrieval by using the primary patent classification symbols, an additional retrieval may be carried out by using an auxiliary patent classification symbols. Note that more than one auxiliary patent classification symbols may become involved.

(3) Complementary retrieval by using technical terms contained in the text of patent documents

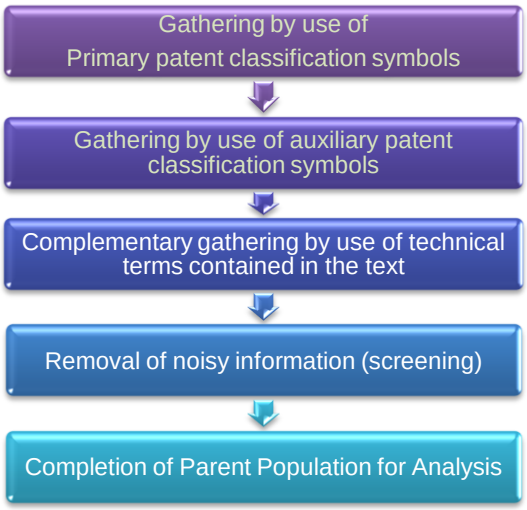
Since relevant information may be in a field that cannot be retrieved by using the patent classification, retrieval should be carried out by using technical terms contained in the text of patent documents.

(4) Denoising (Screening)

After completing the above three steps, a visual screening of all extracted patent documents should be carried out.

In this work, all the patent documents extracted by using the patent classification should be retained in the parent population and only obviously noisy information should be removed, as the former provides the fundamental framework for patent information analysis. For patent documents extracted by technical terms contained in the text of patent documents, since they merely complement the purpose of patent information analysis, only obviously relevant patent documents should be picked out.

Fig. 4-2 Conceptual Diagram of Procedure for Gathering Patent Documents



Although this screening process essentially involves reviewing patent specifications, the name of applicant, title of invention and drawings may serve as selection criteria. If this is applicable, the following process of additional analysis should entail denoising.

For the purpose of a Patent Map or a quantitative analysis, any inclusion of irrelevant information (or noisy information) or any omission of information in the underlying parent population would have a fatal impact. If this is applicable, the following process of additional analysis should entail denoising. Therefore, screening is crucial for the effectiveness and quality of a resulting Patent Map.

4.3.3. Gathering of Overseas Patent Information

When building a Patent Map, whether to include overseas patent information depends on the intended use, budget, and time available.

In a field dominated by domestic companies or in which the number of patent applications filed from overseas accounts for more than half of the total, it may be reasonable to use domestic applications only.

4.3.4. Access to Electronic Data

Although a Patent Map can be created t manually, machine-readable data (i.e., electronic data) is more efficient if tens of thousands of patent documents are involved.

Patent offices in many countries have built systems that allow users to search for patent information and access search results via their websites.

However, many offices restrict on batch downloading of search results. In this case, patent information should be gathered through commercial database services. Some services offer bibliographical information with new information added or with necessary maintenance including unification of company names, and offer information that cannot be obtained from primary documentary information.

Fig. 4-3 Bibliographical Data Available from Commercial Database Services (Partial)

KEY	P346103861	P347018656	P347063269	P347113465
Class code (P or U)	P	P	P	P
Application number	346103861	347018656	347063269	347113465
Filing date	197112	197202	197206	197211
Unexamined publication number	348067934	348087536	349021545	349070351
Date of Examined publication	197309	197311	197402	197407
Examined publication number			352016189	
Date of Examined publication			197705	197708
Registration number	0000000000	0000000000	0000896265	0000907179
Date of registration			197802	197805
Final decision code	7	9	1	1
Date of final disposition		197904	197802	
Examiner's decision code	2		1	1
Date of mailing of examiner's decision	197611		197709	197801
Number of requests for examination	1	0	1	1
Date of request for examination	197201		197212	197212
Priority date for unexamined publication				
Based date for unexamined publication	197112	197202	197206	197211
Examination code	01	01	01	01
Application code	0000	0000	0000	0000
Priority date				
Number of oppositions	0	0	0	0
Number of inventions	1	1	1	1
Number of applicants (Kanji characters)	1	1	1	1
Number of inventors (Kanji characters)	1	1	1	1
Number of priority	0	0	0	0
Number of pages	4	3	5	8
Number of IPCs	2	1	1	1
Number of FIs	2	1	3	1
Number of F-terms	5	1	21	1
Section of Publication	0501	0501	0401	0501
Representative	1			1
Representative code	6214			6002
Total number of representatives	1	0	0	1
Whether the invention has been disclosed or not				
Whether the fungus has been deposited or not				
invention relates to pollution control technology	0	0	0	0
Title of the invention	Electrical drive system for bicycle	Bicycle	Multi power-driven interlocking clutch	Engine-loaded bicycle
PCT Release number				
PCT Release date				
IPC	B62M 2302	B62M 2302	F16D 2106	B62M 2302
FI	B62M 23/ 2 M	B62M 23/ 2 K	B62M 23/ 2 G	B62M 23/ 2 B
F-term used				
Name of applicants	****	*****	*****	*****
Name of inventors	****	*****	*****	*****

The rest is omitted.

When building a Patent Map, it is preferable if the underlying patent information, including the primary documentary information, can be obtained in electronic format. However, obtaining bibliographical information only in electronic format is no less effective for generating lists and structuring. In contrast, in the subsequent process of complementary analysis, many analysts use hard copy.

4.4. Additional Indexing and Hierarchization

Bibliographical information in patent documents includes a great number of information items. As further advances are made at patent offices, additional valuable information such as patent family information and citation information will become available.

Nevertheless, in terms of content, the original information is not sufficient to carry out an analysis

To complement this, it is necessary to review gathered patent information and extract complementary information to ensure the resulting map serves its intended use.

Information items that are frequently obtained from additional indexing include:

(i) Use of the invention and technical field to which the invention pertains;
(ii) Technical features (technical elements);
(iii) Problem to be solved by the invention;
(iv) Means for solving the problem;
(v) Advantageous effects of the invention;
(vi) Information on prior art cited in the patent specification; and
(vii) Other necessary matters for analysis

To carry out an indexing efficiently, indexers often make a preliminary classification of relevant items (e.g., classification of use). This should be done not only by using the analyst's knowledge and experience, but also by organizing various cases covered by patent documents gathered through a detailed reading of about 10% of the documents. This work is vital to prevent the indexing results from centering on specific items.

Even if the indexing makes full preparations before starting the analysis, unforeseen cases may arise. Therefore, classification item headings should include "Others" to accommodate such unforeseen cases. The indexer should check the box under the "Others" heading, and make a quick note of the details of the case, and then eventually sort through such cases again to minimize the number of patent documents that come under the "Others" heading.

Once the indexing is completed, "hierarchization" takes place. Hierarchization involves transferring patent documents that fall under similar categories into a broader category and/or redistributing many patent documents in a single category into a number of narrower newly defined categories.

Figure 4-4 shows an example of structuring patent information for "problems to be solved by the invention" relating to IC-tag-based information transmission technology.

Fig. 4-4 Hierarchization of the Results from a Complementary Indexing
(Relating to IC-tag-based Information Transmission Technology)

Original problem	
Improvement of bit error rate	Detection of position posture and speed
Improvement of C/I	Simplification of circuit and configuration
Improvement of S/N	Reliable read/write
Active tag circuit	Sensitivity improvement
Security	Prevention of malfunction
Sensor	Extension of communication range
The conditions between the IC tag and the reader/writer	Increase in receiving energy
Tag circuit	Avoidance of receiving null point
Sense of discomfort caused by the location of an IC tag	Reduction in size and weight
Sense of discomfort caused by the posture of a tagged item	Collision avoidance
Improvement of user interface	Compatibility both with contact and contactless sensors
Reader/writer circuit	Noise- and disturbance-resistance
Stable supply of electric power	Overvoltage- and overcurrent-resistance

Problem Category I	Problem Category II	Problem Category III
Improvement of covered range/area	Extension of communication range	Extension of communication range
	Reduction of blind spot	Avoidance of receiving null point
		Sense of discomfort caused by the location of an IC tag
		Sense of discomfort caused by the posture of a tagged item
Countermeasure against interference	Prevention of interference	Between a tag and the reader/writer
		Between adjacent tags
		Between adjacent readers/writers
		Between adjacent systems
	Collision avoidance	Collision avoidance
Improvement of efficiency	Improvement and stabilization of the energy transfer efficiency	Stable supply of electric power
		Increase in receiving energy
		Use of alternative energy
		Prevention of reactive energy radiation
	Improvement of the energy transmission efficiency	Shortening of time required for reading and writing
		Improvement of read rates
		Reduction of communication time

Adapted from data in the "Patent Distribution Support Chart: Electrical 33—IC Tag Information Transmission Technology" (INPIT, 2006)

"Problems to be solved by the invention" cited in patent specifications are too wide-ranging to categorize, though they are concrete content. Indexers should transfer patent documents coming under similar categories into a broader category. In this example, as part of the structuring, Problem Category II is created under the heading of "reduction of sense of discomfort" as a broader category than the one which included "avoidance of receiving zero points," "occurrence of blind spot depending of the location of the tag" and "occurrence of blind spot depending on the posture of the tagged item." Furthermore, Problem Category I is created under the heading of "improvement of communication range/area" as a broader category than Problem Category II. This provides a three-layered structure of problems to be solved by the invention.

Additional indexing may not be a single step; another round may be required as the indexing progresses.

4.5.Database Compilation

In parallel with or even prior to additional indexing, a list of all patent documents gathered should be compiled as a database. Although this list can be made on paper without using dedicated

software, it is more convenient to use commercially-available spreadsheet software or database software. In addition to bibliographical information of patent documents obtained beforehand, data resulting from additional indexing and other information is merged into the database. In some cases, abstracts and/or key drawings may be added, and links may be provided to the primary patent information.

Figure 4-5 shows a conceptual diagram of a working database relating to "shape memory polymer." Usually, such a database is structured with the patent document number immediately following the reference number. Under the headings of "technical element," "problems to be solved by the invention" and "means for solving the problem," comes information obtained from complementary analysis, and further information is added as needed. A space for the analyst to make notes is useful.

Fig. 4-5 Conceptual Diagram of a Working Database (Shape Memory Polymer) (Partial)

	Document No.	Title of the invention	Filing date	Applicable classification	Applicant	Technical element	Problem to be solved by the invention	Means for solving the problem
1	A1995-299089	Soft artificial anus	Apr. 28, 1994	A61F5/445	Yoshihito Osada, Hokkaido University	Material design technology	Enhancement of comfort	Improvement of polymer
2	A1995-292040	Thermosensitive shape memory gel	Apr. 28, 1994	C08F220/18	Yoshihito Osada, Hokkaido University	Material design technology	Improvement of other quality components	Improvement of polymer
3	B3066465	Method for manufacturing objects formed of shape memory resin	July 16, 1997	C08J5/00	Shoji Ito, National Institute of Advanced Science and Technology	Material design technology	Improvement of other quality components	Improvement by use of additives
4	A1997-235329	Shape memory materials	Mar. 1, 1996	C08F220/12	Yoshihito Osada, Hokkaido University	Material design technology	Increase of durability	Improvement of polymer
5	B2972913	Methods of shape memory and shape restoration for objects formed of biogradable shape memory polymer	Jan. 20, 1998	C08L67/04	Kazuo Nakayama, National Institute of Advanced Science and Technology	Material design technology	Improvement of ecological safety	Improvement of polymer
6	A1995-60835	Heat-shrinkable tubing and heat-shrinkable-tube-coated instrument	Aug. 25, 1993	B29C61/06	Matsumoto Dental University	Material design technology	Improvement of safety for the human body	Improvement by use of additives
7	A2004-337419	Provisional dental crown and method for temporarily fitting a provisional dental crown	May 16, 2003	A61C13/107	Takeshi Tsukada, Kagoshima University; and Mitsuo Torii	Post-processing technology	Improvement of workability	Improvement by use of additives
8	A2000-313726	Fluorine-compound-introduced shape memory hydrogel	Apr. 28, 1999	C08F220/22	Yoshihito Osada, Hokkaido University	Post-processing technology	Improvement of heat shrinkability	Improvement of polymer
9	A2005-125674	Biogradable heat-shrinkable material and method for manufacturing the biogradable heat-shrinkable material	Oct. 24, 2003	B29C61/06	Japan Atomic Energy Agency Sumitomo Electric Fine Polymer, Inc.	Post-processing technology	Improvement of ecological safety	Improvement by use of additives

Adapted from data in the "Patent Distribution Support Chart: Electrical 32—Shape Memory Polymer" (INPIT, 2006)

It is also useful to add information cited in subsequent patent applications (hereafter "cited patent information") to the database. Figure 4-5 shows the same conceptual diagram focusing on cited patent information.

Any document judged by screening or additional analysis to be unnecessary should be deleted from the database as the parent population case by case to keep the database up to date.

Fig. 4-6 Conceptual Diagram of a Working Database (Shape Memory Polymer) (Partial)

	Document No.	Title of the invention	Filing date	Applicant	Frequency of citation	Frequency with which the applicant cited its own patents	Frequency with which the applicant cited patents owned by others	Applicants of the cited patents
1	A1997-71675	Foam and method for manufacturing thereof	June 26, 1995	Sekisui Chemical Co., Ltd.	22	21	1	Minami Yuzo Jimusho (1) Tsuchitani TISCO (1) Arude Engineering Co., Ltd. (1)
2	B 2728266	Method and equipment for manufacturing pipe liner	July 27, 1987	Pipe Liners	20	0	20	Sekisui Chemical Co., Ltd. (17) C.I. Kasei Co., Ltd. (2) Osaka Gas Co., Ltd. (1)
3	B1993-72405	Usage of norbornene polymer formed products	Sept. 20, 1982	Zeon Corporation	14	0	14	Tokai Rubber Industries, Ltd. (3) Nitto Denko Corporation (3) Yoshihito Osada (2) Ichikawa Co., Ltd. (1) AIST (1) Daicel Chemical Industries, Ltd. (1) Toray Industries, Inc. (1) Chugoku Rubber Industries, Ltd. (1) 3M Innovative Properties Company (1)
4	B 1994-96629	Polymer elastomer formed products and usage thereof	June 21, 1985	Mitsubishi Heavy Industries, Ltd. Mitsubishi Kasei Dow	10	0	10	Dainichi Color & Chemical Mfg. Co., Ltd. (3) JSR Corporation (2) Mitsubishi Chemical Corporation (1) Nitto Denko Corporation (1) AIST (1) Soutme Yugengaisha (1) Stinger Florence (1)
5	B 2972913	Reexpansive foamed plastic chip and method for manufacturing thereof	July 12, 1985	Asahi Kasei Corporation	10	0	10	Sekisui Chemical Co., Ltd. (10)
6	A1987-13441	Optical recording medium	Mar. 7, 1990	Matsushita Electric Industrial Co., Ltd.	10	0	10	Mitsubishi Chemical Corporation (9) Columbia Music Entertainment, Inc. (1)

Adapted from data in the "Patent Distribution Support Chart: Chemical 32—Shape Memory Polymer" (INPIT , 2006)

4.6. Mapping

After completing a working database, you are ready to draft a Patent Map. If the required format of the Patent Map is defined, you can draft it in the defined format from the beginning.

Usually, mapping is time-consuming and so should be done as efficiently as possible. It should at least provide the necessary information to allow following analyses.

A few examples of approaches for building a Patent Map are given below.

4.6.1. Quantitative Mapping

In order to carry out mapping efficiently and exhaustively, usually the analysis covers the whole, and then goes into detail. The first part of the analysis involves using quantitative analytical methods described previously.

(1) Systematized Art Diagram

A quantitative analysis starts by defining the size of the parent population for the forthcoming analysis (as represented by a cluster of patent information relating to a specific technology or a cluster of patent information relating to a specific applicant or right-holder), and how it will be structured. A Systematized Art Diagram Structure is used for this purpose. This diagram can be relatively easily drawn by using the database described in the preceding paragraph. Information

items usually used as keys include “Patent Classification” and “Technical Element.” These two aspects have different characteristics in terms of usability, and the choice between them depends on the intended purpose of use.

A Systematized Art Diagram based on “patent classification” will enable you to grasp the technological structure in the relevant technical field that otherwise could not be obtained. Furthermore, every patent document invariably includes information relating to patent classification, which means that no special analysis is required to obtain such information. However, a person who is not familiar with handling patent information may find it difficult to handle patent classifications. Terms used in patent classification are often ill-defined and could mislead users unless a detailed description of the concept covered by the term is given. (For example, for a category under the patent classification system, if any narrower category is available, the broader category does not include any pertinent section.) Since the patent-classification-based approach is mainly used for examining patent applications at the Patent Office, the approach is often quite different from the more commonly used approaches such as technical-classification-based, product-classification-based and industrial-classification-based approaches.

In contrast, analyzing the technological structure based on “technical element,” which is used to explain the technological structure in the relevant technical field, will enable you to grasp the distribution of patent applications by using common technical knowledge or general terms. On the other hand, since this technical analysis inherently limits the scope to expected circumstances, it cannot clearly reveal emerging trends in the relevant technical field. In addition, the analyst has to index the technical elements.

Whichever approach is used, a Diagram of Technological Structure is drawn based on a count of the number of applications by technical element.

When adding up the counts by technical element, if the count is too small in some categories, you may need to establish a broader category to merge the narrower categories. Conversely, if the count is too large in a category, you may need to either segment it into a number of narrower categories after a detailed reading of the patent information falling there under, or establish a new category under the name of “Others.”

This produces a Diagram of Technological Structure as shown in **Figure 3-8**.

(2) Time-Series Map

Once you have gained an understanding of the overall structure of patent applications filed, you need to grasp the recent trends by using a time-series map.

As with the Diagram of Technological Structure, the working database described in the preceding section is useful for building a time-series map.

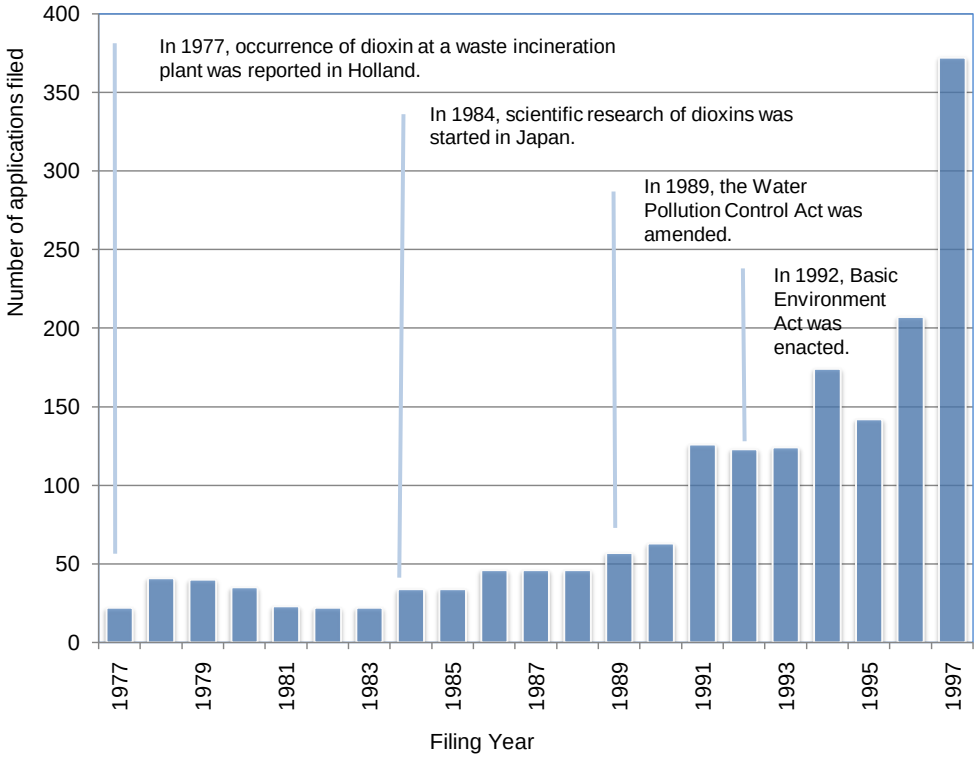
An analysis for building a time-series map uses “Filing Date” as a key. This assumes that the filing date occurs in the possible nearest terms of the date on which the relevant invention was made or on which the term of right in the relevant invention expired. In addition to the actual filing date, the filing date includes the priority date if an application claiming priority is involved. In practice,

"filing year" (or the year in which the relevant application was filed) is more frequently used than "filing date" due to its integrity.

A time-series map is produced by sorting this working database by using the filing date (or priority date) as a sort key and then counting the number of application filed on the basis of filing year and plotting the counts in graph form. When building a time-series map for gaining an overview of applications filed, applications for which refusal or invalidation has become final and conclusive or for which the term of patent right has expired should not be excluded from the parent population. This is because the map is only intended to grasp the trends of patent applications filed, and when conducting a trend analysis covering unexamined applications, it is important to maintain the consistency of data contained.

As shown in **Figure. 4-7**, significant milestones such as the development of new seed technology or enactment of an important law should be marked on the time-series map for future analysis.

Fig. 4-7 Example of Time-Series Map (Incinerator Dioxin Suppression Technology)



Adapted from data in the "Patent Map by Technical Field: General 14—Technology Relating to Countermeasures against Dioxin" (JPO, 2000)

(3) Maturation Map

A "Maturation Map" shows changes in the number of applicants who entered the relevant technical field, together with changes in the number of applications filed relating to the technical field, on an annual basis, representing the interest in the technical field at the time.

This Map is built by using "Filing Year" and "Applicant" data stored in the working database described above as keys and by counting the number of applications filed and the number of

applicants on a filing year basis. As applicants often file multiple applications relating to the relevant technical field in the same year, you should ensure there is no overlap in counting the number of applicants. Even if a merger or split-up of an applicant company is involved, information available at the time the application was filed or when the relevant patent documents were published is usually used without modification. This is because a patent map is generally built to meet an urgent need and inclusion of the original corporate name will pose no problems in practice.

When counting the applicants on a filing year basis, it is useful to keep a record of the number of applications filed by each of the relevant applicants on a yearly basis.

After counting the number of applicants on a filing year basis, you are ready to build a technology maturation map by counting the number of applications filed in the same year. There is no established rule as to whether you should plot the number of applicants or the number of applications filed on the horizontal axis; analysts follow their own preference when drawing a maturity map.

Presentation of the analysis results in graph form does not require dedicated software and can be done by using the graph function of common spreadsheet software.

The Maturation Map as shown in **Figure. 3-12** was built using this procedure.

(4) Twin Peaks Analysis Map

Although a Time-series Map or Maturity Map built using the entire parent population shows the trends of patent applications filed in the relevant technical field, it is not easy to grasp the details of factors or changes involved. Users may be dissatisfied if a Patent Map does not meet their expectations because it shows trends based on information other than patent information.

Any issue pointed out by analyzing patent information should preferably be accounted for by using patent information with respect to its background and details. For this purpose, a Twin Peaks Analysis is used in which the parent population is broken into subgroups, each of which is analyzed for any trend to grasp changes of technology (or applicant).

Any of the information items stored in the working database such as patent classification, applicant and technical element can be used as a tool for breaking the parent population into subgroups. New aspects such as material, function, use and others may be added as needed.

A preliminary Patent Map can be produced by specifying the aspects to be analyzed out of these information items, counting the number of applications filed on a filing year basis for each aspect, and presenting the trends as a time series.

However, an effective twin-peaks analysis requires a map which clearly shows a time lag as in **Figure. 3-10** and clearly shows any shift involved. If the resulting map shows an ever-increasing trend for every element involved and if there is no significant time lag among multiple elements, you should try another analysis using a different aspect.

(5) Quantitative Matrix Map

To more clearly identify notable patents and/or applications filed, a Matrix Map is useful as it presents the results of analysis quantitatively.

In many cases, “technical element,” “problem to be solved by the invention” and “means for solving the problem” are used as aspects for this analysis. The working database described in the preceding section is also useful when building this map.

First, two aspects should be picked out. Next, each of the patent applications in the parent population should be allocated to a single requirement of each of the relevant aspects, thus forming a matrix. An application should not be allocated to multiple requirements. If any application does not fit in any matrix, you should review the choice of aspects.

When you have allocated all the applications in this way, you should count the applications in the matrix. It is useful to distinguish between technical fields in which newer applications account for a majority and those in which older applications account for a majority.

The Matrix Map shown in **Figure. 3-7** was built in this way.

(6) Analysis of Interpatent Relation

Since a quantitative analysis is the basis of a qualitative analysis that comes next, it is effective if the former can pick out important technology or patents. Otherwise, you must carefully read all the patent documents involved when trying to understand the association between the patents, which is inefficient.

An analysis of interpatent relation is used for this purpose. As shown in Figure. 4-6, information on patent documents cited subsequently (“Cited Patent(s)”) as organized and stored in the working databases is an important tool for picking out important patents or understanding the association between the patents.

Although not shown in the example in **Figure. 4-6**, the document numbers of Cited Patents as placed on record enable you to draw a Patent Association Drawing as shown in **Figure. 3-3**.

4.6.2. Qualitative Mapping

When you have identified the overall trend, notable technologies and notable right-holders by a quantitative analysis, you should then perform a qualitative mapping. This involves not only using the working database built under the preceding section but also obtaining and reading the full text (specification and drawings) of the relevant patent documents.

As this would take thousands of hours, an analysis for qualitative mapping may focus on only “Notable Technical Field” and “Notable Patent.” To extract data for “Notable Technical Field,” the quantitative-analysis-based methods already described should be used. On the other hand, to extract data for “Notable Patent,” an analysis of the association between patents should be used in conjunction with the analyst’s knowledge and experience or professional help.

Depending on the purpose of use, an exhaustive analysis of all relevant patent documents may be required.

(1) Diagram of Technological Development

In order to create a diagram of technical development, it is necessary to carefully read the relevant patent documents and position the patents within the overall technological structure. In

doing this, analyzing the association between patents may be useful for suggesting the relations among one another.

To perform the work operation efficiently, some people prepare cards with only a drawing on them and attach them to a whiteboard. Some experts call this “karuta,” as the cards are like the “karuta” cards used in an old Japanese game.

After positioning all the relevant patents and applications filed, confirming the positional relations will produce a map as shown in **Figure. 3-2**.

(2) Matrix Map

A qualitative Matrix Map is one of the most fundamental Patent Maps and is essential for a patent-map-based analysis.

The process of building a qualitative Matrix Map is similar to building a quantitative map. Firstly, two aspects should be defined, and relevant patent documents allocated to each of them. For this purpose, cards describing the contents of patent documents can be used.

As a qualitative matrix-map-based analysis requires more detailed positioning than a quantitative analysis, aspects used in the former analysis should represent more specific or fundamental concepts than abstract or broader concepts.

This will enable the map to clearly demonstrate how a particular patent or application is interrelated with patents existing thereabout.

The Matrix Map shown in **Figure 3-4** was built in this way.

(3) Summary List

As a qualitative Matrix Map only includes patent document numbers or applicant names, you need more details of the invention such as the inventor and other information when using the map in practice. A “Summary List” is drawn up for this purpose.

To draw up a Summary List, you can use the working database created under the preceding section, or you can incorporate representative drawings and abstracts in the database in anticipation of such use.

As a minimum, a Patent Map set consists of three matrix maps and one executive summary, so the Executive Summary is one of the major Patent Maps.

(4) Element-Based Map

Finally, you may need to build an Element-Based Map to present the results of analysis to corporate executives or engineers. The procedure for drafting this map is essentially the same as for the Systematized Art Diagram except that it focuses on technical aspects and includes the specific names of patent documents and names of right-owners.

An Element-Based Map is drafted by picking out necessary patent documents from the working database and contrasting your company’s patents with those of competitors.

4.7. Evaluation and Combination

Upon completion of mapping, the analyst should confirm that the resulting map is suitable for

the intended use, and then proceed to draw up a scenario. If the client needs a Patent Map to help identify targets of technological development to pursue, the analyst should confirm that the map will meet such need. Analyses should be flexible rather than doctrinarian. The created Patent Map should also show the direction to pursue.

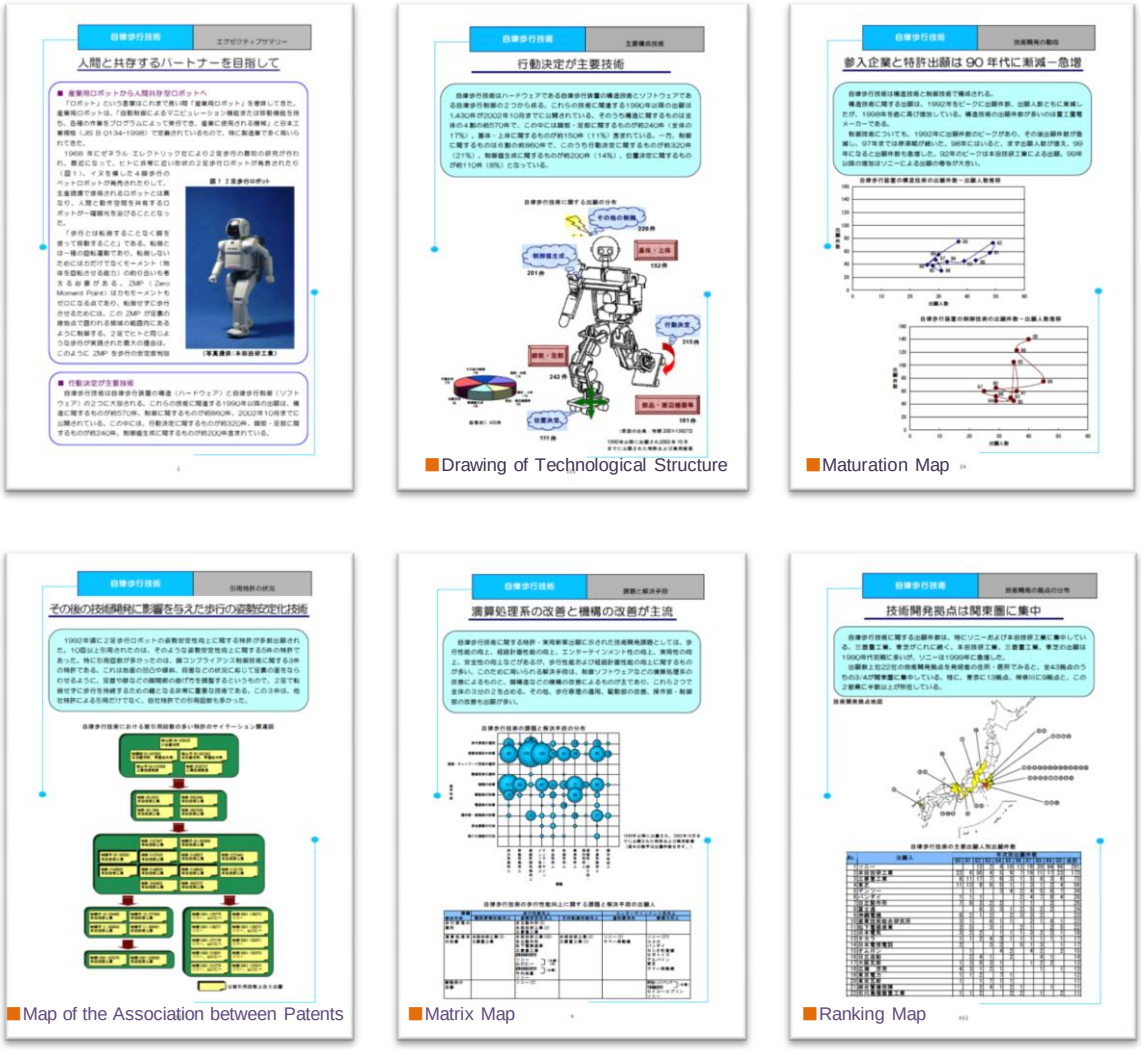
It follows that a Patent-Map based analysis requires the combined use of more than onee Patent Maps in order to take a multifaceted approach to your conclusion.

Figure 4-8 shows part of the executive summary of the Patent Distribution Support Chart created by the National Center for Industrial Property Information and Training (INPI).

The Executive Summary, accompanied by some 300 pages of detailed analysis, shows that technological trends can only be clarified by combined use of various patent maps.

The process of creating a Patent Map ends with confirming that it properly meets the objectives and is suitably logically organized.

Fig. 4-8 Example of Combined Use of Patent Maps



Source: “Patent Distribution Support Chart: Machinery 6—Independent Ambulation Technology” (INPIT, 2004)

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