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ORIGINAL ARTICLE

Trend analysis of technology by using F-trem japanese patent and core technology clarification with Quality Function Deployment (QFD) approach

Análisis de tendencias tecnológicas mediante el uso de la patente japonesa F-trem y clarificación de la tecnología central con el enfoque de Despliegue de la Función de Calidad (QFD)

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ABSTRACT

When a company develops technologies or products, it is important to obtain the trend of technology. It is necessary to obtain the trend of technology from macro and micro perspectives. In this case, patent information was used in both macro- and micro- perspectives. The core technologies of the companies are used to analyze the trend of technology from the micro perspective. The QFD approach is used as a method to identify the core technology of a company. From the core technology obtained by the QFD method, the patent classification codes are identified. The changes in technology were obtained by using the patent classification code.

Keywords: Trend Analysys; Technology Trend; F-term; QFD.

RESUMEN

Cuando una empresa desarrolla tecnologías o productos, es importante obtener la tendencia de la tecnología. Es necesario obtener la tendencia de la tecnología desde las perspectivas macro y micro. En este caso, se utilizó información sobre patentes tanto en la perspectiva macro como en la micro. Las tecnologías principales de las empresas se utilizan para analizar la tendencia de la tecnología desde la perspectiva micro. El enfoque QFD se utiliza como método para identificar la tecnología central de una empresa. A partir de la tecnología central obtenida mediante el método QFD, se identifican los códigos de clasificación de patentes. Los cambios en la tecnología se obtuvieron utilizando el código de clasificación de patentes.

Palabras clave: Análisis de Tendencias; Tendencia Tecnológica; F-term; QFD.

INTRODUCTION

When a company considers their direction to develop technologies and products, it is important to obtain the trend of technology. Two kinds of the trend of technology are necessary for a company. One information is related to the product itself. Another information is related the company's core technology.

In our previous reports, we have shown how to obtain the changes of technology related to the product itself using FI code, Themecode and F-term code. The target products were inkjet printers and projectors. [1,2] In these cases, the analysis was conducted from the macro perspective. However, when companies develop technologies and products, it is also important to know the changes of technology related to their

core technologies, which are their strengths. In this case, the analysis is conducted not only from the macro perspective but also from micro perspective.

As a method for capturing changes in technology, we use a method that does not require the opinions and experience of experts in patents and technology. This is because in many studies on technology trend analysis, some results cannot be obtained without incorporating the judgement of patent and technology experts, which the researchers see as a challenge.[5,6,7]

In this case study, as in the previous report,[3] an attempt is made to understand technology trends in a way that does not incorporate the opinions of patent and technology experts.

The technology to be analyzed is the core technology of the company. To identify core technologies, the method of clarification of core technologies by QFD is used.[4] In this study, a company's core technology is defined as 'a "technology" that plays a central role in achieving a "function" that customers are happy with for the company's developed product'.[4]

As a case study, the Japanese manufacturing company O is taken as an example. Note that Company O is the leading manufacturer in its industry.
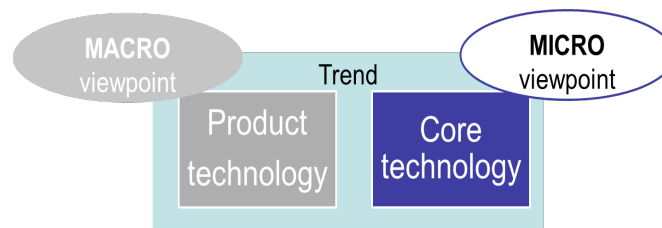

Figure 1. Two viewpoints for trend of technology

Hyposesis

Basically, while using the analysis method to capture technological change in products, it may be possible to capture changes in a company's core technology by replacing the target technology with the company's core technology rather than the product's main technology.

The procedure for capturing technological change in products uses patent classification codes relating to the technology under analysis. In the present analysis, the patent codes relating to technology are replaced with those relating to the company's core technology, rather than the product's.

METHODS

Analysis Tool

For patent searches, the Yamaguchi University search software YUPASS is used, which is synchronized with the DB of the Japan Patent Office and has the ability to obtain several thousand search results at once.

Flow of analysis

Figure 2 shows the procedure for capturing technological change with regard to a company's core technology. This procedure is basically the same as the procedure for capturing technological changes related to products,[3] except that the patent classification codes used in Step 2 are obtained from terms related to the company's core technology rather than product concepts.

The company's core technology is obtained using the QFD.

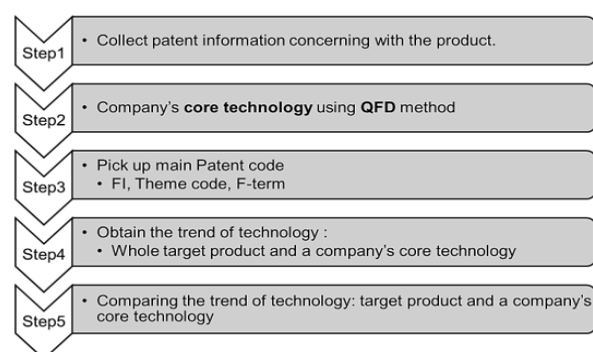The company's core technology is obtained using the core technology clarification method by QFD.[3]

Figure 2. Procedure to obtain the trend of technology about core technology

Patent classification code
    In this case study, Japanese patent-specific classification codes are used. The relationship between international patent classification codes and Japanese patent classification codes is shown in Figure 2. The Japanese patent classification codes consist of FI codes, which subdivide the international patent classification codes, Themecodes, which group the FI codes, and F-terms, which classify each Themecode from multiple perspectives.
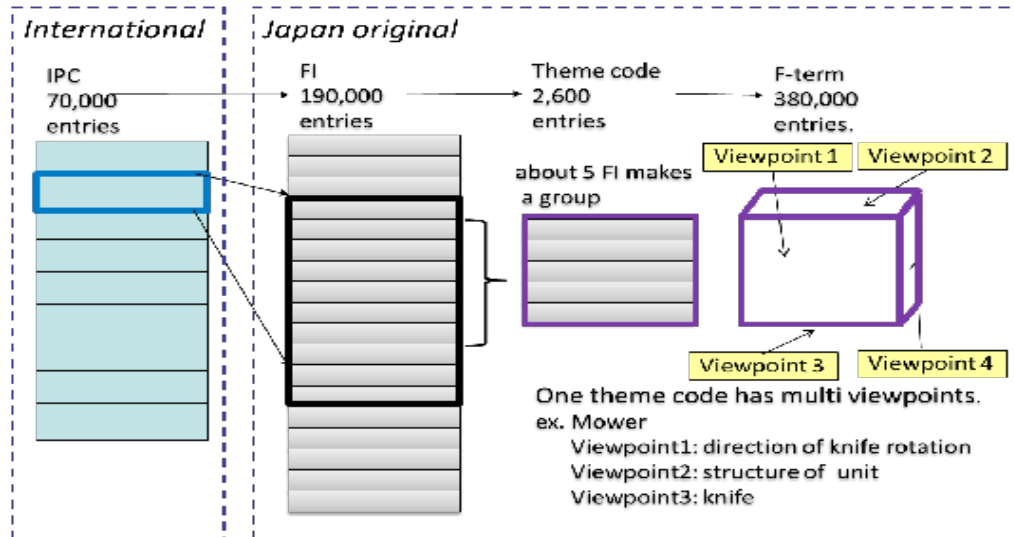

Figure 3. Patent classification codes, IPC, FI, Theme code, F-term

Clerifying Core Technology using QFD
    QFD is a method of translating customer feedback into technical functions, mechanisms and components.[8,9]
    The procedure to clarify core technology using QFD shown in Figure 4. The voice of the customer is translated step by step into technical words.[2] In this case study, the voice of the customer was the product catalogue, flyers and the product introduction wording on the website.
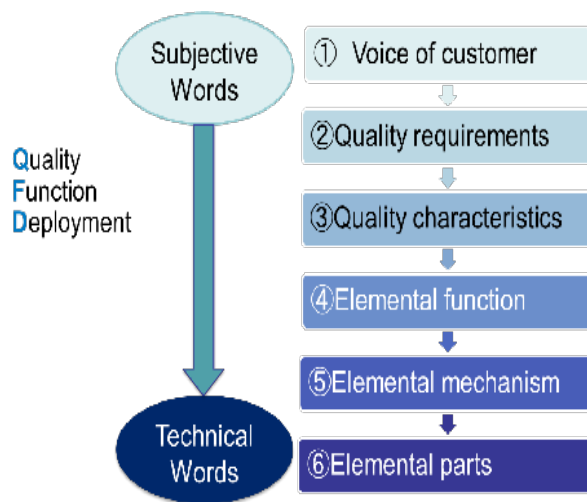

Figure 4. Process image of translating the value from the voice of customers to the tehnology

Analysis case of Company O
    The source information for obtaining the change of technology related to mower machine is patent applications.
    The patent applications include 'mowing' or 'mower' in the abstract and include 'machine', 'device' or 'equipment' are the target to be analyzed. Figure 5 shows the result of the survey on technological change in mowers. 610 patents had been found from 1991 to 2019.Company O has applied 73 patents from 1987 to 2019.
    As Figure 4 shows, mower technology is changing and shifting at intervals of three to four years. It also shows that although Company O is the leading company in mowers, it does not share most of patents related to mowers.
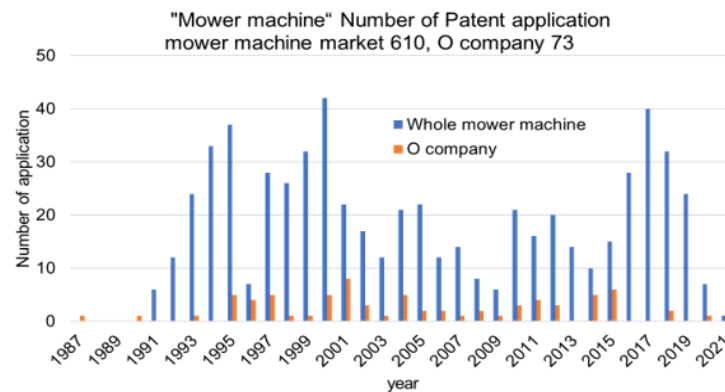
Figure 5. Patent application and changing rate for Mowering and mowering machine

Next, Figure 6 shows the Themecode ranking of mower machine. As shown in Figure6, 2B083, 2B034,2B043, 2B041, and 2B304 are main Themecode.
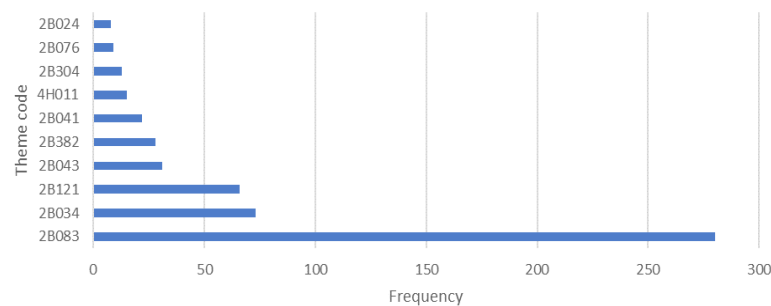

Figure 6. Main Themecode of mowe machine

Next, a theme code ranking for mowers was conducted, as shown in Figure 6, which revealed that the main theme codes for mowers were 2B083, 2B034,2B043, 2B041 and 2B304.

Clarification of Core Technology

We identify the core technologies of Company O.

The analysis focus on four main models of Company O products.

In a previous study,[4] the voice of customer was translated into the technological words. The same method is used to obtain Company O's core technology. Figure 7 shows the results of the analysis for "mechanism".

As shown in Table 1, the words 'efficiently cut various types of grass' and 'a stable run' are common to all four models. These two words are the core technologies of Company O.

Rank	typeA	typeB	typeC	typeD
	mechanism	mechanism	mechanism	mechanism
1	**Mowing**	**Automatic gear shift**	Engine control	Transmission
2	Mowing Width Adjustment	Vibration suppression (damper)	Status display	**Engine control**
3	Mowing height adjustment	Lever Switching	Mowing width adjustment	Mowing width adjustment
4	**Speed stabilizer**	Shock Absorbing	**Automatic gear shift**	**Mowing**
5	Torque stabilization	Drive Switching	**Mowing**	Turning
6	Cover	**Mowing**	Automatic Handle Angle Adjustment	Slope Mowing Width Adjustment
7	Automatic gear shift	Anti-Fouling	Handle storage	Status display
8	Engine start	Engine Start	Handle Switching	Handle switching function
9	Emergency stop	Offset	Lever Switching	Lever switching function
10	Anti-fouling	Mowing width adjustment		

Figure 7. Result of QFD method for Company O's core technologies

RESULT OF ANALYSIS

The analysis so far has revealed the main codes of the mower and the core technologies of Company O. As shown in Figure 8, comparing Themecode ratio of the patents for the mower products as a whole and for Company O's patents, we found that the ratios for both are similar.
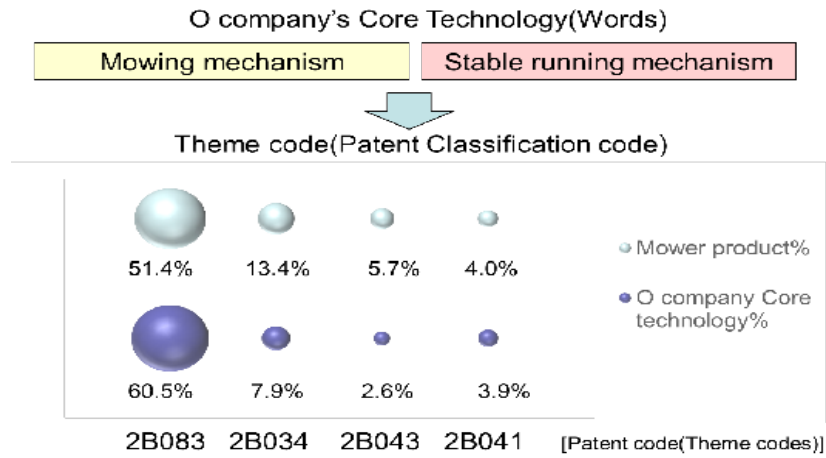

Figure 8. Major theme code rate of mowing machine

CONCLUSION

Our hypothesis is that, by using patent information, it is possible to observe changes in technology. In particular, we hypothesize that, by using the QFD methodology, it is possible to understand the changes in a company's core technology from a micro perspective.

The results of the analysis showed that, using patent information, it was possible to observe changes in product-related technology and in the company's core technology.

The purpose of this case study is also to provide an example of analysis from a micro perspective using a company's core technology. As a result of the analysis, changes in technology from a micro perspective could be obtained.

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CONFLICTS OF INTEREST

None.

FINANCING

None.

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