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Identifying Business Opportunities Based on Patent and Trademark Portfolios: A Technology-Based Service Industry Case

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***Abstract*—**As technology-based service industries grow drastically worldwide; companies are recognizing the importance of market preoccupancy and have made an effort to capture a large market to gain the upper hand. To this end, a focus on patents can be used to determine the properties of a technology, as well as to capture advantages in technical skills, in comparison with the firm's competitors. However, technology-based services largely depend not only on their technological value but also their economic value, due to the recognized worth that is passed to a plurality of users. Thus, it is important to determine whether there are any competitors in the target areas and what services they provide in any field. Despite this importance, little effort has been made to systematically benchmark competitors in order to identify business opportunities. Thus, this study aims to not only identify each position of technology-centered service companies in complex market dynamics, but also to discover new business opportunities. For this, we try to consider both technology and market environments simultaneously by utilizing patent data as a representative proxy for technology and trademark dates as an index for a firm's target goods and services. Theoretically, this is one of the earliest attempts to combine patent data and trademark data to analyze corporate strategies. In practice, the research results are expected to be used as a decision criterion to diagnose the economic value that companies can obtain by entering the market, as well as the technological value to be passed onto their customers. Thus, the proposed approach can be useful to support effective technology and business strategies in a firm.

***Keywords*—**Business opportunity, patent, Portfolio analysis, trademark.

I. Introduction

IN recent years, as the era of "higher technical capabilities make higher profits" has passed, constructing strategies for customers as cognitive subjects of produced goods and services is essential for most enterprises [9], [10], [12]. In particular, the service sector has a complicated market structure and distinguished characteristics because of its diverse customers, from business to business (B2B) to business to customer (B2C) and frequent interactions with multi-market customers [2]. Therefore, identifying niche markets to secure new customers and preparing competitive advantages are crucial activities [4].

On the other hand, services have combined with technology to give customers superior value, as these efforts are not only beneficial to providers but also to customers [1], [5]. In this context, the concept of technology-based services (TBS) has been proposed, implemented, and improved consistently, and a main stream of the service market has focused on TBS. However, the upgraded service market cannot also avoid the high-level competition, because the connection between technology and services implies that more complex products and services can be developed and distributed. Therefore, this environment makes many stakeholders try to find new business opportunities. Namely, attempts to forecast market opportunities have actively been suggested. However, among previous studies, little effort has been spent identifying business opportunities by utilizing information from important competitors and considering other factors systematically.

Therefore, this study suggests a method of identifying target service areas as new business opportunities by analyzing competitors' innovation activities. We adopted patents and trademark data for this purpose. Patents show the characteristics of a firm's technological assets, while trademarks are likely to represent business areas of interest because they are registered for particular goods and services. If any service areas are being addressed by competitors with similar technological assets, the areas are worth considering as new business opportunities.

The remainder of this paper is organized as follows: Section II briefly reviews the relevant literature for the major concepts of the research; Section III explains the data used and provides detailed steps of the research process; Section IV describes the results obtained from a pilot test; and finally, Section V presents the contributions, limitations, and future directions of this study.

II. Literature Review

A. Characteristics of Business Portfolios

Most enterprises are eager to survive in the market by constructing or extending their own business portfolios [11]. On the other hand, although constructing a business portfolio is considered to be a crucial activity due to the high risk of startup ventures or a firm within unpredictable technological changes, there is an argument that business diversity can also be a threat to a firm because of restricted resources. Therefore, identifying new business opportunities is expected to be an essential task. Simultaneously, demands for a precise and accurate methodology to identify business opportunities have increased due to the low performance of identifying opportunity tasks [3].

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Consequently, patents as assets for legal protection [6] are utilized as valuable data, as collecting patent data is relatively easy. In addition, a number of studies have tried to use patent datasets to evaluate technological capabilities or a specific technology because patents can represent a firm's innovation activities [13]. However, using patent information such as citation flows or keywords is insufficient for identifying, selecting, and verifying business opportunities. This is because identifying business opportunities without non-technical information, such as on customers and markets, is hard to achieve.

B. Patents and Trademarks Co-Exploitation Method

On the other hand, as a complementary means to patents [8], trademarks can measure firms' innovation activities indirectly and may be used to search business areas effectively [7]. For this reason, this research will obtain additional information by exploiting patents and trademarks data together to identify new business opportunities that can improve a business portfolio's performance. For the consistency of portfolio analysis, each dataset was handled by a classification dimension. To do this, the International Patent Classification (IPC)—which indicates the characteristics of patents—and NICE classification—which explains the trademark type regarding goods and services—were used to extract useful information.

III. Research Framework

A. Data

The target of the analysis is TBS firms in the IT industry. They have not only continued to make profit based on the IT industry over the decades but also have high demand for investigating business opportunities within the competitive IT industry.

This paper selected the world's top 100 IT service firms based on the report entitled "IT Services Top 100," which was published by Top 100 Research Foundation. Then, we collected data on patents and trademarks from the United States Patents and Trademark Office (USPTO). The application dates (01/01/2006–12/13/2013) and applicants described in the report were used as the search criteria.

For the pilot test, we collected 32,099 instances of patent data and 3,526 trademark data observations based on the top 20 firms.

B. Research Process

The overall research process consists of five steps, as shown in Fig. 1.

Firstly, we collected patent data for technology-based firms from the USPTO. Secondly, their patent portfolios were categorized based on the IPC. Thirdly, the patent portfolios were compared using a Euclidean distance method and the competitors with the most similar technological assets were selected. Fourthly, we collected trademark data for companies with similar technological assets. Finally, trademark portfolios were developed and analyzed to see if there were any new, feasible services for the target firm, as services provided by competitors with similar technological assets are commonly perceived as new business opportunities.

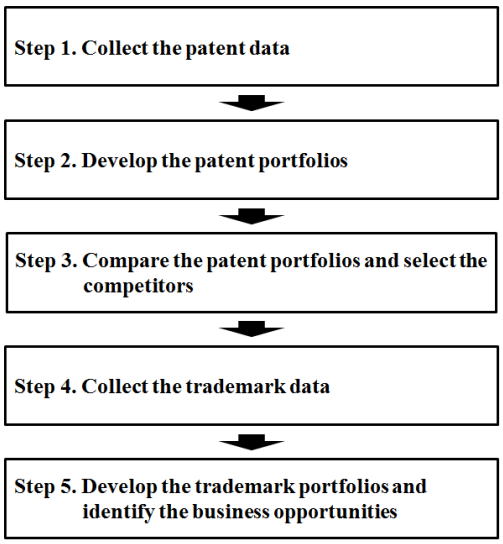

Fig. 1 Research process

IV. Results

A. Development of Patent Portfolios

Among the patent data obtained from the studied IT service firms, portfolios were developed by extracting information about IPC codes. The IPC codes confirmed that data with 422 major categories and 9,541 sub-categories for representing technical characteristics were collected. In the next step, each portfolio was utilized as a vector.

B. Selection of Competitor

The number of patents for each respective IPC was not appropriate to identify competitors due to differences in company sizes. Therefore, in this study, we identified competitors through the similarities in technology classifications for a company's own patents, rather than the size of the company's patent assets. Firstly, the vector value of the respective IPC was calculated using IPC centrality. The centrality was derived from the ratio between the number of patents in a specific IPC to the number of total owned patents.

Then, the similarities were calculated by using the IPC vector values of the respective firms. To do this, we chose the Euclidean distance, which is commonly used to measure similarity. Thus, the value of similarity was calculated using (1):

$$\sqrt{(p_1-q_1)^2+(p_2-q_2)^2+\cdots+(p_n-q_n)^2}=\sqrt{\sum_{i=1}^{n}(p_i-q_i)^2} \quad (1)$$

The Euclidean distance measure is useful in datasets with multiple factors. Table I shows the form of technological similarity of the respective IPC vector between two specific firms in this research.

TABLE I
CALCULATION OF TECHNOLOGICAL SIMILARITY

Class	Firm A	Firm B
IPC_1	p_1	q_1
IPC_2	p_2	q_2
. . .	. . .	. . .
IPC_n	p_n	q_n
Total	1	1

Consequently, a similarity rank for all twenty firms can be calculated. The similarity value is the average among the top 4 firms of the value between each firm and the other 19 firms. In other words, to acquire correct analysis results, it is essential to consider that the number of observations for a firm is not equal to the others when a specific firm must be extracted as a sample.

To this end, a concept of efficiency was applied. As in Table II, this analysis step refers the number of patents that were collected in the previous step (i.e., patent stock). In short, if the firm has a higher similarity value with other firms, even if it has a lower quantity of patents than any other firm, it is reflected in the selection of evaluation objects that the firm tends to share its core technical properties with other firms. In this context, firm B is measured to represent the largest difference between the rank based on number of patents and similarity value–based rank.

In the next step, we analyzed 4 firms that have similar technical features to firm B.

TABLE III
SELECTION OF SUBJECT OF APPRAISAL

Firm	Similarity rank	Patent stock rank	Final rank
A	16	18	5
B	**3**	**10**	**1**
⋮	⋮	⋮	⋮
T	15	13	13

C. Creation of New Business Opportunities

We synthesized trademark application data from the firms that were extracted. Then, we identified trademark information that indicated each firm's business goals. At this point, criteria of five levels were applied to investigate business opportunities by level. Although the evaluation object cannot enter specific business areas, the area has high growth potential, according to the number of competitors with similar technology assets. Simply, the business area is likely to satisfy both the technology value that firms can provide to customers and the economic value that customers require in the market.

Table III is a result of these approaches. We can identify that "Class 40" is the most profitable business area. "Class 40" represents "treatment of materials" and involves mechanical treatment, chemical treatment, and transformation of raw materials. Their competitors have applied services, including: (1) manufacturing services for semiconductor wafers and chips, microprocessors, memory chips, print circuits, or other semiconductor devices for others; (2) customized digital printing of marketing tools for retailers; and (3) laser scribing for metals and semiconducting materials. Thus, the results can be used as reference data when establishing a business strategy.

TABLE III
TRADEMARK CLASSES OF FIRMS

# of firms	Classes
4	40
3	none
2	2, 5, 6, 11, 43
1	1, 3, 4, 8, 10, 14, 15, 17, 18, 19, 20, 21, 21, 22, 24, 26, 27, 29, 30, 31, 32, 33, 44
0	23, 24

V. CONCLUSION

A. Main Findings

This paper analyzed firms with similar features by using patent and trademark portfolios. Then, we proposed a method for investigating new business opportunities. Also, the service industry based on IT technology has various factors: customers, technology, services, and markets can be acted upon multiply and were used as the targets of the pilot test. Consequently, we categorized the technology assets and size of each firm according to the IPC and their number of patents, which described the firms' technical features. Second, we comprehended the target market for trademarks in TBS firms with similar technology features. Accordingly, we not only estimated the market size of the assessment target and markets in which firms focused but also estimated the trademark size of goods and services for firms nominated in the field. Third, we investigated whether each firm entered each particular market and identified their level of interest. On that basis, we suggested a plan for strategic choices.

B. Implications and Limitations

The proposed methodology has certain implications. We identified business opportunities through patent data, which represented technology, and trademark data, which represented the market. Patents were used as useful technology assessment indicators. However, the information variable extracted from the patent data was limited. Accordingly, patent data have been combined with new types of data, such as research papers, or analyzed based on theories from other fields. Although massive amounts of data exist for trademarks, related research has not performed on trademarks. Thus, the use of trademark data is expected to have high research value.

This research will also have practical contributions for the following reasons. While market research that depends on expert advice or customer surveys has limitations based on cost and time, patent and trademark databases can be accessed anywhere and at any time. Second, this paper did not investigate simple topics, such as whether competitors exist or not, but it can provide various decision-making opportunities by identifying business opportunities at the business level. For this reasons, the proposed methodology can be a useful tool for establishing a strategy. However, we need to update the detailed process in further works because this paper is one of the earliest attempts to adopt patent and trademark databases.

First, we used Euclidean distance to compare technology assets based on IPC. Additional verification is needed on whether Euclidean distance can be applied to anomalous data analysis. Second, we will consider whether subspecialized information can be extracted from the data because the NICE classification used in trademark analysis contains various fields.

C. Future Directions

To summarize, considering the implications and limitations of this study, further research needs to consider techniques to measure the technological similarities between companies, while exploring and taking advantage of methodologies that can be further broken down to a NICE classification.

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