

# Who Search for Research Grant for What and When?

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## Abstract

We analyze access logs of the research grant search engines in our university to understand researchers' needs for funding opportunities. Through an analysis of university grant search engine access logs, we present (1) the features of popular grants for researchers, (2) the reasons for grant needs, and (3) the timing of grant seeking. Our analysis of the data suggests that larger number of researchers look for small-scale funding opportunities and the researchers often want budgets for indirect-research purposes such as human development, publication, and holding of conferences. The results show that researchers' needs for funding opportunities can be comprehensively and cost-effectively investigated using access logs to design and improve university research administration/promotion services without direct communication with the researchers.

*Keywords:* funding opportunity, log analysis, research administration, service design.

## 1 Introduction

The Japanese government introduced university research administrator (URA) systems into five universities in 2011. Since then, the number of URA systems has steadily increased in Japan. The more popular URA systems become, the greater the expectations of university executives for URA system contributions to the promotion of research activities.

Japanese URA systems remain in the early stages of application. Academic researchers are not yet familiar with URA systems. Additionally, URA system developers do not have a clear vision of the systems' functions as a researchers' tool. Therefore, Japanese universities must design and develop proprietary URA systems suitable for their particular research environment. The design of useful services requires the observation of potential customers to obtain insights as to customer needs [1, 2]. However, few Japanese URA systems have sufficient understanding of the work of researchers, their thought processes, and what they lack and require in their research activities. There are some reasons for that.

The first problem is an approach to understand researchers. As a basis for the introduction of the URA system, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) conducted a large-scale survey on Japanese university researchers to understand the obstacles to their research activities [3, 4]. The survey summarizes the researcher

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problems. However, the survey represents a macro analysis; therefore, URA system developers must develop additional questionnaires or interviews to grasp the more concrete and precise needs of researchers to provide expected services.

Another problem is the cost of more in-depth observation. The number of researchers in any university exceeds the capacity of many URA systems. Additionally, different researchers have different needs. The needs depend on factors such as the researchers' disciplines, their affiliations, and the project size. Therefore, it is difficult for small and busy URA organizations to monitor or survey many researchers in various fields exhaustively and intensively.

This paper examines a light-weight but intensive observation method to understand researchers' activities and needs for funding opportunities. Funding opportunity support is one URA mission that university executives wish to exploit. However, unfortunately, URA systems have limited information concerning how and why researchers look for grants with the exception of MEXT Grants-in-Aid for Scientific Research (KAKEN-HI), which is the most major research grant in Japan. This paper monitors researcher funding activities using access logs from our university's grant search engine. Search engine log analysis is popular in Web mining and search research field to examine search users' activities and potential needs [5, 6]. The search engine stores a substantial amount of access data on the type of funding opportunity information that researchers seek and view at the university. That is, the logs reflect the researchers' needs with respect to funding opportunities. Therefore, the log analysis can provide comprehensive knowledge of researcher needs without direct communication between the URA systems and the researchers.

In summary, the contributions of this paper are: (1) we introduce a grant search engine log analysis to understand researchers' activities and needs for funding opportunities exhaustively and effectively. (2) We examine how and why researchers in our university seek funding opportunities using the log analysis. We present attractive grant features from the perspective of the researchers, the purpose of the grants, and the timing of researcher grant seeking. (3) We discuss applications and service design implications for research administration/promotion based on the grant search engine log analysis.

## 2 The University Grant Search Engine

Our university gathers funding opportunity information independently and stores the data in a database accessed by a search engine. Typically, funding agencies notify various departments in the university of new funding programs depending on the discipline categories (e.g., natural science, medicines, or arts and humanities) or the funding purposes (research or education). In our university, these notifications are obtained by administrative headquarters and stored in the search engine on a daily basis.

Our grant search engine has a set of Web pages that consist of three parts: (1a) a search form, (1b) a list of search results, and (1c) a details page for each funding opportunity. Moreover, (2) users can subscribe to search results and be notified via email when a new funding opportunity arises that matches their specific conditions.

The search form is depicted in Figure 2. There are five main input fields as follows: (a) keyword search, (b) targeted funding discipline area, (c) funding purpose, (d) budget amount, and (e) whether closed application is required. Here, the entries for (b) and (c) allow multiple choices, and (c) also includes "Young researchers" and "Education". Although not a research discipline area, (c) is for the benefit of the end-user. (d) has two sub-fields

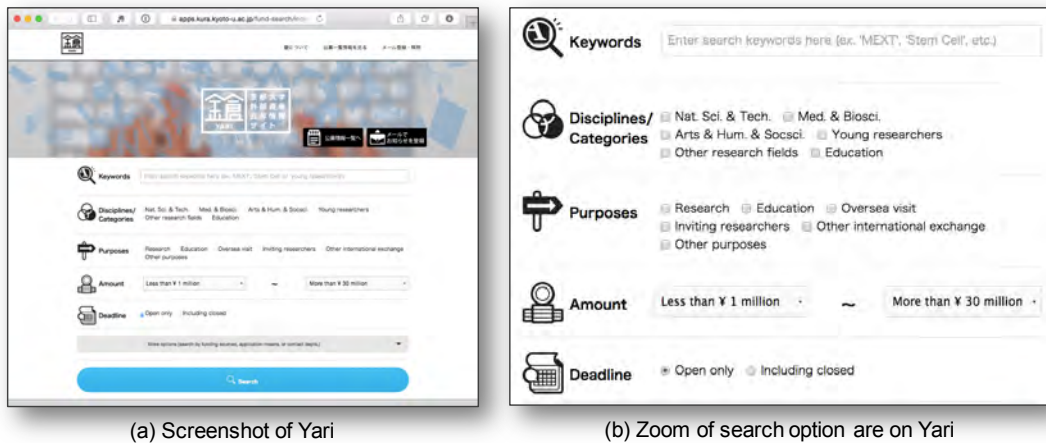


Figure 1: Web search form of grant search engine.

Table 1: Number of stored funding opportunity information (by 6 December, 2015).

| Types of funding opportunity                   | Number |
|--|--------|
| Government research grant                      | 377    |
| Non-government research grant                  | 701    |
| Non-government grant for international matters | 183    |
| Awards   | 160    |
| Scholarships                                   | 58     |
| Others   | 107    |
| Total  | 1,586  |

indicating the range of the budget amount. The lower and upper bounds are chosen from the following: less than 1 million JPY (approximately 1,000 USD), 1 million to 5 million JPY (1,000 to 5,000 USD), 5 million to 10 million JPY (5,000 to 10,000 USD), 10 million to 30 million JPY (10,000 to 30,000 USD), and more than 30 million JPY (30,000 USD).

### 3 Understanding on Researchers' Needs through an Analysis on Search Engine Access Logs

To understand researchers' activities and needs for funding opportunities, we collected a set of grant information and access logs from our grant search engine. The collected data were generated for the period between June 15, 2014 and December 6, 2015. We eliminated access log cases where administrators had accessed the search engine to register funding opportunity information.

The basic statistics from our search engine are shown in Tables 1 and 2. Table 1 shows the total number of funding opportunity information records stored in the grant search engine. Table 2 shows the frequency of user access to the search engine. In Table 2, the number of page view for search represents the frequency of search engine requests. This number includes the cases where the users searched using filtering options such as budget

Table 2: Access statistics to the search engine (by 6 December 2015).

| <b>Types of access pages</b>            | <b>Frequency</b> |
|---|------------------|
| Page view for search (search frequency) | 47,937           |
| Search <i>with</i> keywords             | 7,881            |
| Search <i>without</i> keywords          | 40,056           |
| Page view for detail pages              | 33,658           |
| Other pages                             | 32,519           |
| <b>Total page view</b>                  | <b>114,114</b>   |

Table 3: Access frequency according to the type of funding agency (FA). Avg. of frequency per f.o. means the average access frequency per funding opportunity on each FA type.

| <b>FA type</b>                                 | <b>Frequency</b> | <b>Avg. of frequency per f.o.</b> |
|--|------------------|-----------------------------------|
| Government research grant                      | 5,621            | 14.91                             |
| Non-government research grant                  | 16,864           | 24.06                             |
| Non-government grant for international matters | 4,233            | 23.13                             |
| Awards   | 2,821            | 17.63                             |
| Scholarships                                   | 1,770            | 30.52                             |
| Others   | 2,349            | 21.95                             |
| <b>Total</b>                                   | <b>33,658</b>    | <b>21.22</b>                      |

filter and purpose filter.

The grant search engine access logs represent the search behaviors of the users with respect to funding opportunity information. Therefore, the access log analysis can provide insights into how and why researchers search for funding opportunities.

Below, we discuss the following questions: (1) What grants are popular for the researchers like? (2) For what purpose do the researchers intend to use grants? (3) When do the researchers need the grants?

### 3.1 High demand features

The need for grants varies depending on the research discipline, purpose, and researcher status. To grasp researchers' needs for grants, we examine (1) the grant information pages that the researchers typically accessed and (2) the filter options typically used during search.

Table 3 shows the access frequency statistics according to the type of funding agency. We found that 83.3% of the total volume of accesses focused on non-government funding opportunities (28,037 / 33,658). Also, in terms of the average frequency per funding opportunity, the statistics shows that ones of non-government research/international-matter grants and scholarships are much higher than the one of government research grant. This suggests that a large number of researchers consider company/private foundation grants, whereas many URA staffs try to provide application supports on government research grants.

Figure 2 lists the top 20 funding opportunity information pages that the researchers accessed on our grant search engine. According to the figure, many of popular opportunities

| Rank | Fund opportunity name   | Page View | Peak Month | Sparkline |
|------|---|-----------|------------|-----------|
| 1    | Inamori Foundation Research Grant (2016)                                | 504       | Jun 2015   |           |
| 2    | Kyoto University Foundation Grant (2015)                                | 356       | Oct 2014   |           |
| 3    | Swiss National Science Foundation - International Collaboration Support | 353       | Apr 2015   |           |
| 4    | Inamori Foundation Research Grant (2015)                                | 311       | Jun 2014   |           |
| 5    | Itoh Chubei Fund Research Grant (2015)                                  | 248       | Nov 2014   |           |
| 6    | Academia Sinica Tang Prize 2016   | 245       | Jul 2015   |           |
| 7    | Mitsubishi Foundation Science Grant (2015)                              | 231       | Dec 2014   |           |
| 8    | Naito Foundation Scholarship & Research grant (2015)                    | 228       | Apr 2015   |           |
| 9    | Ministry of Health, Labour and Welfare - AMED Research Grant (2016)     | 213       | Jan 2015   |           |
| 10   | Harvard-Yenching Institute Scholarship (2016/2017)                      | 209       | Jun 2015   |           |
| 11   | Itoh Science Foundation Research Grant (2015)                           | 208       | Apr 2015   |           |
| 12   | JST Sakigake  | 197       | Apr 2015   |           |
| 13   | Itoh Chubei Fund Research Grant (2016)                                  | 197       | Oct 2015   |           |
| 14   | Yoshida Science and Technology Foundation - Dispatch support            | 196       | Apr 2015   |           |
| 15   | Uehara Memorial Foundation Research Grant (2015)                        | 193       | Jul 2014   |           |
| 16   | Kyoto University Foundation Grant (2016)                                | 184       | Oct 2015   |           |
| 17   | The Japan Foundation Program  | 180       | Apr 2015   |           |
| 18   | Inoue Science Foundation Research Grant (2015)                          | 179       | Apr 2015   |           |
| 19   | Sumitomo Foundation Basic Science Grant (2015)                          | 179       | Jun 2015   |           |
| 20   | Pease Nakajima Foundation International Research Grant (2016)           | 176       | Sep 2015   |           |

Figure 2: Top 20 popular funding opportunity information pages on our grant search engine. The page view represents the frequency of researcher access. The peak month means when each grant was accessed with highest frequency. The spark line indicates when and how often each page was accessed during the period June 2014 to December 2015. Grants with blue sparkline, ones with green sparkline, and ones with orange sparkline mean non-government research grants, non-government grants for international matters, government research grants, respectively.

are company/private foundation grants. Additionally, the result suggests that some of funding opportunities could be intensively accessed at same time point every year (e.g. Inamori Foundation Research Grant (around June), Kyoto University Foundation Grant (around October), and Itoh Chubei Fund Research Grant (around October and November)).

Figure 3 illustrates the research areas that users specified to narrow down the list of grants (users could specify multiple research areas simultaneously). According to Figure 3, the frequency in the use of the *life science* filter or the *science and engineering* filter was greater than the use of the *humanities and social science* filter (12,201, 14,638 > 5,476). This suggests that the main users of our search engine are scientific researchers. On the other hand, a substantial number of humanities and social science researchers sought fund-

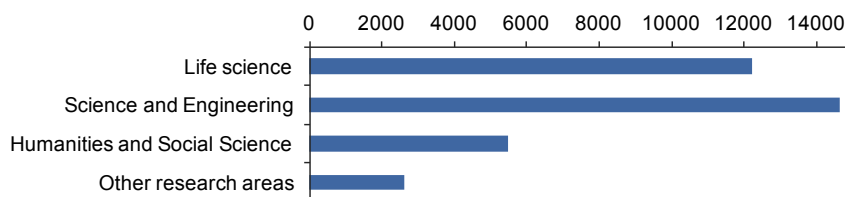


Figure 3: Search frequency and the use of specific research area filters.

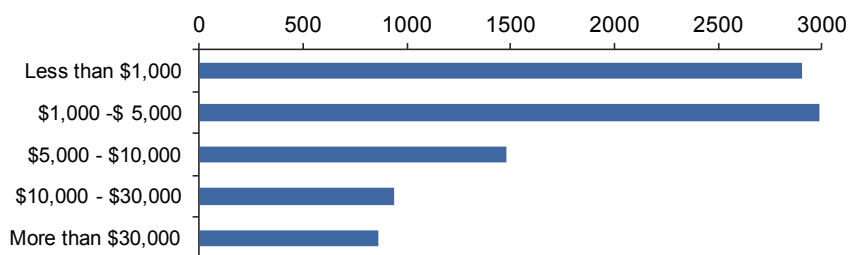


Figure 4: Search frequency in the use of specific budget filters.

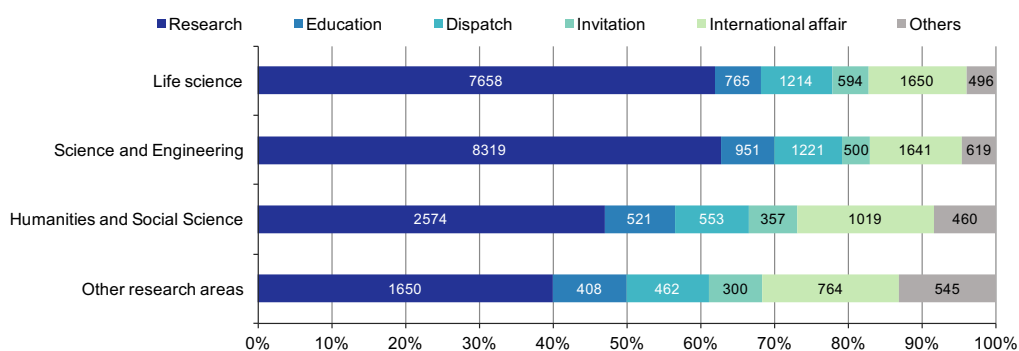


Figure 5: Search frequency with purpose filter for each research category.

ing opportunities, although URA systems often consider that the researchers in these fields have less of a need for research funding.

Figure 4 shows the budget scale that the users applied to narrow down the list of grants (users could specify multiple budget scales simultaneously). According to this figure, more users searched for grants with smaller budget scales. We conjecture that a large number of researchers require grants with relatively small budgets, which the URA systems often ignore to save effort.

### 3.2 Grant use

For what purpose do researchers try to obtain grants? To answer this question, we analyzed how often each of purpose filters was used to search for funding opportunities (e.g., research, education, dispatch, invitation, and international affairs). Figure 5 shows the search frequency for the simultaneous use of specific purpose filters and research category filters. The purpose filter varies among science/engineering and humanities/social science. The most popular purpose filter for life science and science/engineering was *research* and represents a large portion of the search volume (7,658 = 62.1%, 8,319 = 62.8%). However, for humanities/social science, the *research* purpose filter was the most frequently applied (2,574 = 46.9%) whereas the *non-research* purpose filter was used in 53.1% of the searches.

For a deeper understanding of the purpose of funding opportunities for researchers, we analyzed the logs of the keyword queries which users issued to the search engine. Query log analysis is popular in the Web search and data mining field, and many studies discuss the methods of query log analysis to understand the intent of search engine users [7, 8].

Table 4: Keyword query classification.

| Query category             | Frequency | Top 10 queries   |
|----------------------------|-----------|--|
| Grant/FA name              | 4,222     | Uehara, Inamori, Naitoh, Kaken-hi, A-STEP, Sumitomo Foundation, Ishizue, Inoue, SPIRITS  |
| Research topic             | 1,730     | environment, biology, regional research, energy, economics, Wakasa bay, cancer, health, chemistry nuclear power  |
| Use of grant               | 703       | oversea study, graduate student, international, dispatch industrial collaboration, international conference, publication, invitation, human development, symposium |
| Eligibility for applicants | 170       | young researcher, foreigner, female recommendation letter, postdoc, honorable professor fellow, graduate student, doctoral student, master student                 |
| Research site/partner      | 142       | Asia, Taiwan, Harvard, Africa, England Swiss, Strasbourg, Germany, Brunei, U.S.  |

We manually classified the 7,881 queries into the following seven categories: *grant name/FA name*, *grant name/FA type*, *research topic*, *use of grant*, *eligibility for applicants*, *research site/partner*, *miscellaneous*, and *unknown*. The category *grant/FA name* is a set of queries concerning grant names, funding agency names, or parts of grant names. Queries in the category *research topic* are, for example, iPS cell and fuel battery. Queries in the category *applicant eligibility* include age and title. The category *research site/partner* suggests where the researcher would study or with whom they would study, such as Asia or Stanford University. We categorized other queries as *miscellaneous*. If queries were difficult to understand, we categorized them as *unknown*.

Table 4 shows the results of the query classification and the top 10 popular queries in each query category. According to this table, most of queries belong to the categories *grant name/FA name* (53.6% = 4,222) and *research topic* (22.0% = 1,730). It is obvious that queries in these categories are often used. On the other hand, queries in the category *use of grant* are informative to understand researchers' needs for grant usage. This category represented a smaller percentage than the categories *grant name/FA name* and *research topic* (8.9% < 53.6%, 22.0%). However, once taking a look at query keywords in detail, we get some insights to researchers' needs. As Table 4 shows, many of the queries in the category *use of grant* were not directly related to research content but important for keeping or promoting research (e.g., overseas study, publication support, and proof reading). URA systems often consider the purchase of research materials such as reagents, laboratory equipment, computers, and books. Our query log analysis suggests other possible grant uses and hints at expected research support.

### 3.3 The timing of research opportunity seeking

To understand when the researchers look for funding opportunities, we aggregated the access logs by time.

Figure 6 shows the trend in the search frequency with specific purpose filter by month. According to this figure, as for any purpose, the search frequency trend has the biggest spike in April 2014. In Japan, most researchers apply for the most popular research grant,

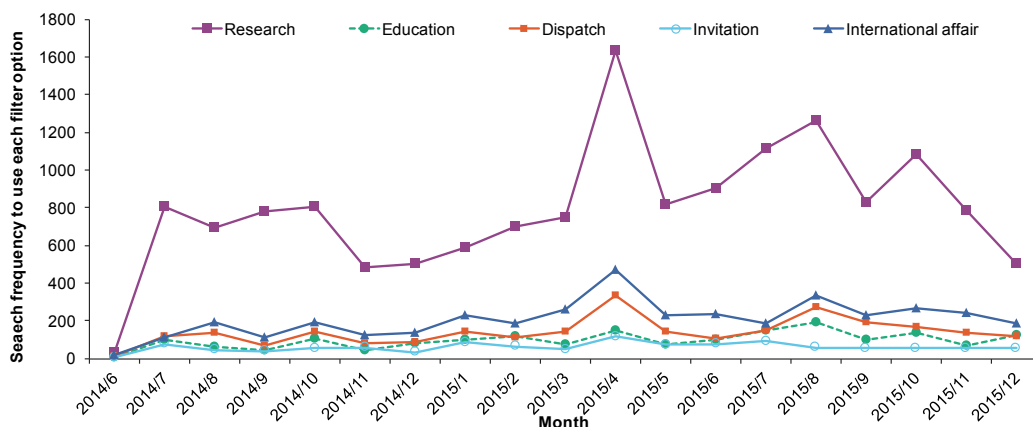


Figure 6: Search frequency and the use of specific purpose filters over time.

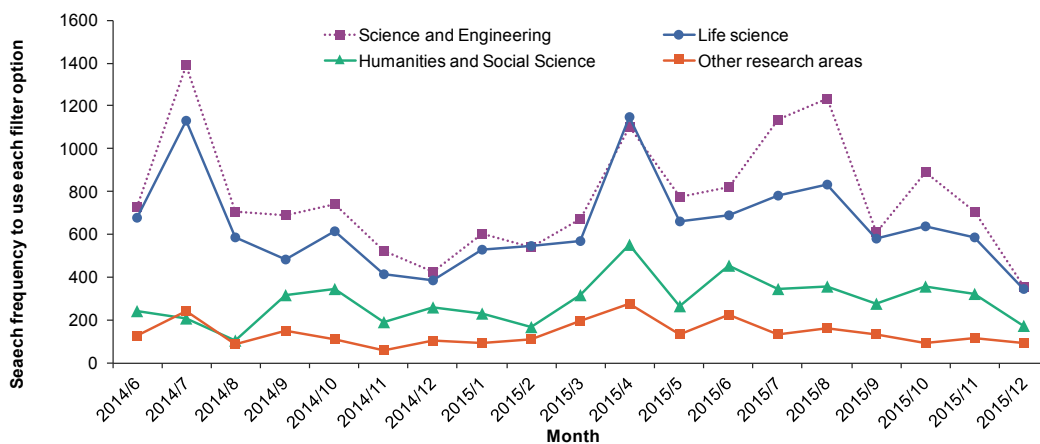


Figure 7: Search frequency for specific research area over time.

*KAKEN-HI* and they get notification of acceptance in the beginning of April. We guess from the result that the spike in April suggests that rejected researchers looked for alternative research grants. Another finding is that there are some peaks on July 2014, October 2014, August 2015, and October 2015. From our experiences of research administration, the peaks in October indicate that researchers prepared for *KAKEN-HI*. However, we have no ideas on what happened around on July 2014 and August 2015.

For deeper observation, we have examined the trend in the search frequency for each research area by month. The trend is illustrated on Figure 7. The figure shows that the peaks around July 2014 and August 2015 are unique to *science/engineering* and *life science* research categories. We guess from this result that application screening notifications of the popular funding opportunities in those categories like *Strategic Basic Research Programs*<sup>1</sup> would come to researchers around July and August, but we need to validate our inference by obtaining a larger amount of data over a longer time span.

<sup>1</sup>Strategic Basic Research Programs: <http://www.jst.go.jp/kisoken/en/index.html>



### 3.4 Post survey for researchers

In order to validate the results on our log analysis, we interviewed 7 academic researchers. The four researchers were from engineering fields, and the three researchers were from social science and humanities. Their ages spread from 20's to 30's, and their titles ranged from postdoc to associate professor, respectively. We asked them the following questions: (1) which types of research grants do they often consider applying for?, (2) when do they often consider applying for the grants?, and (3) for what purpose do they apply for the grants?

Regarding grant types, all interviewees answered that they seriously considered application for MEXT KAKEN-HI, the most popular governmental research grant in Japan. The second popular grant category to them was non-governmental funding opportunities such as grants aided by companies and foundations. The interviewees said that they sometimes applied for the non-governmental funding opportunities, although they were not as deeply conscious of the opportunities as the KAKEN-HI. On the other hand, they were not interested in awards and scholarships as research grants. To understand why non-governmental grants were preferable, we asked the interviewees the merit of the grants. As a result, the biggest advantage was budget's ease of use. Moreover, most interviewees pointed out that it was attractive to carry over budgets on some non-governmental grants. Furthermore, half of them said that they have much more opportunities to apply for non-governmental grants through the year than governmental ones.

With respect to timing to consider the application, most interviewees mentioned March, April May, September, and October as busy season. These opinions correspond to the findings on Fig 6. Most of the interviewees said that October was the season of KAKEN-HI. They also commented that they often searched for other grants in April and May because they received the reject notification of the KAKEN-HI in April. One interviewee explained that many grant opportunities appeared at the beginning and end of a fiscal year, encouraging him to consider the application for the grants. Another researcher reflected that every time joining an annual academic conference at a certain time, he was motivated to apply for the grants. Half of the interviewees said that they wanted additional research budgets when coming up with new research projects.

The interviewees told us that they have various purposes to apply for research grants. The purposes were categorized to three: (1) for experiment (purchase of experiment materials, facility fee, rewards for subjects, market survey, etc.) (2) for achievement publication (proof reading, book publication, travel expense for conference presentation, etc.), (3) for research meeting (travel expense), and (4) others (hosting of research conference, dispatch of researchers, etc.). Moreover, the 6 of 7 interviewees commented that they often searched for 1-5 million-yen grants to cover the above purposes (whereas the one interviewee preferred 10-30 million yen grants). In comparison to Table 4, we found that the results of our query log analysis could predict some of the interviewees' grant use like proof reading, and dispatch of researchers, and travel expense.

## 4 Discussion

Through the analysis of the 19-month access logs of our grant search engine and our post-interview for 7 researchers, we found that researchers who used the search engine exhibit the following with respect to grants:

- Demands for funding opportunities sometimes sharply increase at specific period, although researchers in any field are seeking funding opportunities all year around.
- Many researchers look for small budget grants. Also, many of the sought-after grants are non-governmental, such as those provided by companies/private foundations.
- Some researchers look for funding opportunities for overseas travel, researcher dispatch abroad, publications, English proof reading, and invitations to foreign researchers.

We consider that our access log analysis is imperfect. We need to take it into account that the access logs reflect the behaviors and needs of all researchers with respect to funding opportunities, although we validated the results of our log analysis by interviewing 7 researchers. Additionally, even if that is the case, for more precise and comprehensive analysis the users require monitoring for a longer period to collect a larger amount of access logs. However, our access log analysis requires less investment in terms of time and effort. Additionally, the analytical result is helpful in getting insights to improve research support services. For example, the following actions are recommended considering the results from our study:

#### *4.0.1 Determining the timing of intensive application support*

In terms of grant application supports, URA staffs usually provide intensive support for *KAKEN-HI* in October, whereas they provide on-demand support for other grants. The reasons for this include the fact that the URA staffs have few information concerning when high demands for funding opportunities appear. Fortunately, the analytical results highlighted which grants were popular among researchers and when the researchers struggle to look for funding opportunities. These findings are very useful for resource allocation planning.

#### *4.0.2 Internal programs for specific needs*

For specific needs such as proof reading and overseas travel, designing internal programs can improve research efficiency and effectiveness. For example, our URA office designs a special program for English proof reading and provides researchers with associated budgets. Using this program, the researchers in our university obtain proof reading services even if they miss external grant opportunities.

#### *4.0.3 Funding opportunity recommendation*

Recommendations and predictions concerning specific researcher preferences would be facilitated by more precise and richer needs information, often called information recommendation. A substantial number of related works in the research field discuss information retrieval [9, 10]. The introduction of an authentication system into our grant search engine would ensure a more precise and richer needs analysis. An authentication system can obtain accurate data as to who is seeking funding opportunities and the grants that they require.

## **5 Conclusion**

To understand researchers' needs for funding opportunities, we studied the possibility of access log analysis of our grant search engine. Although the access log analysis was not

sufficiently perfect to understand researcher needs, we obtained insights concerning (1) the features of high demand funding opportunities, (2) grant use, and (3) the timing of grant seeking. This study found that access log analysis is a useful tool in understanding researchers' needs for funding opportunities comprehensively, quickly, and cost-effectively.

There are some challenges in putting this approach into practice. For example, larger amounts of access log data on the grant search engine for a longer time would provide a superior analysis. Additionally, it is important to design better research support services based on the analysis. In Japan, URA systems are often designed to provide services without grasping the researchers' needs. Consequently, the URA systems are struggling to achieve effective results. We believe that our work can contribute to Japanese URA system advancement.

## References

- [1] T. Brown, "Design Thinking", Harvard Business Review, June, 2008, pp. 84-92 .
- [2] M. Stickdorn and J. Schneider. This Is Service design thinking: Basics, tools, cases, BIS Publishers, 2011.
- [3] Y. Kanda, and T. Kuwahara, "Shrinking Research Time for University Faculty Members Comparison of 2002 and 2008 in the Survey on Full-Time Equivalents at Universities", NISTEP Discussion Paper, No.80, 2011 (in Japanese).
- [4] National Institute of Science and Technology Policy, "Analytical Report for 2013 NISTEP Expert Survey on Japanese S&T and Innovation System", 2013; <http://www.nistep.go.jp/en/?p=3449>.
- [5] I. Weber and C. Castillo, "The Demographics of Web Search", Proceedings of the 33rd international ACM SIGIR conference on Research and development in information retrieval (SIGIR 2010), 2010, pp. 523–530.
- [6] I. Weber and A. Jaimes, "Who Uses Web Search for What: and How", Proceedings of the fourth ACM international conference on Web search and data mining (WSDM 11), 2011, pp. 15–24.
- [7] Andrei Broder, "A taxonomy of web search", ACM SIGIR Forum, vol. 36 no. 2, pp. 3-10, 2002.
- [8] J.R. Herskovic, L.Y. Tanaka, W. Hersh, and E.V. Bernstam, "A day in the life of PubMed: Analysis of a typical day's query log", Journal of the American Medical Informatics Association, vol. 14, no. 2, 2007, pp. 212-220.
- [9] P. Resnick, and H. Varian, "Recommender systems", Communications of the ACM, vol. 40 no. 3, 1997, pp. 56-58.
- [10] Y. Koren, R. Bell, and C. Volinsky, "Matrix factorization techniques for recommender systems", IEEE Computer, vol. 42, no. 8, 2009, pp. 30–37.