A Study on the Provision of National R&D Information Service through User Analysis

Nam Gyu Kang, Kyung Tae Lim and Kwang Nam Choi
Korea Institute of Science and Technology Information, 245 Daehak-ro,
Yuseong-gu, 34141 Deajeon, Korea

Abstract: The NTIS has a very high used according to the accumulated page views over the last 10 years but whether it can be used easily and conveniently by users must be reviewed. This study will find the issues of NTIS by analyzing its service structure status and usage by user types. In the current NTIS service, users must access several different services to access the functions because it is structured by national R&D information and this study analyzes status of NTIS service and authority System and then classifies NTIS functions by the purpose of service use. To survey the usage status of NTIS, this study utilized Google analytics functions. The survey period is 3 months and the range is the entire NTIS service. The NTIS main portal was used the most, followed by project management service. Usage status analysis shows there are clearly distinctive characteristic by user type but they are not huge enough to influence the service. And it is difficult to distinguish frequently used functions and unused functions by user types. Several noticeable characteristics by user types are as follows. Department/project managing institutions users used project management service and national R&D standard information management service more than other services to manage national R&D information. Also, this type of users mainly used functions such as assignment search, statistical information and restricted information. Researchers often used functions of registering and managing research facility and equipment as well as searching scientist/engineer registration numbers and similar assignments. For company users and general users, only the performance search was added unlike other user types and other characteristics were not found. If NTIS improves its service as suggested in this study, service users will be able to search and view various information through integrated search, easily access the functions to use during R&D activities and use the NTIS easily and conveniently through stronger personalized functions.

Key words: NTIS, national R&D information, user type, usage status, Google analytics, service improvement plan

INTRODUCTION

NTIS (National Technology Information Service) which started as a trial service from 2008 is used to manage, view and analyze national R&D information by various user types such as science and technology policy-makers, researchers, departments/project managing institutions, businessmen, etc. (Anonymous, 2017). The accumulated page views until 2016 were 216 million which is about 138 views when converted into the page view per person a year, showing a high level of use. Likewise, although, it has a high level of use, it is necessary to review whether the NTIS is provided easily and conveniently to various users such as department/project managing institutions, researchers,

businessmen, etc., regarding the service structure. It is because the responses of customer satisfaction survey that is carried out twice a year and NTIS training that is held twenty times have been "NTIS is difficult and complicated", "I don't know what kind of information there is" and "I don't know what kind of information is provided".

To increase the connectivity and accessibility of national R&D information, NTIS expanded integrated search range and strengthened the connections of project-assignment-performance-personnel-research facility and equipment information in 2015. It also unified the UI of detailed view of each information and improved the service by gathering the reports and statistical information spread throughout within the NTIS, it

Corresponding Author: Nam Gyu Kang, Korea Institute of Science and Technology Information, 245 Daehak-ro, Yuseong-gu, 34141 Deajeon, Korea

improved to provide them in the same UI. It divided NTIS users into department/project managing institutions, university/government-funded researchers, corporate researchers and general users and started providing their frequently used menus only. Yet, despite such attempts at functional changes, no improvement has been made to service structure, still making NTIS inconvenient.

To make a plan to improve the NTIS service, this study will identify the current status of NTIS and analyze logs by user types to suggest a direction on how to constitute the system.

MATERIALS AND METHODS

Status of ntis service
Constitution of NTIS service: National R&D information contained in NTIS is classified into projects and assignments, personnel, performance and research facilities/equipment information based on national R&D information standard set by law and the NTIS service system is classified by national R&D information. That is, each different function is connected by links to the NTIS main portal (Lim *et el.*, 2008) as project/assignment information to project management service, personnel information to participating personnel information service, performance information to performance information service, research facility and equipment to national research facility and equipment management service, NTIS cloud that can analyze national R&D information issue R&D, research ecology map (Yang *et al.*, 2013, 2014; Kang *et al.*, 2015), national R&D standard information management service that can manage national R&D information, open R&D data, etc. Such service system is structured by the person-in-charge or institution that manages national R&D information, regardless of user needs or is classified for the convenience of budgeting activity to carry out NTIS projects as in Table 1.

Status of NTIS service: Project/assignment information can be searched and viewed in the project management service as well as provides the following information such

as R&D announcements to view the detailed plans of projects/assignments performed by each department or project managing institution, function to search for similar assignments to check whether there are similar or overlapping assignments that were already performed before a research proposes a project and restricted information to check whether one or one's affiliated institution has restrictions to participate in a national R&D project and survey analysis statistics to give the results of status analysis on national R&D projects/assignments.

In the participating personnel information service, users can search and view information on researchers participated in national R&D projects. The service also has an issue/view function of scientist/engineer registration number to identify individuals instead of resident registration numbers as well as a candidate recommendation for an evaluation committee member for fair, transparent project/assignment evaluation.

The main functions of performance information service are search/view of national R&D outcomes such as research papers, patents, research reports, etc. which are the results of national R&D activities while providing performance verification to check the authenticity of research papers and patents. The research facilities/equipment over 30 million KRW developed with national R&D budget must be registered on the NTIS as an obligation which is overseen by the national research facility equipment management service. This provides the function of registering, searching and viewing research facilities and equipment. NTIS offers an NTIS cloud service to meet the needs of sharing, opening and analyzing national R&D information; national R&D information can be downloaded, viewed and analyzed in real-time within the NTIS cloud environment (Kim and Jeong, 2016). Issue R&D provides national R&D and researcher information to help find and solve current social issues and problems from news (Kim *et al.*, 2015). Research ecology map analyzes national R&D status of user-interested fields mainly by researchers or research institutions and visualizes the results. Furthermore, the project manager or chief researcher of a

Table 1: Status of NTIS execution by institutions

Institution	Main items of execution	Provided services
Korea Institute Science and Technology Information (KISTI)	Activate the open share of science and technology infrastructure open, Promote the use of science and technology personnel information, Spread the joint use of R&D outcomes, etc	NTIS main portal, participating personnel information service, performance information service, NTIS cloud, issue R&D, research ecology map, national R&D standard information management service, open R&D data, etc
Korea Institute of Science and Technology Evaluation and Planning (KISTEP)	Strengthen the support system of national R&D project management	Project management service
Korea Basic Science Institute (KBSI)	Support the management of all cycles of national research facility and equipment	National research facility and equipment management service

department/project managing institution of national R&D projects directly register and view the project/assignment and performance and submit evidence data on the performance. Finally, open R&D data provides primitive data or open API related to national R&D to departments and project managing institutions (Kang *et el*, 2016).

NTIS authority system: Part B briefly examined the main services provided by NTIS and the functions included in each service. Can anyone use the functions provided by the NTIS? Most functions of NTIS can be used after one signs up as a member and logs in but some functions must be used with an access authority. In Table 2, lists functions that need authority by services and these functions are shown to all users regardless of having authority or not.

The current NTIS service provides independent services by national R&D information regardless of user

types and user needs such as departments/project managing institutions, researchers, company, etc. That is, since, NTIS is created by supplier-focused, it can expect to have feedback such as "It is inconvenient to use" and "It is difficult" as it provides the same service to all kinds of users.

Classification of NTIS functions by the purpose of service use: NTIS is a service to manage national R&D information and support R&D activities. R&D activities can be classified into the stages of planning/announcement preparation, request/select, perform, end/evaluate and analyze. However, in the current NTIS service, users must access several different services to access the functions needed in certain stages, because it is structured by national R&D information as in Table 3. For example, during the request/select stage of R&D activity, researchers must search assignments, view

Table 2: Access authority by service/functions

Service name	Function name	Needed authority
Project management service	Search restricted information	Project managing institutions, departments, etc
	Display performance evaluation information	Institution person-in-charge
	Information of entire period	Department
Participating personnel	Recommend a candidate	Project managing institutions, departments, etc
information service	For evaluation committee	Institution person-in-charge
National research facility and	Register facility and equipment	
equipment management service		
National R&D standard	Register project information	Departments
information management service	Register assignment information	Project managing institutions, chief researcher
	Register performance information	Project managing institutions, chief researcher
Company information service		Companies
Open R&D data	Open API	Project managing institutions
	Use national R&D data	Departments, project managing institutions

Table 3: Mainly used functions by R&D stage

Service/Functions	Planning/Announcment/Preparation	Request/Select	Perform	End/Evaluate	Analyze
Project management service					
Project/assignment search	□	□	□	□	
Performance evaluation information	□				
Evaluation information register				■	
Statistical information	○			○	○
Similar assignments		□			
Restriction information		●			
Policy information	○		○	○	
Announcement information	○				
Participating personnel information service					
Personnel search		□	□	□	
Scientist and engineer registration number		○			
Recommend a candidate for evaluation committee		●		●	
Performance information service					
Performance search	○	○	○	○	
Performance verification		○		○	
National **research facility and equipment management\service**					
Research facility and equipment search	○	○	○	○	
Equipment management		▼	▼		
Others					
NTIS cloud	□				□
Research ecology map	○		○		○
National R&D standard information management		▲	▲		
Primitive open data					●
Open API	●	●	●	●	

○ Can access even when not logged-in; □ Can access when logged-in; ■ Department users can access; ● Users of department or project managing institutions can access; ▲ Project managing institutions or chief researcher can access and ▼ Institution person-in-charge can access

statistical information and search similar information and restricted information in project management service and view scientist and engineer registration numbers in the participating personnel information service. Also, researchers must search the performance in performance information service, equipment in the research facility and equipment management service and use a research ecology map, NTIS cloud, etc. to identify the research ecology of the field related to the assignment and survey national R&D status. The person-in-charge in a project managing institution must view similar and restricted information in project management service for the proposed assignment, view detailed personnel information in the participating personnel information service and receive recommendation on an evaluation committee member needed for choosing an assignment. Also, performance verification function of performance information service must be used if verification is needed for a researcher's performance. Likewise, inconveniences exist as there are different functions to use by user types and several services must be accessed in a certain R&D activity stage.

RESULTS AND DISCUSSION

Analysis of ntis usage status: To survey the usage status of NTIS, this study utilized Google analytics function (Pakkala *et el.*, 2012). The survey period is 3 months from August 1st 2016 to October 31st 2016 and the range is the entire NTIS service. The analysis were results drawn from 47.52% of all sessions and excluded meaningless logs such as main page access. There were 758.327 users (including overlapped) for 3 months, the number of visits was 920,016 and the number of page views was 4.395,519. 84% of the path of entering NTIS was by directly entering the URL showing that NTIS had a high awareness.

In terms of usage status by service domain, the NTIS main portal was used the most, followed by project management service, participating personnel information, research facility and equipment management service, national R&D standard information management service and performance information service in order. The status of main functions by each service is as in Table 4. For project management service, project announcement, assignment/project search, etc. were used mainly while for participating personnel information, Scientist/Engineer Registration number and modify history information were used noticeably as in Table 5.

Table 6-11 lists commonly used functions by user types, showing survey results from not logged-in status

Table 4: Usage status by service domain

Domain	Usage status (%)	Page view
NTIS main portal	32.45	1,103,316
Project management service	14.01	476,389
Participating personnel information service	13.15	447,069
Research facility and equipment management service	11.75	399,610
National R&D standard information management service	3.03	102,972
Mobile NTIS	2.85	96,958
Performance information service	2.48	84,170

Table 5: Usage status by service (project management and participating personnel information)

Usage status of project information service	Values (%)	Usage status of participating personnel management service	Values (%)
Project announcement	50.35	Scientist and engineer registration number	73.98
Assignment search	27.70	Modify history information	21.22
Project search	7.74	Researcher search	3.13
Similar assignment search	7.11	Recommend a candidate for evaluation committee	1.16
Survey analysis statistics	2.75	Researcher status	0.26

Table 6: Usage status of non-login users

Functions (Service name-Function name)	Usage status (%)
Main portal-member information	20.53
Participating personnel information-scientist and engineer registration number	15.91
Project management-project announcement	11.77
Main portal-integrated search (integrated website)	11.22
Research facility and equipment-integrated search (facility and equipment)	6.42
Project management-detailed assignment	4.40
National R&D standard information management service	4.08
Participating personnel information-modify history information	2.63

Table 7: Usage status of department users

Functions (Service name-Function name)	Usage status (%)
Main portal-member information	16.18
Project management-detailed assignment	13.78
National R&D standard information management service	12.49
Project management-detailed project	7.87
Project management-project announcement	5.91
Project management-survey analysis statistics	5.82
Project management-similar assignment search	5.33
Project management-restriction information	5.29
Open R&D data	2.67

Table 8: Usage status of project managing institution users

Functions (Service name-Function name)	Usage status (%)
Main portal-integrated search (Integrated Website)	28.34
National R&D standard information management service	17.08
Main portal-member information	12.02
Project management-detailed assignment	9.80
Project management-detailed project	5.35
Project management-project announcement	3.45
Open R&D data	2.41
Project management-restriction information	2.40
Project management-survey analysis statistics	2.18

and researchers (university and government-funded) to companies, project managing institutions departments and general users. Regardless of the user types, member

Table 9: Usage status of research users

Functions (Service name-Function name)	Usage status (%)
Research facility and equipment-facility and equipment manage	20.97
Main portal-integrated search (integrated website)	19.69
Main portal-member information	15.86
Project management-detailed assignment	10.30
National R&D standard information management service	6.66
Research facility and equipment-integrated search (facility and equipment)	2.76
Participating personnel-scientist and engineer registration number	2.26
Research facility and equipment-facility and equipment register	2.09
Project management-similar assignment	2.01

Table 10: Usage status of company users

Functions (Service name-Function name)	Usage status (%)
Main portal-member information	25.37
Main portal-integrated search (Integrated Website)	17.00
Project management-detailed assignment	6.89
Research facility and equipment-facility and equipment management	6.67
Participating personnel information-modify history information	6.38
National R&D standard information management service	5.27
Participating personnel-scientist and engineer registration number	5.24
Project management-project announcement	3.23
Performance information-performance search	2.95

Table 11: Usage status of general users

Functions (Service name-Function name)	Usage status (%)
Main portal-integrated search (integrated website)	23.24
Main portal-member information	21.15
Project management-detailed assignment	17.95
National R&D standard information management service	6.45
Performance information-performance search	3.68
Participating personnel-scientist and engineer registration number	2.93
Project management-project announcement	2.33
Project management-detailed project	1.89
Mobile service	1.65

information, project announcements, integrated search and assignment search were used often; member information included not only member signup and edit member information but also service authority setting and other functions.

Several noticeable characteristics by user types are as follows. It was examined that member signup issue/view of scientist and engineer registration numbers and announcement information during not logged-in status were used often. Department/project managing institutions users used project management service and national R&D standard information management service more than other services to manage national R&D information. Also, this type of users mainly used functions such as assignment search, statistical information and restricted information. Researchers often used functions of registering and managing research facility and equipment as well as searching

scientist/engineer registration numbers and similar assignments. For company users and general users, only the performance search was added unlike other user types and other characteristics were not found.

Usage status analysis shows there are clearly distinctive characteristics by user types but they are not huge enough to influence the service and it is difficult to distinguish frequently used functions from unused functions by user types after excluding the characteristics. Thus, it can be expected that further dividing user types and providing frequently used functions by types as in 2015 are not that helpful for users.

NTIS service improvement: This study seeks to change the service structure by focusing on for what purposes that users use functions provided by the NTIS, based on the facts discovered through the usage status analysis. That is, this study seeks to suggest improvements for NTIS service structure based on users' purposes of using the service.

The basic principles of improving the NTIS service structure are as follows: Pull down the boundaries among services and reclassify all services by detailed functional units; Recommend functions or allow users to select the functions they want to construct their own NTIS service; Observe the web standard and provide a consistent UI in various environments; Rearrange detailed functions by R&D stage. To tear down the boundaries among services, all functions within the service by national R&D information types must be reclassified and provided through the NTIS main portal. Separate search and view provided by information such as assignment, personnel, performance, etc. must be unified into an integrated search. However, service structure must be flexible so that users can search only the selected information types and the connection among information must be strengthened further. Figure 1 must say what information is searched through integrated search as the main screen of integrated search and allow users to directly select the search range. Furthermore, the previously chosen search range must be continuously maintained even if accessed later. All information provided by the NTIS must be found on the integrated search, such as project-assignment-personnel-performance-research facility and equipment information, performance information including papers, patents, research report, software, bio-resources, new items, compounds, technological summary information, etc and legal information, policy information, scientific data map, statistical index, relevant data issue R&D, announcements, FAQs, etc.
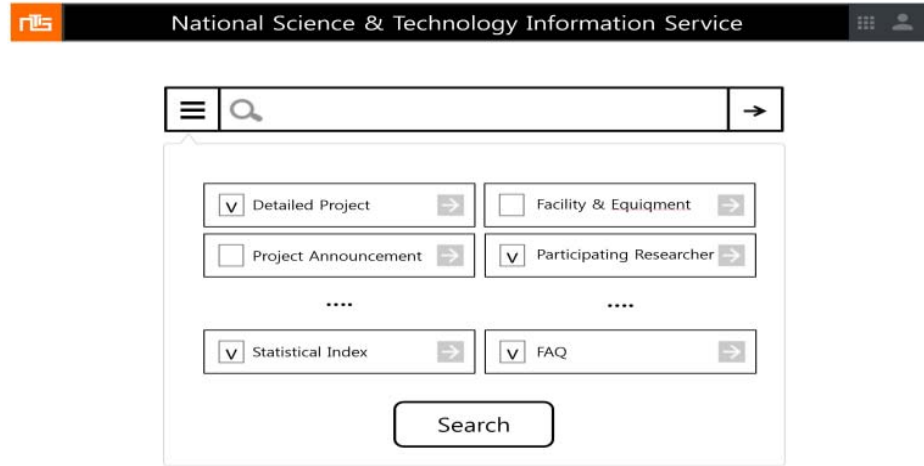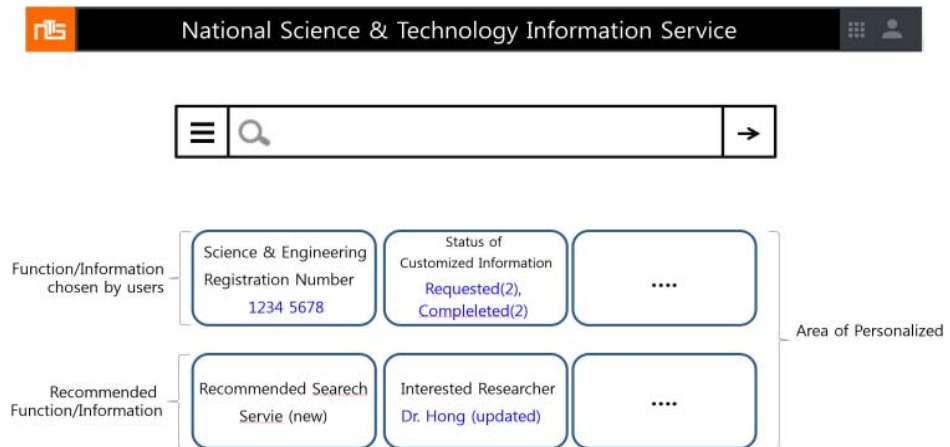
Fig. 1: NTIS integrated search screen

Fig. 2: NTIS personalization screen

Personalized functions must be strengthened to recommend functions that users may need or for them to choose the functions they want to structure their own NTIS service. For example, when users first access the NTIS, the service must list all functions given by NTIS for users to understand the service range and learn about choosing functions. After their second access, the service must recommend the previously used or necessary functions based on the usage form and strengthen personalized functions to provided related information. Figure 2 is NTIS main screen that provides functions selected by the user and recommended by the NTIS in the bottom of integrated search. It is important that this screen provides not only links to access the functions but also information to users through functions. That is, this screen must provide functions to give related information on the link even without accessing the link. For example,

if a user added a "Scientist and Engineer Registration Number", the link related to his or her number should be provided together.

To observe the web standard and provide a consistent UI in various environments in PC, mobile or any kinds of devices, HTML5 standard must be followed, web-style guides for each function must be unified and a response-type web must be applied when realizing NTIS. Also, existing restrictions that fixed the width must be eased and the latest web trends must be reflected to make full screen possible.

As in Fig. 3 to improve the service, NTIS functions must be arranged for R&D activity by stage and the authority needed to explain and use the functions must be shown, so that, users can access the desired functions easily and quickly. If authority is necessary, the service must be connected directly by the authority management function.
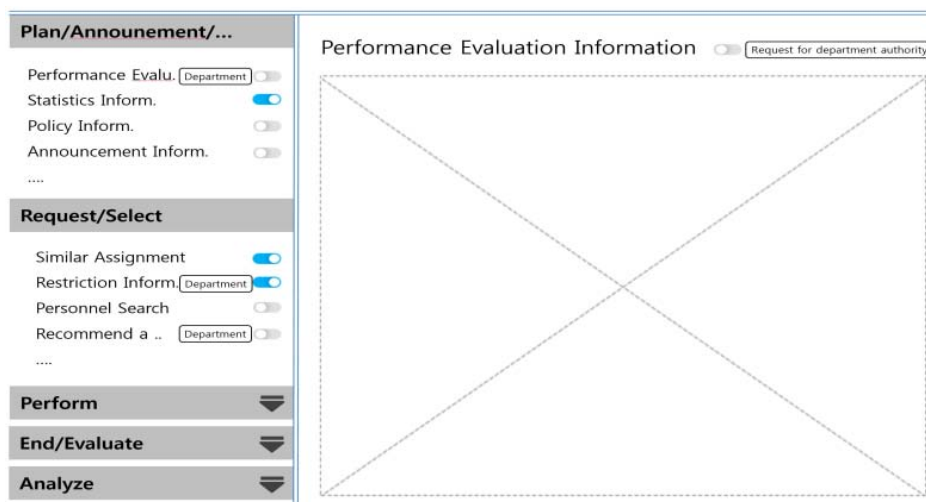
Fig. 3: Screen on the list of NTIS R&D functions by phase

CONCLUSION

If NTIS improves its service as suggested in this study, it may be inconvenient to develop and run the service and because it will be difficult to clearly divide the roles and responsibilities of institutions and managers in charge of the service. However, service users will be able to search and view various information through integrated search, easily access the functions to use during R&D activities and use the NTIS easily and conveniently through stronger personalized functions. They will also be able to receive the same forms of service at anytime, anywhere on various devices. In the future, it will be necessary to create a virtuous cycle to receive user feedback through NTIS Usage status, satisfaction survey, training, etc. and use them to improve NTIS service later. After improving the service system, it will also be necessary to setup a plan to improve usage convenience by each function.

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