

Report to Concytec

Overview and Recommendations on Peru's National Research Information System



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Acronyms

ALICIA	Acceso Libre a Informacion Cientifica para la Innovación
CERIF-XML	Common European Research Information Format Extensible Markup Language
CONCYTEC	Consejo Nacional de Ciencia, Tecnología e Innovación Tecnológica (National Council of Science and Technology and Innovation of Peru)
DANI	National Directory of S&T Institutions
DEGC	Directorate of Evaluation and Knowledge Management
FONDECYT	National Fund for Scientific, Technological and Technological Innovation
IEEE	Institute of Electrical and Electronics Engineers
INDECOPI	National Institute for the Defense of Competition and the Protection of Intellectual Property
INS	National Institute of Health
KISTI	Korea Institute of Science and Technology Information
MBIE	Ministry of Business, Innovation and Employment of New Zealand
NDSL	National Digital Science Library of Korea
NIPA	National IT Promotion Agency of Korea
NTIS	National Science and Technology Information Service of Korea
NZRIS	New Zealand Research Information System
OAI-PMH	Open Archive Initiative Protocol for Metadata Harvesting
ORCID	Open Researcher and Contributor ID
PeruCRIS	Peru's Current Research Information System
PGC	Platform for Knowledge Management
PRC	Research Portal of Catalonia
PRISA	Health Research Projects
RENACYT	National Registry of STI researcher (former REGINA)
REGINA	National Registry of STI researcher (renamed as RENACYT)
RENIEC	National Registry of Identification and Civil Status
RIMS	Research Information Management System
RINA	Integrated System of Management of Research Projects
SINACYT	National System of Science and Technology
STI	Science, Technology and Innovation
SUNAT	National Superintendence of Customs and Tax Administration
SUNEDU	National Superintendence of University Higher Education

1. Introduction

Information is an essential part of research activities. In this rapidly changing digital world, success of R&D heavily depends on the use of information in timely and suitable manner. Science communities all over the world are compelled to have good information systems managing their R&D data.

Peru is no exception, though their efforts to establish R&D information system at national and institutional level have started a few years ago, which is somewhat behind compared to other countries. ALICIA is one of the most representative R&D information systems in Peru. In 2015 the law 30035 was launched to organize a national information network of open science productions consisted of the institutional repositories and a national repository, ALICIA, operated by CONCYTEC, National Council of Science and Technology and Innovation. CONCYTEC is also managing other directories of researchers, research institutions and public projects.

However, those national information services are not satisfactory in quality and quantity. Their information mostly depends on the sources from researchers and research institutions, which are not reliable and sufficient in many cases. The overall inferior infrastructure for science and innovation of the country would be an intrinsic obstacle toward more reliable and rich R&D information systems in Peru at institutional as well as national level.

In an effort to reshape their information system CONCYTEC, with the support of the World Bank, is initiating some notable programs to renovate their systems. They plan to integrate their current information services in one platform called "PGC" (Platform for Knowledge Management) and this will be equipped with a variety of value added services to form a national research information system called "PeruCRIS".

Now is the crucial time for Peru and CONCYTEC since the government's current initiations will decide the shape of Peru's future R&D information service for a considerable period of time. The present concept and design period is particularly important for construction of an integrated system involved with many actors in the country.

In order to develop a modern and errorless system it is very advisable to get lessons from the international systems already existed. The purpose of this report is to review the current Peruvian system and its recent initiations and make recommendations for improvement with reference to other countries' systems, in particular, the cases of South Korea, New Zealand and Catalonia.

2. Current status of research information system in Peru

2.1 National repository of open science information - ALICIA

The law 28303 of Peru, The Framework Law on Science, Technology and Technological Innovation, covers all issues about promotion of science, technology and innovation. This law includes the articles about STI information network, which, however, are comprehensive and declarative. Based on the law 28303, Peru government launched the law 30035 in 2015 to regulate the National Digital

Repository of Open Access Science, Technology and Innovation, which is a primitive governmental legal framework to promote STI information service at national and institutional level.

Under the law 30035 and the follow-up regulations, 166 universities and research institutes are operating repositories for open science data, and they are connected to the national repository, ALICIA¹.

ALICIA has metadata information harvested from universities, research institutes and journals in Peru such as bachelor, master, and doctor degree theses, articles, reports and books. Researchers can access the metadata information in ALICIA and get the full texts through links to the institutional repositories.

For last few years CONCYTEC has made a lot of efforts to persuade institutes to establish repositories and now 166 institutes are connected to ALICIA, which shows very good figures considering the weak infrastructure of universities and research institutes for STI information service.

In particular, in case of thesis information, degree recipients are supposed to submit their theses to SUNEDU through CONCYTEC, which makes ALICIA possible to get information on thesis automatically thanks to the unique legal process of Peru. A number of domestic articles by Peruvian researchers are also published in open access domestic journals and those information are also collected by ALICIA from the domestic journals. This sector is a good part of ALICIA collections as well.

In general, you can access most of the information on thesis and domestic articles through ALICIA and its connected institutional repositories.

Then what problems can we observe with the repository systems of Peru?

First question is about the quality of the information that ALICIA provides. Major information supplied by ALICIA are theses, mostly, bachelor² and master degree theses, which is 73% of all the contents of ALICIA in numbers³. This thesis information seems to be used as for administrative and identification purpose and not for research purpose. The quality of domestic articles in ALICIA would not be high level compared to the articles in international journals. In short, ALICIA dominated by information on thesis and articles in domestic journals may not be attractive to researchers of Peru.

ALICIA is operating well in terms of connecting institutional repositories in Peru and providing open data at certain level and category, however, the current ALICIA service may not attract researchers and research institutes.

Another important user, the Peru government may expect STI information from this kind of national service, which can help their decision making, but ALICIA's open data repository service is far from the needs of the government.

1 Acceso Libre a Información Científica para la Innovación

2 In Peru, a university graduate needs to submit a thesis to get a diploma of engineer.

3 ALICIA now has 231,825 items, and among them the number of bachelor and master degree thesis is 169,359.

2.2 Service for overseas literature - Biblioteca Virtual

"Biblioteca Virtual" (Virtual Library) is a digital library service by CONCYTEC for qualified researchers in Peru. It currently includes science production information from international DB services such as Scopus, ScienceDirect, IEEE, EBSCO, IOP, SAGE and Wiley. The researchers can search for abstracts and full texts of overseas articles upon their memberships⁴ in CONCYTEC.

Access to Elsevier's ScienceDirect and Scopus, which is at the same time the most attractive and costly component of this governmental service, is currently available as a part of World Bank Project for 2019-2021, however, it is doubtful whether this service can continue after the termination of the World Bank Project⁵. Accordingly it would be one of the important tasks for CONCYTEC how to keep sustaining this kind of service after the year 2021.

2.3 Directories of researcher profiles - CTI-Vitae

Peru government is operating a national researcher directory called CTI-Vitae (former DINA). Researchers can register their self-referring profiles to this open system voluntarily and those profiles are opened to any others. The content of each profile is the sole responsibility of the person enrolled and therefore it is not considered as a source of official information.

Researchers should enroll to this directory if they want to participate CONCYTEC projects and use Biblioteca Virtual service. CONCYTEC examines the information in the CTI-Vitae and sorts out researchers with certain requirements and then register them as qualified researchers in a national registry called "RENACYT" (formerly "REGINA") after verification process.

CONCYTEC funding calls normally require that research project teams include RENACYT researchers. Qualified researchers have also the benefit of the advanced service of Biblioteca Virtual, and usually receive salary bonuses from Ministry of Education when employed by public universities.

At the moment CTI-Vitae has 14200 user accounts and REGINA has around 2500 qualified and verified researchers in their systems respectively. Most researchers upload their profiles to CTI-Vitae since this is a compulsory step for them to participate CONCYTEC projects and some other government projects, however, this directory based on self-referred and voluntary information cannot be regarded as a reliable and accurate source for statistics about human research resources in Peru, which credibility is one of current concerns of CONCYTEC. CTI-Vitae is also not used by most other government organizations.

4 CONCYTEC runs two researcher directories. "CTI-Vitae" is a registry of Peruvian researchers who voluntarily fill in their profiles to the system. "RENACYT" is a registry of researchers who are the members of CTI-Vitae and sorted out by CONCYTEC upon their qualifications.

5 The budget for the current program is about 8 million USD for 3 years' contract and supported by the World Bank .

2.4 Information on research institutes - DANI

CONCYTEC operates DANI, which is a directory of public and private legal entities related to science, technology and innovation in Peru. The institutions are supposed to enter information such as data of the legal representative, data of the coordinator for contact with CONCYTEC, general budget, name of research units or groups, researchers, projects, intellectual property, equipment and products. This directory is used for administrative purpose such as management of research institutes and reporting for tax benefits by the institutes.

Data of the directory again depends on the institutes' voluntary entries like CTI-Vitae and therefore could be a little different from their real status. Main user of this directory is the government and the institutions registered in the directory and this is not open to the public.

In general, DANI is mainly a system for government's need and cannot be utilized as a source of research activities information.

2.5 Project Bank

It is a directory of national research projects. It was intended to serve information on all the government projects about science, technology and innovation. At the moment it has information from four government programs, FONDECYT projects of CONCYTEC, National Health Institute (INS⁶, both RINA⁷ and PRISA⁸ projects), Innóvate Peru, and National Program for Innovation in Fisheries and Aquaculture (PNIPA). FONDECYT, the "National Fund for Scientific, Technological and Technological Innovation" managed by CONCYTEC is currently a main part of Project Bank.

Total of 853 projects are registered as of now and it shows metadata of projects such as name of prime researcher, summary of project, budget, implementing institution and project period. This directory, however, does not look attract researchers well enough, since it covers only few government programs with poor data, not including project outcomes.

If Peru is looking for a rich national directory of projects in science and technology, they should consider renovation of the current directory, one with the inclusion of all other government projects information and the increased depths of information.

6 Instituto Nacional De Salud (National Health Institute)

7 Sistema Integrado de Gestión de Proyectos de Investigación(Integrated Research Project Management System)

8 Proyectos De InvestigaciónEn Salud (Research Projects forHealth)

2.6 CONCYTEC's self-analysis on the current directories⁹

Followings are the self-analysis of CONCYTEC on the current directories, which are quoted from "Terms of Reference for the Implementation of the Knowledge Management Platform of the National System of Science and Technology and Technical Innovation" (October 2018)¹⁰.

"These directories were designed independently to respond to specific needs without considering a long-term technological integration strategy. As a result, they do not meet of the needs of Peruvian science community. In particular, it is costly to maintain operation and ensure data quality of the directories. Likewise, they are not prepared for intensive consumption and rapid response by users.

On the one hand, the user interfaces of the directories are not easy to use and are not friendly. On the other hand, the provision of information to the directories is a long, complex and sometimes even redundant task. As a result, typically only minimal information is provided, so the current directories do not have complete and validated information on the R&D activities of Peru. This does not allow the generation of indicators that reflect reality of the country and support the formulation of evidence-based policies, plans and studies."

2.7 Other government systems

2.7.1 INDECOPI

INDECOPI is the "National Institute for the Defense of Competition and the Protection of Intellectual Property" in Peru. The institute provides information on the patents registered in Peru through their web¹¹. However, their information service focuses mainly on legal details relating application and registration of patents and is not appropriate for researchers looking for STI information necessary for their research. Besides this service system has no connection with CONCYTEC.

2.7.2 SUNEDU¹²

SUNEDU is The National Superintendence of University Higher Education of Peru, which is attached to the Ministry of Education. SUNEDU is responsible for licensing of universities and administration of the national registry of degrees and titles.

Under a government regulation, university students are supposed to submit their theses to SUNEDU through CONCYTEC harvesting system and CONCYTEC opens those theses information to public through ALICIA.

⁹ This analysis is quoted from the "Terms of Reference for the PGC".

¹⁰ Andrés Malgar, Ian Brossard, Cesar Olivares, "Current Status of Research Information Management in Peru" Peru", Procedia Computer Science 00 (2018) 1-10

¹¹ http://servicio.indecopi.gob.pe/buscadorResoluciones/propiedad_intelectual.seam

¹² Superintendencia Nacional de Educación Superior Universitaria

This process makes ALICIA serve well in the area of theses and ironically this is the reason why ALICIA is dominated by information on theses, in particular, theses from university graduates.

2.7.3 Innóvate

Innóvate¹³ is the “National Innovation Program for Competitiveness and Productivity”, an executing unit of the Ministry of Production established to increase innovation in business production processes, to promote innovative entrepreneurship, and to facilitate the absorption and adaptation of technologies for companies.

Innóvate Peru currently manages several funds¹⁴ for science, technology and innovation projects. Their web provide information mostly about project calls. There is no information service to disclose details of the process and results of the projects. There is no notable cooperation for information sharing between CONCYTEC and Innóvate or Ministry of Production.

2.7.4 INS

INS is the “National Institute of Health”, an executing public body of the Ministry of Health, dedicated to the R&D for health problems.

INS is operating RINA, “Integrated System of Management of Research Projects”, for the purpose of the management of the health research projects of INS to facilitate technical and administrative procedures. The system includes registration of the research protocol for review and approval by the institutional ethics committee, administrative processes for execution, budget availability, monitoring and supervision of activities based on periodic progress reports, final report and its subsequent drafting of the scientific article and scientific dissemination.

It is interesting to know that INS is cooperating with CONCYTEC to share researcher information. For instance, a researcher should be a member of CTI-Vitae to use RINA system.

INS also provides PRISA, Registry of Health Research Projects, where institutions and individuals in Peru can register their health research projects. PRISA contributes to give visibility to the work of researchers, promotes the formation of research networks, and serves for decision making for health policies, though the information in PRISA is not officially certified by INS. A researcher should be a member of CTI-Vitae to register his/her research work in PRISA and information in PRISA is open to public.

In short, INS is operating two system, RINA and PRISA. RINA is information source for INS projects, but they are focusing on notification of projects and management of the projects. PRISA is simply a registry of non-INS projects.

13 Innóvate was created on July 24, 2014 by Supreme Decree N° 003-2014-PRODUCE.

14 They are Science and Technology Program (FINCyT 1) (Closed), Innovation Project for Competitiveness (FINCyT 2), Improvement of Levels of Productive Innovation at the National Level (FINCyT 3), Research and Development Fund for Competitiveness (FIDECOM), Framework Fund for Innovation, Science and Technology (FOMITEC), and MIPYME Fund

2.8 Summary

A most notable effort by Peru government during last few years was to establish repositories for open science data at institutional and national level. At the moment 127 universities and 39 other research institutes are operating repositories, and information in those repositories is open to public through ALICIA, a national repository. The nation-wide open science data repository system based on the law 30035 has made great impact for universities to realize the importance of science information management, however, the national repository is a bit far from satisfying the needs of researchers and public because of their insufficient contents and quality.

Along with ALICIA, CONCYTEC operates a few directories such as a researcher DB, a research institutions DB, and a national projects DB. These directories now manage to serve for their own individual purposes, but each directory has its own problems as described in the previous sections. They have many tasks ahead for improving their service, for instance, integration of them into one system for easy access, and development of tools to produce meaningful data through synchronization of those directories.

Biblioteca Virtual, the government service to provide latest and qualified global articles incorporated in the world journals will be really helpful for Peruvian researchers. However, it is not certain how long the government can continue this costly service.

On the bright side, CONCYTEC is building up their efforts to improve their research information systems, in particular, with the help from the World Bank Project¹⁵. Details of CONCYTEC initiations are described in next section and a lot of issues raised in this paper could be solved if CONCYTEC can fulfill their plans successfully.

3. New initiations by Peruvian Government

3.1 PGC¹⁶ (Platform for Knowledge Management)

Background

CONCYTEC is implementing a World Bank project to strengthen the science, technology and innovation system in Peru with the IBRD loan of USD 45 million for 2017~2021. One¹⁷ of the components of the project is to strengthen CONCYTEC management capacity. It includes "financing to develop an integrated information system and implement the equipment and infrastructure needed to monitor programs and instrument of the entities involved in STI activities. This activity will fund a central internal system for CONCYTEC that generates relevant information using national surveys, polls and other data to provide timely and accurate information on the status of the STI activities in the country."

¹⁵ IBRD loans USD 45 million to Peru for the period 2017~2021 for strengthening the science, technology and innovation system in Peru.

¹⁶ Plataforma de Gestión del Conocimiento.

¹⁷ Component 1: Improving the Institutional Framework of the National STI System.
Subcomponent 1.2: Strengthening CONCYTEC and FONDECYT Management Capacity.

Structure of the system

Under the framework of the World Bank Project, CONCYTEC is planning the establishment of PGC (Platform for Knowledge Management), which will be consisted of the following 5 directories:

- **Human Talent Directory:** data on researchers, technology developers, innovators and STI managers (based on the current CTI Vitae directory)
- **Scientific Production Directory:** publications, patents and products (based on the current ALICIA repository)
- **Institutions Directory:** institutions and organizational units related to STI activities as well as their dependencies, for example, faculties, headquarters, or subsidiaries of a university (based on the current DANI directory)
- **Infrastructure Directory:** infrastructure used to carry out STI activities such as laboratories and equipment (based on the current DANI directory)
- **Projects Directory:** Information about projects developed by funding agencies, international cooperation agencies and research institutions (based on the current Project Bank directory)

All directories will be linked each other. For instance, if you access a researcher, you will get information on his profile as well as his scientific products in one place. Information will be harvested from universities, public research institutes and public funding agencies such as FONDECYT, Innóvate and INS. The platform will integrate information from international databases such as Scopus, Web of Science and SciELO. It also expects R&D related information from other government agencies such as INDECOPI, RENIEC¹⁸ and SUNEDU. PGC targets the compilation of regional base lines and the follow up and monitoring of STI activities of Peru. CONCYTEC expects to make a contract with a service provider in the second half of 2019, which will develop a software program for the system and the operation of PGC is scheduled to start from 2021.

3.2 PeruCRIS (Peru's Current Research Information)

PeruCRIS literally means *Peru's Current Research Information System*. This concept has been recently developed by DEGC¹⁹ of CONCYTEC and the definition of the system looks still under development. The current concept of PeruCRIS can be found in the CONCYTEC web²⁰, though it is not official document. The review in this report is based on the information in the web.

PeruCRIS is defined as "a CONCYTEC project that seeks to establish, develop and operate the National Information Network on *Science, Technology and Technological Innovation (STI)* which will allow consolidating and managing scientific and academic information throughout Peru, as well as gene

18 National Registry of Identification and Civil Status.

19 Directorate for Evaluation and Knowledge Management.

20 <https://sites.google.com/concytec.gob.pe/perucris>

rate statistics that serve as support for decision making at the institutional, regional, sectoral and national levels in addition to making globally visible the activities, capacities and scientific production of Peruvian researchers”.

The National Information Network on STI

CONCYTEC develops and operates this network with interoperability among the institutions that make up the system, with the following objectives:

- Allow the development of scientific and technological statistics
- Provide information for the planning, promotion, execution and evaluation of STI activities
- Promote the systematic dissemination of academic, technical and industrial knowledge and human capabilities in STI
- Facilitate access to national and foreign STI information sources

The National Information Network in STI will integrate information from various institutional sources such as Universities, Public Research Institutes, Public Funds for STI (Fondecyt, Innóvate, INS, PNIA, PNIPA), other government entities (SUNEDU, RENIEC, SUNAT, INDECOPI), as well as international sources of information such as Scopus, Web of Science, SciELO, CrossREF and ORCID, among others.

Components of Peru CRIS

- **Directories of Peru STI Network**

It includes the Directories of Human Talent, Scientific Production, Institutions and Infrastructure, and Projects as well as validation, standardization and data integration tools.

- **CV of Human Resources related to STI**

It includes the management of self reported information by SINACYT natural persons in an integrated manner to the SINACYT Directories, as well as mechanisms to facilitate that users of the new system can import information from their profiles of the current National Directory of Researchers and Innovators, CTI Vitae.

- **RENACYT Registry**

It includes support for the application, qualification and registration procedures of natural persons and legal entities in the RENACYT records.

- **Monitoring and Evaluation (including Technological Surveillance).**

It provides support for the monitoring and evaluation of STI policies, programs and projects, namely: Generation and Management of Scientific Technological Statistics (including technological surveillance) prepared from the information contained in the Directories of SINACYT and other sources; the Management and Evaluation of Plans, Policies, Programs and Projects; and a STI Observatory that provides the service of visualization of information and indicators of STI (including technological

surveillance) to support decision making by the members of SINACYT.

- **Services Portal and Application Programming Interface (API)**

It includes the integration into a web portal of access to different services that will be provided to SINACYT members, such as: Federated SINACYT members, such as: Federated Authentication, HR CVs related to Authentication, HR CVs related to STISTI, Access to information , Access to information sources, sources, STISTI Observatory and Observatory and Fund Opportunities. It also includes an Application Programming Interface (API) for the consumption of information from computer systems of the institutions that make up SINACYT.

Timeline

CONCYTEC DEGC expects to operate PeruCRIS from 2021.

3.3 Summary

CONCYTEC's recent initiation to establish PGC (Platform for Knowledge Management) with the support of the World Bank is regarded as a big opportunity to renovate the national R&D information system of Peru. The most notable change is that Peru will have one place where all actors in science community can exchange R&D information and communicate among them, though in quite a limited extent at the beginning.

Along with the expected construction of a physically integrated system, main concerns will be about the contents served in the system, which should be more than just a collection of current directories. PeruCRIS seems to be the initiation by CONCYTEC to respond to these kinds of concerns.

The establishment of PGC will go on upon the financial support from the World Bank, however, the contract with a system provider is being delayed and all the timeline should be prolonged accordingly. It will be hard to expect to see the establishment of PGC by the end of 2020 as scheduled.

The current task list of PeruCRIS, looking very ambitious, includes many cooperative works such as standardization to secure interoperability and cooperation with the participating entities for data flow, which will need a lot of time, personnel, and budget.

One thing that should be pointed out is about the concept of PeruCRIS. The details of the concept are described in the CONCYTEC web, however, it is not in the form of government documents and somewhat a moving concept with the times at the moment. And it is confusing and difficult for general public to differentiate the two initiations, PGC and PeruCRIS.

Some administrative measure would be necessary to formalize PeruCRIS for effective mobilization of resources and better collective works among partners in the government and the science community of Peru.

4. Lessons from international cases

4.1 South Korea: NDSL and NTIS

South Korea (referred as “Korea” hereinafter) has a long history of managing science information at national level, even from the analogue age. KISTI (Korea Institute of Science and Technology) is one of public research institutes supported by MSIT²¹ of the government, which is responsible for management of R&D information.

Two major programs of KISTI in this area are NDSL (National Digital Science Library) and NTIS (National Science and Technology Information Service). NDSL is a national repository of science production s of Korea and the world. NTIS is a n ational portal for R&D information, focusing on national projects information. These two national services are the major backbones of R&D information flow in Korea and have contributed greatly for research activit ies in Korea during last 15 years.

Other government entities for STI activities such as Ministry of Education and Korea Intellectual Property Office are also operating very high level of information system for their areas and they share their theses and patents information in real time with NTIS a nd NDSL.

Infrastructure for information flow at institutional level is also strong. Most universities run digital repositories of their STI production s and RIMS for the management of their projects.

This report will go into detail on NDSL and NTIS, the two most representative national R&D information systems in Korea.

4.1.1 NDSL

With the coming of the digital era, KISTI had started digitalize its repository of science production s in late 90' and the digital repository has continue d to enlarge its contents through its conne cti on to a variety of resources outside. In 2008 KISTI launched NDSL based on then its digital library service.

NDSL has information about domestic and overseas articles, patents, domestic reports, trend informat ion, world journals, world proceedings, domestic researchers and domestic research institutes.

For information harvesting, NDSL uses its robust network with a variety of domestic and overseas information providers as follows:

- KESLI (Korea Electronic Site License Initiative Consortium) for articles in domestic and overseas journals and conference proceedings
- KERIS (Korea Education and Research Information Service) for domestic thesis
- Universities and research institutes for domestic and overseas articles
- KIPRIS (Korea Intellectual Property Rights Information Service) for patents of Korea, US, Japan, China and Europe

²¹ Ministry of Science and ICT

- Government organizations for public funded project reports, trends information
- British Library and IEEE for overseas articles
- International publishers and journals such as Elsevier, Wiley for articles²²

NDSL's successful operation can be attributed to a good planning, well organized cooperation with domestic and overseas information providers, government's financial support²³, and KISTI's expertise and experience.

4.1.2 NTIS

Background

Investment for science and technology in Korea during last few decades was remarkable. Korea government used to invest more than 3~ 4% of its total budget for STI every year during last decade and this percentage ranked from 2 nd to 5 th in the world.

Such aggressive investment for science and technology was one of moving force for economic development of Korea, however, there have been continued questions about efficiency and suitability of the investment. Somewhat competitive investment even among different government bodies used to raise the possibility of duplicative investment and the need for proper management of government projects as a whole. It is interesting to know that 17 government organizations are investing for R&D projects in Korea at the moment. Strong demands for systematic management of government projects at national level in one place resulted in the launch of NTIS system in 2007 .

Governance

NTIS is basically an integration of government projects funded by 17 government organizations²⁴. Many government organizations delegate the management of their projects to their own project management institutions. At the moment, NTIS collects government-funded projects information from 4 government organizations and 13 project management institutions.

MSIT (Ministry of Science and ICT), the governing body of the system at government level, leads formulating the framework of NTIS every 3 years²⁵, managing three consulting bodies such as:

- Committee for national R&D information management (vice minister level)
- Advisory group for reviews and advisory on NTIS policy
- Working-level group consisted of project management institutions.

²² This service is limited to past articles.

²³ The budget assigned to the NDSL project is approximately USD 3 million a year.

²⁴ 9 ministries and 8 agencies are managing R&D projects.

²⁵ It is now under the 5th framework for 2019~2021.

KISTI is operating NTIS system under supervision and financial support²⁶ from MSIT. The role of the advisory group and the working level group is important as driving forces and coordination among stakeholders.

For interoperability between NTIS system and the project management institutions, the government enforces a regulation that provides the standard format for R&D data²⁷ to be uploaded in the system.

Service

NTIS provides all information around the whole cycle of the government funded R&D projects, including announcement, selection, implementation, outcomes and evaluation. Information on outcomes includes articles, reports, patents, royalty, and commercialization information. It also provides information about researchers and institutions participating in the government projects.

Researchers can search for their funding opportunities for national projects, information on researchers and R&D activities of his/her research field. In addition to these fundamental service, it provides information about high value equipment, facilities, software program, bio information and chemicals, which are supplied by a variety of resources in Korea. It also supply interesting values added information such as science and technology related policy, world trends, statistics and even R&D knowledge map, which can attract not only researchers but also government decision makers, R&D managers, private sector and general public.

Evaluation

This 12 years old system is one of the most representative national information systems in Korea and with its excellent level of service it was awarded several domestic and international prizes including the UN Public Administration Awards in government's knowledge management sector in 2012. Researchers are the major users consisting more than 80% of the total users, but government officials and management institutions' staff are very important customers and the general people interested in up-to-date science topics can get information customized for their needs easily from this system.

NTIS's successful development can be attributed to government's sustainable and strong will, well organized planning and governance, cooperation among many public institutes related to the public funding projects, government's financial support for the system²⁸, and KISTI's expertise and devotion.

A file on NDSL and NTIS with more details is attached as Annexe 1.

26 The budget for NTIS is about USD 10 million a year.

27 The regulation has 422 standardized data items as of now.

4.2 New Zealand: NZRIS

New Zealand is establishing an information hub, National Research Information System (NZRIS) "that will contain information about research, science and innovation funded wholly, or in part, by the New Zealand government."²⁹

NZRIS will include information about researchers, research groups and organisations, projects, the funding environment, R&D facilities, equipment, events (such as scientific conferences and workshops or periods of observation or experiment), outputs, processes, measurements and indicators including outputs, outcomes and impacts.

NZRIS will help people answer questions such as: What projects are underway? Who is working on them? Who is an expert I can contact on a particular topic? What are they working on? How much is being spent on a particular area? Which areas need additional resources and support?

Most of the information about research, science and innovation that NZRIS holds will come from funders such as the Ministry of Business, Innovation and Employment MBIE and the Ministry of Primary Industries (MPI), and research institutions such as Crown Research Institutes and universities.

However, NZRIS is not a repository, i.e. it will not hold the actual results of research such as published papers or research data.

The first iteration of NZRIS is expected to be operational by the end of 2019 with data from major public funders such as MBIE, MPI, the Health Research Council (HRC) and the Royal Society Te Apārangi. Over the next five years, they expect all major suppliers of data to be progressively integrated, including, universities.³⁰

Development of the system is being led and managed by MBIE. The development and operation of NZRIS is driven by a commitment to collaboration, co governance and co design. MBIE is working in partnership with the research, science and innovation sector, including the Maori research community, to build a system that benefits all participants and users.

²⁹ As experience and confidence with the system grows, they expect information on other research activities, such as privately funded research, could be included.

³⁰ They classified their research information in New Zealand into 3 categories:

1. Research, science and innovation (RS&I) activities in whole or in part by the New Zealand government
2. RS&I activities in New Zealand state sector organizations, such as Crown Research Institutes, universities and Callaghan Innovation, and
3. RS&I activities in New Zealand performed and funded by other organizations and individuals.

NZRIS is focusing the 1) category for the current stage and it can include 2) and 3) categories later as experience and confidence with the system grows.

Operation

Data will be transferred to NZRIS electronically from organizations that are sharing data. The technical process will be automatic and seamless, an MBIE will work with each organization to determine the best frequency of data feeds.

NZRIS defines common data standards. This will enable organizations that are sharing data to do so easily from a variety of systems. Data standards are being developed collaboratively.

MBIE is working through issues around data security, access and confidentiality with the organizations that are sharing data.

Other information sharing systems such as ORCID will be integrated with NRIS.

Cooperation

MBIE is working with the "Funder Researcher Working Group", which was set up in 2015 with representatives from key research policy and funding agencies, the research, science and Innovation sector, and Stats New Zealand.

The data standards and the data transfer models will be developed and refined by MBIE in collaboration with the research, science and innovation sector through the Funder Researcher Working Group.

Lessons from NZRIS

The process toward construction of national R&D information system is very clear and open to public. The whole program can be seen clearly in the government's web [web³¹](#) with the attached documents on overview, conceptual framework, timetable and technical documents about the system. It is crucial to success to have a master plan and make it visible to every stakeholder to pull their consensus and cooperation in this kind of program involving multiple actors.

NZRIS studied several existing R&D information systems around the world for their reference. It is a wise process to learn from other systems, though each country has its own infrastructure and resources.

New Zealand's case would be particularly useful for a country looking for establishment of new national R&D information system. They can learn from New Zealand's case on how to initiate a national program and mobilize their resources.

NZRIS is focusing on enhancement of national R&D projects management and better financing opportunities for researchers. However, the system without repository service about outcomes such as project reports and articles will be insufficient to encourage utilization or transfer of the research results to a private sector and further research by any other researchers.

Anyhow, NZRIS is still under development stage and it is not yet proved how well the system will function actually.

31 <https://www.mbie.govt.nz/science-and-technology/science-and-innovation/research-and-data/nzris/>

4.3 Catalonia: PRC

The Research Portal of Catalonia (PRC) collects, displays and disseminates from a single place the results of the research produced in Catalan universities and research centers, in terms of researchers, publications, research groups and projects for the scientific community, companies, financing organizations and the public in general thus facilitating open access to scientific production.

It is based on the information provided by the CRIS (Research Information System) of the 12 universities and 9 research centers in Catalonia.

This system is done by deciding jointly arranging the data, capturing information through standard formats (CERIF) and interoperability protocols, using common identifiers such as ORCID and the use of institutional repositories.

All the data of the portal are pivoted in the researchers, therefore, there will be no department, institute or area, group or research, publication, thesis and projects that does not have at least one associated researcher. The portal is based on the DSpace-CRIS software.

The PRC project is created by the Directorate General of Research of the Secretary of Universities and Research of Catalonia CSUS (Consortium of Universities of Catalonia) is coordinating and managing the system with a *work commission* formed by members of Catalan universities and research centers.

Features of the PRC

The PRC gives very good visibility to the current status and the potential of the research of the region as a whole. The governance of the system is very clear, simple, well coordinated and robust, though it is a rather small system which covers information from only 21 research institutions of the region.

PRC is very user friendly and easy to use. PRC relies on the data uploaded bimonthly through files with the CERIF XML standard by the research institutions, but work is being done so that it can be automatic in the future, preferably through the OAI-PMH protocol.

This can be a good example on how a portal can be constructed based on research information systems of research institutions. This system is effective only when each member institute consisting the system has good level of research information system and there is a good governance to pull cooperation among the member institutes.

PRC, however, is not a real time information service and it cannot serve beyond the information provided from the member institutes, hence, for instance, it does not provide information for funding opportunities and it is difficult to provide a value added service through applications of data stored in the system.

4.4 Lessons

Many research organizations around the world have invested in a research information management system that connects various systems across the institution. Inspired by these developments at the institutional level, over the last decade some countries have developed systems at a national level that link various systems. The trend is towards national systems systems.³²

This report has reviewed herewith four different representative information systems in the world at national and regional level.

NTIS and NDSL represent pretty well matured national systems of Korea with more than 10 years' experience, NTIS for national projects in formation service and NDSL for cross national science publication information service. NZRIS of New Zealand is a very well planned national system under construction for national projects information service. PRC of Catalonia, Spain is a well governed compact portal of institutional repositories of the region.

Even though these systems have different purposes, contents, structure and governance respectively, they have common factors, which can be a valuable lesson for other counties. They are;

1. The programs started with the planned frameworks initiated by government bodies, which include purpose, concept, structure, operation, timetable, legal basis and budget.
2. They have good governance to enforce such multiactor programs and to pull cooperation among participating members.
3. Standardization of data and protocols, and use of international identifiers are well considered in advance for interoperability.
4. They apply strategy for gradual progress to develop their systems. They focus on basic functions at the beginning stage and scale up their systems later with additional services and information providers.

5. Review and recommendations

5.1 Launch of national projects information system

Researchers in Peru seem to have difficulties in searching for information on government funded projects. Current major government funding agencies such as CONCYTEC, Innóvate and NIH provide their project information through their own web services respectably. There is no one place to show all the government projects in collective and complete manner, hence, researchers would experience inconvenience in searching for their funding opportunities

Even the level of the current services provided by each agencies is relatively low, mostly focusing on announcement of new projects. Those systems do not include details of the project results.

³² This paragraph is quoted from NZRIS overview 2018, P16.

Hence, the government could not be able to have any statistics relating government funding from the systems and it is not possible for other researchers or private sector to utilize the outcomes of the government projects.

Peru has a national project directory called "Project Bank", which is an initiative by CONCYTEC aiming an integrated place for all the government projects information. However, this directory is now consisted of information only from FONDECYT, INS and PNIPA, and only includes very basic data such as project title, researcher, institution, project period and budget .

One of the most important areas of a government's R&D information service should be about government funding projects among others. Hence, through the service researchers can get the answer on such questions as: What projects are underway? Who and what institutions are participating in projects? Can I apply for a project? Are there project outcomes for technology transfer? Are there useful scientific data for further research? Who is an expert I can contact on a particular topic?

The CONCYTEC's report³³ on RIMS survey in Peru done in 2018 also shows researchers' aspiration for a national information portal of public funding R&D projects, quoting that "The offices of research in the institutions expect also CONCYTEC to aggregate and provide information regarding funding and projects financed by different public agencies. They would benefit greatly from having a way to know which projects are being developed by other national institutions, in order to improve synergy and avoid duplication."

33 Andrés Melgar, Ian Brossard, Cesar Olivares, "Current Status of Research Information Management in Peru", *Procedia Computer Science* 00 (2018) 1-10, Page 9

(Recommendation for section 5.1)

Recommendation 1: Launch of national projects information system

It is strongly recommended to construct a “National Projects Information System”. The national system will integrate all the information on projects funded by government agencies, which includes;

- Project profiles such as title, concept, budget, period, and funding agency
- Researchers, Institutions implementing projects
- Outcomes of projects such as reports, articles, and patents
- Add hoc information such as high value equipment and evaluation of a project

Crucial factor for the success of this system should be cooperation among government agencies financing STI projects, which will become main information providers. For this purpose, it will be necessary to *establish a standing body* consisted of all the participating agencies to discuss and decide on the design and operation of the system, including the basic concept of the system, standardization of data for interoperability. The experience of other countries shows that close cooperation among stakeholders is a key for success of this sort of cooperative project.

Considering CONCYTEC’s current effort to build up its “Project Bank” directory as part of “PeruCRIS” program, it could be one alternative to establish the National Projects Information System based on “Project Bank”, however, another alternative is to establish the system based on new consultation among the funding agencies, not inheriting from “Project Bank”, which new brand approach may attract more interests from them .

It is important to establish “Master Plan” as a first step toward this initiation, which will include concept, contents, governance and timeline. “Master Plan” will be essential for getting self confidence, clear and sustainable process, and getting support from the participating government bodies .

It will be desirable to adopt a step by step strategy in which the system will be build up gradually adding more participants and features at each stage. It is worthwhile to monitor the case of Korea, which formulates new iteration of their system NTIS every 3 years³⁴, reflecting needs from users, new trends and new technology and strengthening weak points.

³⁴ NTIS development plan of S. Korea is a 3 year national plan and currently it is implementing the 5th plan (2019~2021).

5.2 Strong governance

The core of the current Peruvian R&D information system is to promote institutional repositories and management of a national repository rooted on them under the law 30035. ALICIA, the National S&T Digital Repository, was constructed in 2015 and 166 institutional repositories are connected at the moment.

Structurally the service quality of ALICIA should depend on the quality of information provided from the repositories of universities and research centers in Peru. Though the Law has made ALICIA possible to have relatively good connection with the institutional repositories, the success of the system depends on how good quality information the institutions have in their repositories. In short, the cooperation between the government and the institutions is very essential for the success of the current system, however, the reality is that CONCYTEC largely relies on person to person communication to discuss their common interests with the institutions and it is very hard and time consuming for CONCYTEC to pull out cooperation from the institutions, which are in different status of STI information systems, and are located in various regions.

That is the reason why Peru should consider better governance for exchange of R&D information among stakeholders to come up with needs for reliable, consistent, extensive and high quality information service in the future. Weak governance is also existing even inside the government. It is difficult to observe active exchange of information among government bodies related to R&D. CONCYTEC will be in need of strong cooperation with other agencies as follows;

- SUNEDU for thesis information information³⁵
- Ministry of Production and Innóvate for industry and innovation program information
- INS for health research program information
- INDECOPI for patents information

³⁵ The universities in Peru are supposed to send their thesis information to SUNEDU through CONCYTEC harvesting system, which can be served to the public by ALICIA. CONCYTEC seems to have relatively strong networking with SUNEDU.

(Recommendation for section 5.2)

It is very essential to *develop strong governance* to stir up cooperation among stakeholders for efficient, effective, realistic and forceful implementation of national programs for R&D information service.

A governance framework of a social system should be heavily affected by culture and practices of the people consisting the system. Accordingly there will be no only one clear solution for good governance which can be applied to all countries of the world .

However, for better governance to handle a collective and coordinated information system in Peru, the following two tools can be suggested among others, which have been seen commonly in many other countries and communities in the world, but not in Peru. They are;

Recommendation 2: Establishment of master plan

When you have a variety of actors involved in an integrated program, you need a master plan which describes purpose, contents, actors, legal backgrounds, timeline, action plan and financing of the program. It is important that the plan should be based on proper legal authority and consultation with the participants of the plan .

Master plan can be used a paper to show clear picture of the program to all the stakeholders with description on the role of each participant and partner. It will be used as a central part of driving force for the program and can be used to persuade a governing body for authorization and a funding authority for securing necessary budget for the plan when necessary.

The international cases described in the previous section shows that all of them³⁶ was developed based on a master plan (named "framework" sometimes) designed through collaborative works with participants.

Recommendation 3: Establishment of a coordination body of participants

Collaboration is another key word for success for this kind of multiactor program, which is required from the planning stage. Development of efficient administrative process can be driven by a commitment by stakeholders for collaboration, co-governance and co-design.

A committee and a working group consisted of related parties are representative bodies for consulting, coordinating and making decisions on their common interests.

³⁶ Korea's NTIS operates under "3 Year Basic Plan for NTIS", and new version comes out every 3 years. New Zealand's NZRIS has the government documents such as "NRIS Overview", "NRIS Conceptual Framework", "NRIS Implementation Timetable", and "NRIS Technical Documentation".

There are a lot of examples in other countries. Korea runs “Committee for National R&D Management” at vice minister level for coordination of NTIS policy and “Working level Group” at institutional level for coordination of working level details. New Zealand’s MBIE is working with the “Funder Researcher Working Group” for data collection and standardization. Catalonia runs “Work Commission” formed by members of the Catalan universities and research centers to coordinate technical details.

Usually the coordinating body does not need to be a standing entity, however, it is recommended to have a body to hold a meeting whenever necessary. Details for the management of the coordinating body should reflect its governance culture and government hierarchy of Peru. Host can be CONCYTEC or another government organization beyond the level of CONCYTEC .

Recommendation 4: Appointment of a full time staff only responsible for planning and policy about R&D information system at working level

All DEGC staff of CONCYTEC are busy with their own tasks in their technical areas. It is recommended to have one full-time staff who is only in charge of planning of R&D information system(s) in Peru. Accordingly CONCYTEC-DEGC could build up its planning and policy making capacity remarkably.

5.3 Successful implementation of PGC and PeruCRIS

Even though CONCYTEC is making a great effort for the two initiations, PGC and PeruCRIS at the moment, it is not so clear to distinguish and find the difference between them, as pointed out in the section 3. It seems that there is a need to clarify the difference between the two.

Anyhow, the PGC and PeruCRIS start with integration of current R&D information directories of CONCYTEC. However, it seems that there are a lot of tasks for CONCYTEC beyond just physical integration of the directories. CONCYTEC should examine carefully the issues with current directories and develop solutions, if not, those problems will be inherited in the new integrated system.

For example, some information in CTI Vitae Directory is believed to be not reliable because the profile information is being uploaded by researchers by themselves. CONCYTEC may want to modify the current system to fix the problem. ALICIA Directory also needs improvement for better visibility and more high quality contents to attract users. Project Bank Directory needs total renovation for information from other government organizations and richer information on projects. Many of the problems cannot be solved by simple technical integration and synchronization of data of such directories.

Another sector of PeruCRIS in doubt is the value added services such as statistics, monitoring, and evaluation, since the current PeruCRIS description does not show details on how it can provide such services on what mechanism. For instance, it is questionable how and what data of the system can be used to help STI policy decision making in Peru.

PGC program being supported and supervised by the World Bank will go on anyway toward the final product, a platform. However, the program is already behind the schedule, and careful monitoring and self-checking would be necessary for successful completion of the program without further delay.

(Recommendation for section 5.3)

Recommendation 5: Clarification of the concepts of PGC and PeruCRIS

CONCYTEC's official proposal to the World Bank defines that PGC (Platform for Knowledge Management) is a portal service based on the integration of the current 5 directories of CONCYTEC. On the other hand, PeruCRIS (Peru's Current Research Information System), according to the CONCYTEC web, is described differently as a project, a network, and a system from time to time.

It is recommended to clarify the difference between the two initiations or modify definition of PeruCRIS .

Recommendation 6: Establishment of elaborate action plans for improvement of directories and additional functions (statistics, monitoring and evaluation)

It is recommended to establish elaborate action plans to improve the current directories and to add such functions as statistics, monitoring and evaluation. The early consideration for the elaborated action plans will be required since PGC will be undertaken soon.

5.4 Researchers' access to qualified science production information

Biblioteca Virtual of CONCYTEC is the excellent digital DB service of qualified international publications for Peruvian researchers. However, it is doubtful whether this service can continue after 2021 as pointed out at section 2.2. It would be one of the important tasks for CONCYTEC how to keep sustaining this kind of service.

In principle, it will be responsibility of researchers or their institutions to purchase publications for their research activities and not of a government. But considering the weak infrastructure for R&D information service in Peru, government's support is essential for the time being. Even in Korea the government led to establish KESLI³⁷, a consortium consisted of KISTI and applying universities to purchase overseas publications collectively in better terms.

37 Korea Electronic Site License Initiative

(Recommendation for section 5.4)

Recommendation 7: Preparation for the end of Biblioteca Virtual service

It is recommended for CONCYTEC to prepare measures to provide qualified international science publications to the researchers. An ordinary alternative is to secure government budget and another alternative is to consider a kind of consortium as you can see in case of Korea.

It will be important for CONCYTEC to monitor how Biblioteca Virtual will be utilized by researchers for coming years, which data can be used to justify continuation of the service.

5.5 Improving overall STI information infrastructure of Peru

Information providers for Peru's national STI information system are universities, research institutes journals and government organizations. Accordingly the quantity and quality of the national system will depend on the level of data and data management of those entities. The level of data depends on their researchers.

Most repositories of R&D institutes in Peru are not rich in data and only few of the institutes are operating RIMS. Information services of government organizations such as INDECOPI, Innóvate, and INS are not satisfactory. Hence, even if CONCYTEC is able to have good cooperation and links with them, it will be difficult to expect a high standard of national STI information system with the current level of data produced in Peru.

In short, overall level up of STI infrastructure in Peru is regarded as the most fundamental factor for the success of Peru's national STI information system.

(Recommendation for section 5. 5)

Recommendation 8: Government's aggressive Investment for STI

It is recommended for Peru government to invest boldly for STI programs of the country in order to expand the roles of STI in their future economy. Peru government's recent spending for STI as a percentage of total budget, 0.13% (2018), is too low compared with most other countries³⁸. With this absolute lack of investment for STI, it would be very hard to expect the economy reshaped by STI in the near future regardless of its R&D information systems.

Recommendation 9: Establishment of a research management office in universities and development of RIMS at institutional level

Universities are the most important players for research activities. Many programs can be devised to enhance research capacity of universities. One recommendable program is to establish a research management office in a university, which role includes securing external R&D projects, managing projects and stimulating technology transfer³⁹. In case of Korea the government has launched a variety of programs with incentives including financial support in an effort to promote establishment of a research management office within universities. Now they have become central units managing research projects of universities, and almost all of them are operating RIMS for the management of projects. A research management office is crucial for enhancement of research capacity of a university as well as for the management of STI data along with a library of university.

Annexe

1. NDSL and NTIS of Korea (PDF), Choi, Kun MO, June 2019

³⁸ Korea government's STI spending to the total budget ratio is around 4% a year for last few years, which ratio ranks around the 2nd in the world. Even in 1980s and 90s when Korea's economy was poor, the ratio was about around 2%. R&D expenditure as a % of GDP is 4.24 in Korea (2016), 2.4 in OECD average (2016), and 0.13 in Peru (2018).

³⁹ Peru government forces a university to have a vice rector of research. This is a good initiation as well for active R&D activities in a university, but the installation of a research management office is a little different concept.