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Current Status of Research Information Management in Peru

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Abstract

Nowadays, there is full consensus that the promotion of Science, Technology and Innovation has a positive impact on the economic growth of a country. In Peru, national and institutional STI decision-making is hindered by the lack of information on research activities. The National Council of Science, Technology and Technological Innovation (CONCYTEC) in Peru is increasingly aware of the value of embracing best practices in Research Information Management (RIM) and establishing an adequate national CRIS infrastructure, a project which has taken the name PeruCRIS. In order to assess a baseline status for RIM practices along with other research management needs, CONCYTEC visited 20 public universities, 23 private universities and 10 research institutes and promoted the participation of Peruvian institutions in a Global Survey on Research Information Management (RIM) Practices. Although only 6 institutions reported having a RIM system, more than half survey respondent institutions were in the process of exploring, acquiring or implementing one. Most RIM systems have being developed in-house, and no commercial CRIS product was reported. Interoperability of existing RIMs is very limited with internal systems. No interoperability with external systems or support for persistent identifiers was reported. Institutions expressed very positive expectations regarding the role of CONCYTEC in the establishment of a national CRIS infrastructure in Peru.

Keywords: research information management, current research information systems, national CRIS

1. Introduction

Investment in Science and Technological Innovation (STI) has a positive impact on competitiveness, economic growth, and social indicators of a nation [1, 2, 3]. Investment in Research, Development and Technological Innovation (R+D+i) by governments strengthens the scientific human capital, allows the industrial sector to have local professionals to assist in their transformation and innovation initiatives, and encourages collaboration between researchers and industry [4]. In order to measure and maximize the economic and social impact of public funding for research and technological innovation at a national level, it is essential to have quality information about STI activities and results.

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In a global context of digital transformation, the National Council of Science, Technology and Technological Innovation of Peru (CONCYTEC) is increasingly aware of the value of embracing best practices in Research Information Management and establishing an adequate national CRIS infrastructure for the generation of scientific-technological statistics and the management of the information necessary for the planning, promotion, execution and evaluation of STI activities.

As an important first step towards the conception of a national CRIS project, which has taken the name PeruCRIS, CONCYTEC carried out a study to identify the current state of research information management in Peruvian universities and public research institutes, whose main results are presented in this article.

The remaining of this article is organized as follows: Section 2 introduces in more detail the background and motivation for the study, particularly management difficulties faced by National System of Science, Technology and Technological Innovation and the benefits expected from PeruCRIS project. Section 3 presents goals, methods and procedures of the study through the participation in a Global Survey on RIM Practices and the visit to 53 institutions around the country. Section 4 presents and discusses the most salient results. Section 5 concludes and presents related work in the project.

2. Background and Motivation

The Political Constitution of Peru establishes that it is the duty of the state to promote the scientific and technological development of the country. The Law of Science, Technology and Technological Innovation states that the development, promotion, consolidation, transfer and dissemination of STI are of public necessity and of preferential national interest, as they are fundamental factors for productivity and national development at different levels of government [5].

In Peru, institutions and individuals dedicated to R+D+i and its promotion, conform the National System of Science, Technology and Technological Innovation (SINACYT). This includes not only public funds for STI and about 25 government institutions with R+D+i activities, but also 145 universities and other higher education institutions, public or private, that qualify.

CONCYTEC is the governing body of the SINACYT, in charge of the development of policies, regulations and promotion of activities related to STI. According to a diagnosis published by CONCYTEC as part of its National Policy for the Development of STI [6], the main problems that affect SINACYT are the following:

- The results of research and technological development do not respond to the needs of the country.

- Insufficient incentives for STI.

- Insufficient critical mass of researchers and qualified human resources.

- Low quality levels of research centers and laboratories.

- Insufficient information about the conditions of the SINACYT.

- Deficient institutionality and governance of SINACYT.

These problems are intertwined and one could argue that, although it appears in the penultimate position, the lack of information about the conditions of SINACYT is a transversal issue that directly affects the ability to improve the system. In particular, each stakeholder may have its own management mechanisms, which makes it difficult to share and homogenize the information between institutions, and SINACYT does not have as a whole an information system for gathering information on a national basis. This situation does not allow to adequately orient the activities, quantify inequality gaps or manage in a timely manner the execution of policies and incentives, let alone measure the quality and impact of results.

Currently, CONCYTEC manages a national CV platform, a national aggregator for open access repositories and a handful of other applications for storing information about researchers and innovators, evaluators, institutions, publications and STI projects. However, these systems were implemented independently, covering specific needs for which they were built, with ad-hoc data models.

This also presents great inconveniences for the researchers, who frequently require to enter into the national CV platform information that is already registered in national or international systems to which CONCYTEC has access, even its own.

To get ahead of these difficulties, CONCYTEC is launching PeruCRIS project for the establishment of a national CRIS infrastructure, based on international standards, with the expectation of obtaining significant benefits in the following aspects, among others:

- Strengthen research management capacities in institutions.

- Give greater visibility to activities and scientific production at the institutional, regional or national level.

- Improve the ability to generate differentiated statistics by geographic regions and areas of knowledge.

- Facilitate the creation of reports for the evaluation of the quality of the research.

- Support transparent management of research activities.

- Facilitate coordination and avoid duplication of projects among public funding agencies.

- Provide valuable information for monitoring public spending on STI.

- Improve the connection of people and institutions with each other and with the sources of financing.

- Avoid researchers entering the same information in different systems.

In order to establish a baseline for the project, to raise awareness of the importance of adequate Research Information Management, and to gain a closer understanding of ongoing practices and needs of SINACYT institutions, CONCYTEC carried out a study about the current state of Research Information Management in Peru.

3. Goals, Methods and Procedures

The general objective of the study was to assess the current state of Research Information Management in the Universities and Public Research Institutes of SINACYT.

The specific goals for the study were the following:

G.1 Identify the current state of implementation of Research Information Management systems and the type of system being used (open source products, commercial products or systems made in-house).
G.2 Identify the roles and areas responsible for Research Information Management.
G.3 Identify the main drivers and motivation for Research Information Management practices.
G.4 Identify how Research Information Management systems currently interact with other internal and external systems.
G.5 Identify the degree of satisfaction of the institutions with their Research Information Management systems and the degree of satisfaction with the quality of the information they currently have.
G.6 Identify other related needs and expectations regarding the role of CONCYTEC in Research Information Management at a national level.

The study was based on two components: the participation in a global survey that gathered in a mainly quantitative way the Research Information Management practices, and the visit to a significant sample of SINACYT institutions to gather *in situ* qualitative information about the perception, needs and expectations of institutional research managers.

3.1. Participation in Global Survey on RIM Practices

The development of a CRIS infrastructure at national level depends on each research institution having quality information following standards that allow its interoperability. Thanks to euroCRIS, CONCYTEC made contact with OCLC and was able to participate in the beta release of a Global Survey on Research Information Management (RIM) Practices jointly launched by both of those organizations. The suitability of this international instrument was positively evaluated by CONCYTEC and it was consequently chosen for the collection of quantitative information about ongoing RIM practices and systems in SINACYT. Among the main reasons for this option were the extensive experience of the team in charge of its preparation, the suitability of its content, the possibility of establishing international comparisons, and the benefit of contributing to the survey with a significant sample of institutions from this part of the world.

To facilitate Peruvian participation, CONCYTEC prepared a Spanish translation of the survey, which was made available on the OCLC website. The survey was administered directly by OCLC between October 2017 and January 2018. Raw anonymized data was subsequently provided to CONCYTEC for the analysis.

Although the survey included data for many aspects regarding RIM practices, CONCYTEC chose to focus on the answer to aforementioned specific goals G.1–G.5.

Peruvian public and private universities as well as public research institutes were openly invited to participate in the survey. A total of 39 Peruvian institutions responded to the survey, representing 10% of the global sample, the highest national participation together with the United Kingdom and the United States of America [7].

3.2. Visit to Research Institutions

A national CRIS project requires an effort not only technical but also strongly organizational, so it is critical to ensure that the motivation, needs and the situation of research institutions are being considered. In that way, it will be possible to align the project to institutional requirements and facilitate the adoption of the guidelines that CONCYTEC may propose as governing body of SINACYT.

With this motivation, between September 2017 and January 2018 CONCYTEC visited a sample of 20 (39%) Public Universities, 23 (25%) Private Universities and 10 (58%) Public Research Institutes, for a total of 53 visited institutions within 13 (52%) regions of the country: Ancash, Arequipa, Ayacucho, Cajamarca, Callao, Cusco, Ica, La Libertad, Lambayeque, Lima, Piura, Puno, Tacna and Ucayali.

For the selection of the sample, research institutions were clustered hierarchically by number of researchers, number of research publications and R+D+i spending, as reported in the First National Census of R+D+i 2016 [8]. Clustering was performed with SciPy [9] implementation of Ward variance minimization algorithm [10]. Due to the severely higher attribute values for the capital city, Lima Region was considered *a priori* as a cluster of its own, and removed from the dataset before clustering.

At least one region was selected from each of the resulting 9 clusters, in order to consider a wide variety of regional contexts for research institutions.

The visits were made by teams of maximum 2 interviewers, and included at least 3 institutions per visited region, with the exception of the Ayacucho region, where only 2 institutions were visited, and Lima, the capital city, in which it was possible to visit 13 institutions due to their proximity to the CONCYTEC main offices.

At the beginning of each visit, a one-hour presentation was made about the international situation of research information management and about the objectives of the study in the context of the information needs of SINACYT. Then a 60-minute semi-structured interview was held with the Research Vice Chancellor or Director, intended as the main input for the collection of qualitative information about their perception, needs and expectations of information in the context of their institutional management priorities. Finally, a technical meeting was held with library and IT staff with the aim of establishing close contact and getting to know at an operational level the institutional support for RIM. The entire visit also served as a means to better understand and contextualize the results that would come from the survey.

The semi-structured interview was lead with the aid of a guide containing sample questions around the following research question: What is the perception of research managers in Peruvian universities and public research institutes in relation to the current state of RIM at their institutions? Particular questions addressed

institutional research goals and context, main information needs, level of satisfaction with available research information, and expectations regarding the role of CONCYTEC. An informed consent form was signed in advance. Interviews were recorded and subsequently transcribed for analysis.

4. Results and Discussion

Below are the main results of the study, grouped by research goals.

4.1. G.1 – Identify the current state of implementation of research information management systems and the type of system being used (open source products, commercial products or systems made in-house).
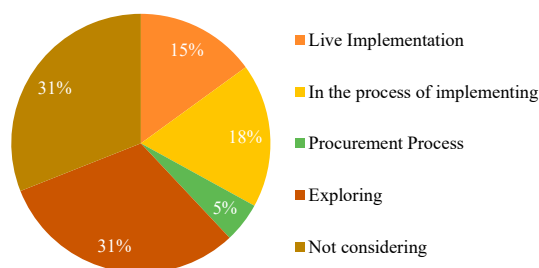
Fig. 1. RIM implementation status (n=39)

Figure 1 shows the results for the current implementation status of RIMs. Survey question was: *Please choose the status that best describes your institution's research information management (RIM) implementation stage.*

Our of all 39 respondents, only 6 (15%) reported a live implementation. However, it is significant that 21 (54%) are exploring/procuring/implementing, with only 12 (31%) not considering an implementation.

Besides 2 declared DSpace-CRIS installations (1 live, 1 implementing), every other system has been/is being developed in-house. None reported the use of a commercial product.

The information obtained in the visits and interviews confirms these results. The university context is marked by the recent enacting in 2015 of a new University Law that has given the mandate to establish Vice-Rectorates of Research, as well as to report research personnel, activities and results to the National Superintendence of Higher Education (SUNEDU) [11, 12]. As part of the licensing process after the Law, most universities are completing the configuration or reorganization of their research areas and are beginning to experience the need for information systems that support research management processes.

Before the visit, there had been no national orientation about data representation standards or CRIS/RIM software. Those who have started to build applications to manage their research information, carried out independent developments, usually very well suited to specific institutional needs, but lacking general features and support for international standards found in commercial and open source products.

4.2. G.2 – Identify the roles and areas responsible for Research Information Management.

Figure 2 presents the results for roles and areas for Research Information Management. Only institutions with a live implementation are considered for this analysis. Survey question was: *Please select the stakeholder who has a primary responsibility for each activity as it relates to the RIM system(s) at your institution.*

As expected, most activities are performed by Research Offices in coordination with IT departments and Academic Units. A very low participation of Libraries is reported.
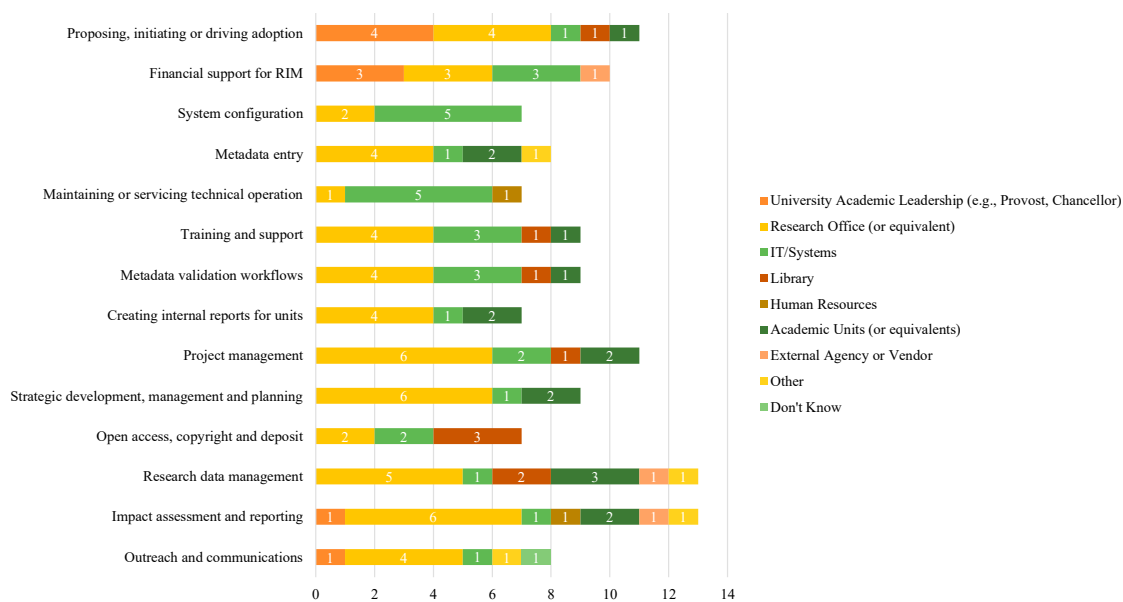
Fig. 2. RIM stakeholders and collaborators in institutions with a live implementation (n=6)

During the visits it was observed that library departments in Peruvian institutions typically operate under small budget and staff. Institutional repositories are frequently under IT responsibility with very limited participation of institutional library.

With very few exceptions, visited institutions do not have full-time professionals dedicated to the management of research activities.

4.3. G.3 – Identify the main drivers and motivation for Research Information Management practices.
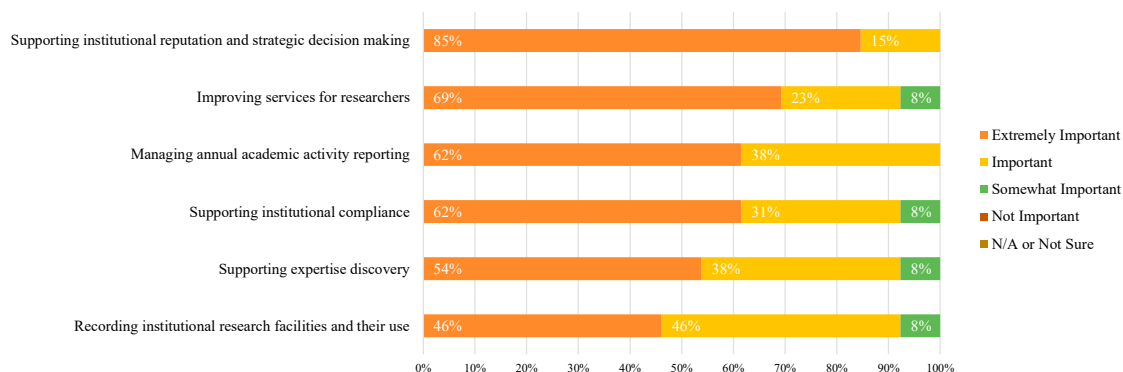

Fig. 3. Drivers for pursuing RIM activities in institutions with a live implementation or in process of implementing (n=13)

Figure 3 presents the reported drivers for Research Information Management. Only institutions with a live implementation or in process of implementing are considered for this analysis. Survey question was: *Please indicate the importance of the following reasons for pursuing research information management (RIM) activities.*

The most important driver reported by Peruvian institutions in the survey is Supporting institutional reputation and strategic decision making. This comes in contrast with information gathered in

the visit to institutions, where the most important driver for implementing RIM practices and systems was external reporting to SUNEDU.

The licensing process carried out by SUNEDU has forced universities to collect and report data on research areas, personnel, centers, publications, patents, projects, spending and equipment. Many institutions have felt the need of retrieving information from physical records scattered in different areas. Only a few institutions have digital support for managing awards/grants and monitoring research projects. Research information processes are typically carried out without a RIM system.

4.4. G.4 – Identify how these systems currently interact with other internal and external systems.
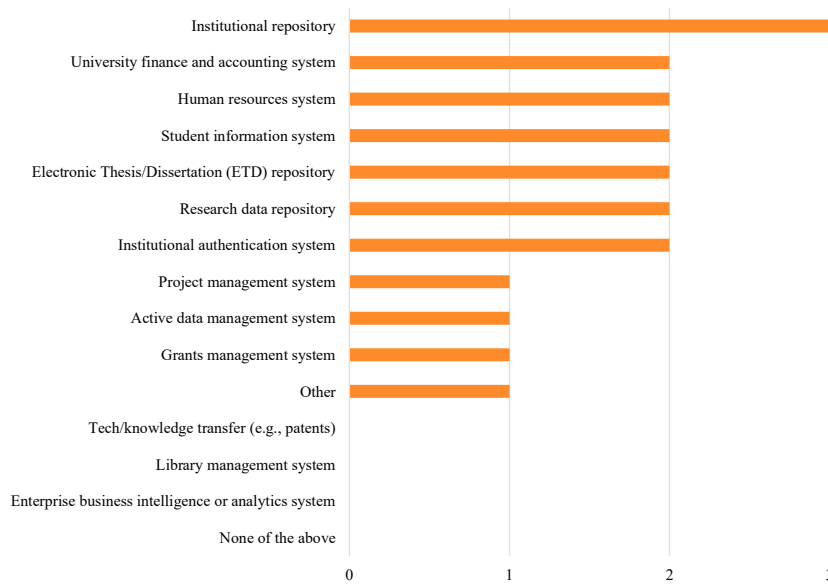

Fig. 4. RIM interoperability with internal systems in institutions with a live implementation (n=6)

Figures 4 and 5 present reported internal and external interoperability for RIM systems. Only institutions with a live implementation are considered for this analysis. Survey question was: *"Which of the following internal/external systems interoperate with your RIM system(s)? (Select all that apply.)*

The results show an incipient interoperability with internal systems, in particular with institutional repositories, financial systems, human resources systems, student information systems and institutional authentication systems. During the visits, the lack of systems for the management of funds and institutional financing projects was noted, which is also reflected in this question regarding internal interoperability.

Most notably, the results show the almost absolute absence of interoperability with external systems. At the national level, although CONCYTEC and SUNEDU have interfaces to share information on the profile of researchers and academic degrees, these data are not being consumed by institutional RIM systems. Likewise, the reporting of research information from the institutions to these government entities is not yet done through interoperability mechanisms.

Integrations with persistent identifiers or research metrics sources were not reported or observed at all during visits. Although CONCYTEC implemented ORCID integration in national CV platform in 2016, none of the respondents or visited institutions have system integrations with ORCID.

4.5. G.5 – Identify the degree of satisfaction of the institutions with their Information Management systems and the degree of satisfaction with the quality of the information they currently have.

Figure 6 shows the perceived performance of live implementations by RIM functionality. Survey question was: *Thinking about the following functions of RIM, how well do you feel your institution is performing?*
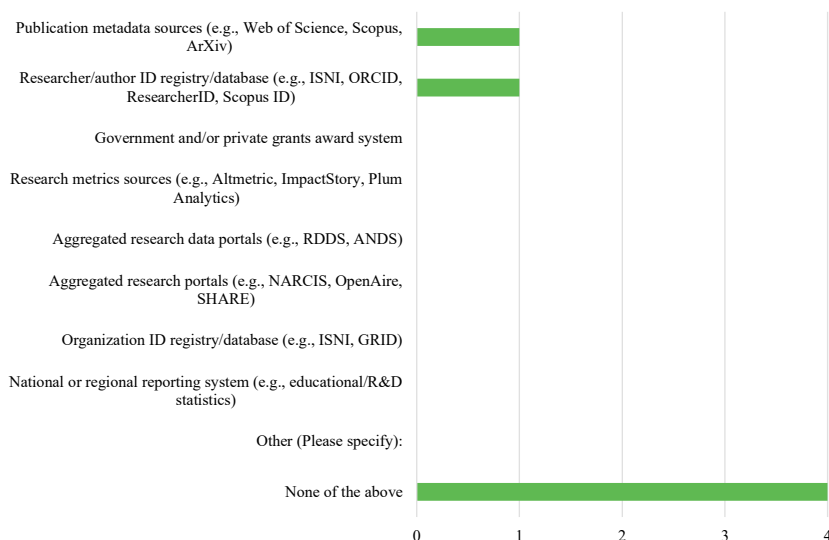
Fig. 5. RIM interoperability with external systems in institutions with a live implementation (n=6)
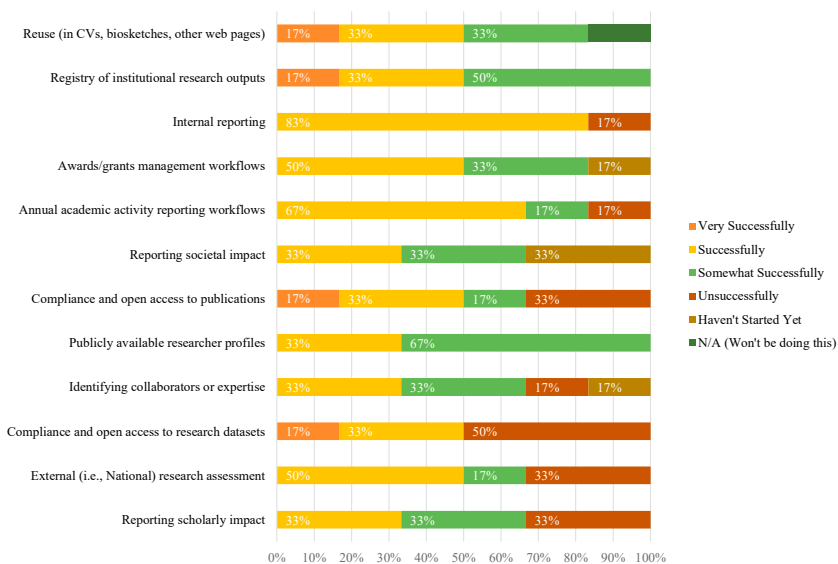

Fig. 6. Current performance of RIM functions in institutions with a live implementation (n=6)

In the results of the survey it is observed that a good score is assigned to performance in basic RIM functionality such as profile information, research outputs and internal reporting. More advanced features, particularly the support for reporting impact and for research datasets, are generally lacking or unsuccessful.

During the visits, particular attention was given to the degree of satisfaction of research authorities with information available to them, whether they had a RIM system in place at the institution or not. In many cases, research managers recognized the work of their teams to consolidate information, but at the same time lamented the lack of a system that facilitated the sharing of information with other academic and administrative areas. In particular, the licensing processes for universities have meant a great effort to report in many cases for the first time institutional information about research capacities, activities and results.

A few managers who receive adequate budget and institutional sponsorship reported being highly satisfied with research information available to them.

4.6. G.6 – Identify other related needs and expectations regarding the role of CONCYTEC in Research Information Management on a national level.

CONCYTEC visit was very welcome at every institution. Institutions expect CONCYTEC to lead the homogenization and standardization of scientific information management, as well as the knowledge transfer of best RIM practices from the leading international institutions. They also expect CONCYTEC to align the research information requirements from the different government stakeholders.

Research managers requested that, in order to facilitate external reporting, national authorities such as Ministry of Education, SUNEDU and CONCYTEC should reach a consensus about what information would be periodically requested from them and how should it be represented.

Research offices 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.

There is a also a great need for discovering potential national and international evaluators for projects and publications, without conflicts of interest. The possibility of a national CRIS infrastructure was seen also as a way for increasing the visibility of Peruvian researchers for evaluating international projects as well.

Many institutions reported a need to strengthen research capabilities in students and faculty. 60 out of 143 Peruvian universities have been created in the last 10 years. Before the enacting of the 2015 University Law[11], which attempts to guarantee minimal quality levels, a great number of institutions focused only in academic activities and did not have proper research management.

Public Research Institutions, which are usually aimed at developing a particular field of research on a national level, expect CONCYTEC to be able to report STI indicators by geographical regions and fields of knowledge, so as to avoid duplication of efforts for gathering information and generating statistics.

Particular value was given to CONCYTEC interest in reducing the inequality gap in research activities and fund allocation between the capital city and other regions in the country. There are still no competitive funds designed to accommodate for very asymmetric characteristics in different regions of the country. Institutions with different capacities and needs must compete for the same funds.

5. Conclusions and next steps

The results of this study have allowed obtaining a diagnosis of the Peruvian reality in the implementation of RIM practices. The increase in funds allocated to the promotion of STI and the introduction of the University Law in 2015 have generalized the need to efficiently manage spending in the promotion of research and innovation at the institutional, regional, sectoral and national levels.

Although there are still very few Peruvian research institutions that have a RIM system, more than half institutions report being in the process of exploring, acquiring or implementing one. The few current systems are in-house developments, except for a couple of open source systems. The use of any commercial CRIS product was not reported.

Existing systems generally provide good performance for the specific needs for which they were designed, but are not ready to interoperate with external systems. For the implementation of a national CRIS infrastructure it is urgent to define and promote the adoption of persistent identifiers for people, institutions, projects and funding.

Institutional research offices have been developing such systems directly with their IT departments or with external suppliers. International experience shows that a more active participation of librarians might be of great advantage for effective RIM practices.

Peruvian institutions expressed very positive expectations regarding the role of CONCYTEC in the establishment of a national CRIS infrastructure. It is expected that CONCYTEC will exercise leadership

among the government and academia institutions, establishing interoperability standards and favoring the implementation of institutional RIM systems and best practices. This endeavor could be carried out upon the basis of the already operating national network of open access repositories, which currently integrates more than 150 institutions.

Undoubtedly, a notable outcome of the study has been the improvement of communication channels between institutional research managers, librarians, IT teams and CONCYTEC's team in charge of the PeruCRIS project. In order to strengthen this link, as well as to continue raising awareness and knowledge exchange at a national level, a First National RIM Conference was held in the city of Arequipa in July 2018. Likewise, CONCYTEC continues visiting research institutions in order to share experiences and develop collaboration opportunities.

As next steps in this initial phase of the PeruCRIS project, efforts are being made to consolidate national and international strategic partnerships, to offer international training activities on RIM practices and systems for Peruvian institutions, to develop with research institutions a national application profile based on CERIF for research information exchange, to promote the adoption of ORCID and other persistent identifiers, and to strengthen metadata quality and coverage of the national network of open access repositories.

CONCYTEC is also working in preparing the specifications for a national CRIS system to consolidate information already available to CONCYTEC from national and international sources, and to integrate with institutional CRIS systems as they become available and interoperable. Pilot projects will follow for interoperability with FONDECYT, CONCYTEC fund for STI promotion, and with research institutions.

6. Acknowledgements

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