ARTICLES

Carrots and Sticks

Some Ideas on How to Create a Successful Institutional Repository

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Abstract

In this article, we tackle the ubiquitous problems of slow adoption and low deposit rates often seen in recently created institutional repositories. The article begins with a brief description of the implementation process of RepositoriUM, the institutional repository of the University of Minho, and moves on to thoroughly describe the set of activities included in a strategic plan specially designed to undertake the previously outlined problems. Among those activities are the development of an adequate promotional plan, development of value-added services for authors, engagement in the international community and definition of a self-archiving mandate policy. The article also provides some figures on the results of the strategic plan and explores future initiatives being devised to further increase the adoption of the repository.

Introduction

Institutional repositories may be defined as information systems capable of capturing, preserving and providing access to the intellectual output produced by the members of an institution [1, 2]. Within the specific context of academia, an institutional repository may contribute to the increase of the institution's prestige and nourish the ideal of an "institutional memory", because it manages and preserves relevant informational items that otherwise would remain scattered, unattended or inaccessible.

Institutional repositories have emerged along side the Open Access to scientific literature movement. In broad terms, Open Access means free, online access to digital scholarly materials, primarily peer-reviewed research papers but also other types of digital content that authors wish to make freely available to all users online. Self-archiving peer-reviewed journal articles in institutional repositories is one of two pathways to Open Access as defined in the Budapest Open Access Initiative[i] (the other being publication in Open Access journals), and self-archiving in repositories is often considered the most effective and the quickest to attain

[3].

The University of Minho and, in particular, its Documentation Services (SDUM) have embraced the Open Access movement and engaged in the implementation and promotion of its own institutional repository. The primary goals for the repository were rather ambitious:

- Maximise the impact of the research carried out at the institution;
- Preserve the intellectual memory of the University of Minho being produced in digital forms; and
- Accelerate the progress of science.

However, implementing an institutional repository is not as simple as just installing repository software and making the repository accessible to its potential users. The general idea that "if you build it, they will come" does not really reflect the reality of what happens when an academic institution establishes an institutional repository (IR). Adoption is usually slow, as users do not generally perceive the potential benefits that may arise from using such a system [4]. Some are extremely careful regarding what concerns publisher rights, others recognise barriers in the use of technology, while still others might find difficult to fit an additional task, such as self-archiving, into their already overbooked agendas [4, 5].

At the University of Minho we are overcoming the problems of slow adoption and low deposit rate by committing to the following set of measures: 1) devising a thorough promotional plan; 2) developing value-added services for repository users; 3) engaging with the international community; and 4) implementing a mandated self-archiving policy as well as offering a financial incentive to promote self-archiving.

The acquired experience and the results obtained with the implementation of these measures are worth sharing with the general community. In this article we will provide an overview of the implementation process of RepositoriUM and describe the most effective measures that were conducted to achieve what we consider to be a successful IR implementation. We will also unveil some of the ideas for future initiatives that will soon be put to practice at the University of Minho that aim to further increase the adoption of our institutional repository.

2 The implementation process

The implementation process of RepositoriUM has integrated a national programme called e-U (Electronic University) established by the Portuguese government and aimed at building infrastructures, services, and communication networks to facilitate the production and interchange of knowledge among college students and teachers within Portuguese universities. The project was assigned to the Documentation Services (SDUM), the organizational unit responsible for managing the various libraries that spread across the two campuses that compose the University of Minho.

The first stage of the implementation process consisted of evaluating available open-source content management systems and subsequently identifying the right platform to fulfil the goals of the Documentation Services.

In April 2003, it was decided that DSpace[ii] would be the platform of choice. DSpace is open-source software developed in partnership by the Massachusetts Institute of Technology (MIT) and Hewlett-Packard (HP). Its creators define DSpace as "a groundbreaking digital library system to capture, store, index, preserve, and redistribute the intellectual output of a university's research faculty in digital formats." [6]. Among other features, DSpace comes with a simple but effective software architecture, uses state-of-the-art technologies, has an intuitive graphical user interface and is very much targeted to open access to scholarly material. Between its release in 2002 and the establishment of the IR at the University of Minho, DSpace had been installed in over 100 institutions around the globe, ranging from large universities to small higher education colleges and research centres [6].

In addition, DSpace was endorsed by some of the most important universities in North America. This fact alone was interpreted as testimony of its wide-range acceptance while, at the same time, assured us that the system would be maintained and supported for the foreseeable future.

In May 2003, we began preparing DSpace for deployment. First, it was translated into Portuguese, and its user interface was adapted to meet the graphical identity of the holding institution. After that, several recently graduated Ph.D. and Msc. students were invited to deposit their theses in RepositoriUM. The main idea behind this initiative was to instigate the population of the repository so that it would contain at least a few hundred items before going public. At this stage, members from six pilot communities of the University of Minho were also invited to contribute their conference papers, journal articles, grey literature and other materials that they felt were important to preserve and to which to provide access. Four of those communities accepted the invitation and provided content to the repository.

On November 2003, the repository was announced to the academy and opened to the general public, with a total of 280 documents. To highlight the opening, a ceremony and a press conference were held at the University of Minho. Both events were endorsed by the dean, who was present at both events.

In January 2004, the deposit on the RepositoriUM was finally made available to all the members of the University, and a call for deposit was sent to each person in the academy. During that year, several reminders of the call were issued to the internal community.

The year 2004 was the year of consolidation and affirmation. The main objectives for that period were intimately related: to increase, significantly, the number of deposited items in the system, and to promote its utilization both inside and outside the University of Minho faculty. To accomplish those goals, several generalized appeals were made directly to the organic units of the university (mostly departments and research centres) requesting them to deposit and preserve their original intellectual production in the institutional repository. On those appeals it was suggested that the process could be initiated with an introductory presentation and training seminar where all interested authors could be instructed on how to deposit their materials.

Between January and July 2004, ten presentations were given to departments and research centres. A consequence of that was the creation of two additional communities. However, also during that period, three of the pilot communities had come to a standstill and had not deposited any more documents in the IR. By the end of the first semester of 2004, it had become apparent that despite the fact that RepositoriUM had acquired some visibility and registered good figures in terms of access and downloads, the number of communities and documents in the repository was growing more slowly than initially envisaged.

By the end of 2004, the number of documents in the repository reached about 630. It was felt that in spite of the various calls for deposit, the calls were not producing the expected results. The number of self-archived documents was still remarkably low. Of the 630 documents in the repository, only a mere 128 were archived by the authors themselves. Clearly, something had to be done to disrupt this tendency.

3 Measures to increase adoption

After realising that the levels of adoption of the repository were below the initial expectations, we took some time to reflect and research the factors that were influencing the behaviour of the authors and – most importantly – to discover ways to turn this tendency around.

After careful reading of research literature, we realised that most institutional repositories were suffering from the very same problems that we were experiencing at the University of Minho [7]. The generalization and adoption of self-archiving habits by academics had been reported as a complex and slow process due to inertia on the part of faculty as well as other obstacles that usually orbit this procedure. The traditions rooted in the majority of the scientific communities; fears that self-archiving would mean more work for faculty

and the frittering away of their time; doubts and difficulties related to copyright issues; and faculty lack of knowledge regarding the advantages of Open Access were all obstacles found among RepositoriUM users, as well as among the majority of other institutional repository users around the world.

Based on these reflections, we devised a strategy to further stimulate the adoption of RepositoriUM. This strategy was composed of four essential components:

1. Develop a promotional plan for RepositoriUM and Open Access in general.
2. Develop value-added services for authors.
3. Become further engaged in the international community, i.e., to proactively participate in the Open Access, institutional repositories and DSpace communities worldwide.
4. Define a self-archiving policy and create financial incentives to increase deposit.

3.1 The promotional plan

Concerning the first step of the strategic plan, the work consisted mainly of reinforcing and systemizing a set of activities that, from 2003 onward, were already being carried out.

RepositoriUM and Open Access continued to be evangelised within our faculty, and occasionally in other national institutions, by means of presentations, papers, interviews, news in the press, promotional materials, flyers, websites, etc., as well as by participating in a large number of meetings, conferences, workshops and projects related to Open Access and the development of DSpace [8-13].

We found that sometimes the best way to reach our target audience is not to aim our discourse directly at them, but instead to flood the surrounding channels that nourish their informational needs.

3.2 Value-added services for users

The second step of the strategic plan consisted of the development of several informational and value-added services for both authors and readers.

One of the recurrent issues associated with self-archiving lethargy was stated as confusion and uncertainty about intellectual property rights [5]. To counteract that problem, a series of help pages and user guides were created to aid authors with the decision of whether or not they could publish their materials in Open Access IRs without infringing any previous copyright releases they may have already signed. We also added technical information to DSpace to help newcomers understand the overall procedures offered by the platform, and we updated the IR ingestion process to make it more user-friendly.

Origin	Consults	Downloads
Brazil	475	2771.00
Portugal	1464	1132.00
Argentina	2	89.00
United States	18	27.00
Universidade do Minho	90	26.00
Peru	2	19.00
Uruguay	0	18.00
Venezuela	0	12.00
Spain	12	9.00
Angola	3	8.00
China	0	7.00
France	5	7.00
Colombia	2	6.00

Figure 1: A screenshot of the output produced by the Statistics Add-on.

We made it possible for authors to check various types of useful statistics about their communities and their deposited information items. For example, authors were able to check how many times their deposited items had been downloaded, identify the countries from which those downloads originated and see how many people read the metadata for the items but had not downloaded the items themselves.

Community-driven statistics were also made available. Each author was provided access to a summary of downloads per community and collection, a top authors page, a list of the most downloaded items, the current state of the ingest process, etc. These types of statistical services enabled authors to appreciate the tremendous impact that their deposits produce once the materials become available to the outside world. Figure 1 depicts the type of downloading statistics produced by the statistical service developed at the University of Minho for a typical paper deposited in the repository.

3.3 Engaging in the community

Together with the evangelisation of Open Access and the endorsement of DSpace as an excellent platform for the implementation of institutional repositories, the University of Minho has been actively involved in the development of add-ons for that platform. Among these, the most noteworthy are:

- **Statistics add-on**[iii] – generates various access and downloading reports. The purpose of the statistics add-on was to promote RepositoriUM and author self- or mediated-archiving, by demonstrating the worldwide accessibility and usage (access/downloads) of archived documents (as described in the previous section). The add-on also provides usage, content and administrative statistics to community/collection administrators, as well as repository level statistics [14].

- **Request a copy add-on** – enables universities to implement Steven Harnad's ID/OA (Immediate Deposit/Optional Access) policy in DSpace repositories for documents with access restrictions. Basically, it works by sending an e-mail to the author of a document requesting a copy of the item that is not publicly available in the repository (i.e., not available via Open Access) [15].

- **Controlled Vocabulary add-on** – allows the user to choose from a predefined taxonomy of keywords to describe items of information that are being submitted to the repository. That same taxonomy is

subsequently used to find and access items held in the repository [16, 17].

- **Commenting add-on** – allows users to append comments to documents in the repository [16].

- **Recommendation add-on** – provides recommendations of items related to the document currently being visualised [16].

- **Web of communication add-on** – draws an interconnected network of all the items and users in the repository, highlighting their interactions at the informal level of communication (e.g., comments, downloads, deposits, etc.) [16, 18].

In a much less technical arena, members of the University of Minho have been present at several conferences and scientific meetings around the world, exposing the university's own experience on the implementation of institutional repositories and Open Access practices [8, 10-13, 19, 20]. Moreover, two international conferences on the subject have been organised at our institution, in May 2005 and November 2006 – the first and second Conferences on Open Access to Knowledge.[iv]

3.4 Self-archiving policy & deposit incentives

The fourth component, and probably the most effective one, was the definition of a self-archiving policy stating that all scientific work produced by a member of the University of Minho should be deposited in the RepositoriUM. This policy, signed by the dean of the university, was put into practice in January 2005 and can briefly be summarised by the following points:

- All the teachers and researchers at the University of Minho, these being authors or co-authors of any type of published work, should deposit those resources in the institutional repository of the University of Minho and grant permission for the dissemination of the resources via Open Access;
- All organic units of the University of Minho should subscribe or adopt self-archiving policies for their own research output;
- All authors of theses and dissertations approved by the University of Minho should authorise their deposit and dissemination through the institutional repository.

The second paragraph of that policy stated that, during the year of 2005, a financial supplement of 99.000 euros would be distributed to departments and research centres as a reward for their commitment in the implementation of the policy. The policy also established the criteria for the awarding system. For example, the reward would only be handed to departments and research centres, never directly to individual researchers.

To stimulate the early adoption of the self-archiving practice, the reward was distributed according to the number of documents archived along three distinct time spans: 42% of the reward would be given according to the number of self-archived documents till April 2005, 33% according to the number of documents archived between May and August 2005, and 25% according to the number of documents archived from September to December 2005.

At each of these stages, the amount of funding that each research centre or department would receive was calculated according to the following scoring system:

1. Type of documents self-archived

   - peer-reviewed journal articles = 1 point;
   - peer-reviewed/accepted conference papers = 0.5 points;
   - other documents = 0.1 points;

2. Date of publication

- 2004 to 2005 = 1 point;
- previous to 2004 = 0.3 points;

3. Research centre and departmental self-archiving policy

- Departments that adopted a self-archiving policy based on the general template (basically, self-archive and make available via Open Access whenever possible; restrict access or post metadata only; and consider the institutional repository as the official registry of its research output, from which all the lists and scientific production statistics should be extracted) = 1 point;
- Departments without an internal policy = 0.3 points.

As a result, from 1 January to 31 December 2005, 2,813 documents had been deposited in RepositoriUM: 41% of these were journal articles; 40% were conference papers; and 19% were other types of documents (book chapters, books, working papers, etc.).

In 2006, the dean issued additional financial support in the amount of 30,000 euros to be distributed according to the same rules as the previous year. As a result, in 2006 an additional 1,885 documents were deposited in the repository. 83% of those were self-archived by the authors themselves, while the rest (315 documents, mainly theses and dissertations) were deposited administratively by Documentation Services staff.

4 Analysing implemented measures

In an attempt to measure the effects of the strategic plan, some statistics have been drawn from RepositoriUM. Table 1 depicts the growth of the repository in terms of deposited items, number of available communities, registered users, downloaded items and percentage of self-archived items (i.e., self-archived items/total amount of items deposited). Each figure represents the state of the repository after a 12-month period of implementation of each of the measures.

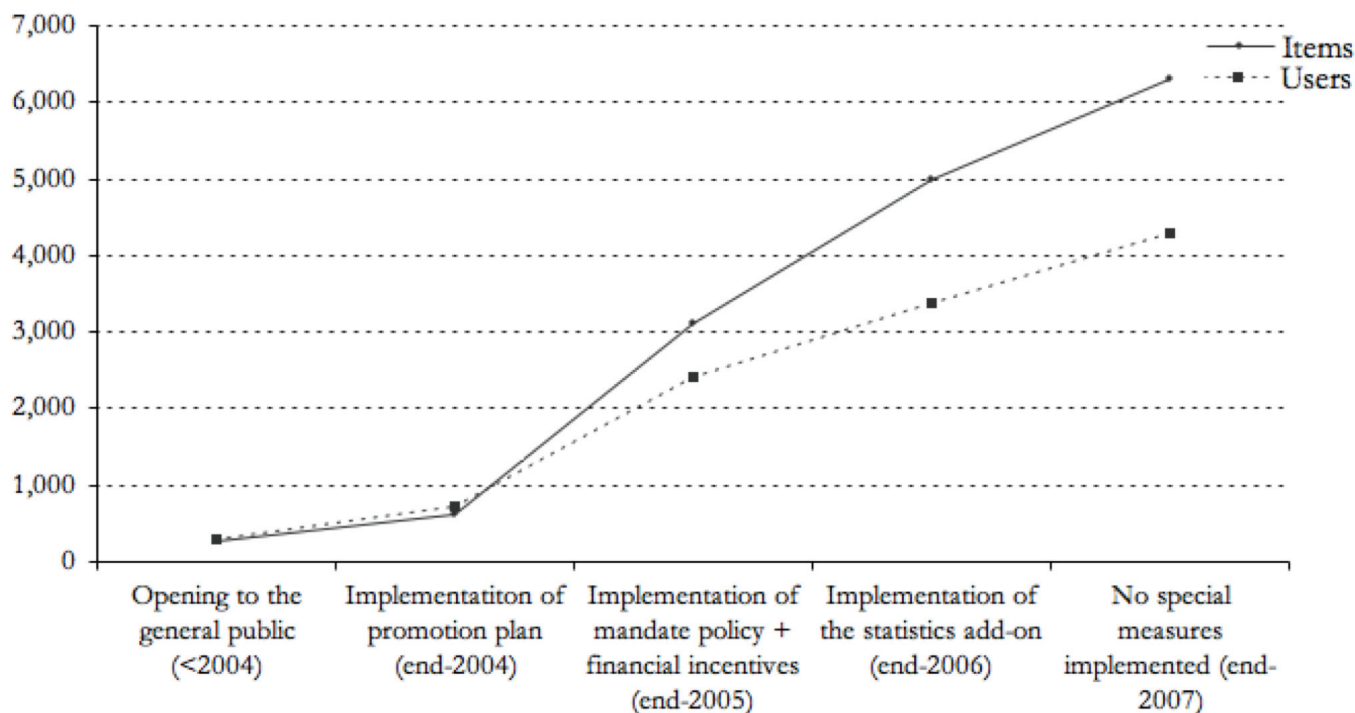**Table 1: Growth of RepositoriUM since its implementation.**

Measure	Date	Items	Communities	Registered Users	Number of downloads	% self-archived
Opening to the general public	end 2003	280	4	300*	3,363**	0%
Implementation of promotion plan	end 2004	626	7	717	88,328**	20%
Implementation of mandate policy + financial incentives	end 2005	3,105	33	2410	189,916**	91%
Implementation of the statistics add-on	end 2006	4,990	35	3,390	473,189	92%
No special measures implemented	end 2007	6,296	35	4,301	915,341	75%

* estimated data.
** data collected before the implementation of the statistics add-on.

After analysing the data, we concluded that the most effective measure implemented was the self-archiving mandate policy combined with the financial incentives. The implementation of both of these measures produced an increase in self-archiving of roughly 71% during that year, and the number of items in the repository has increased each year since 2003.

It is difficult to separate the influence of the mandate deposit policy from that of the financial incentive, since both measures were implemented simultaneously. However, a close examination of the authors' deposit behaviour shows that the number of deposits was much more concentrated close to the proposed award deadlines, i.e., the end of March, end of August and end of December.
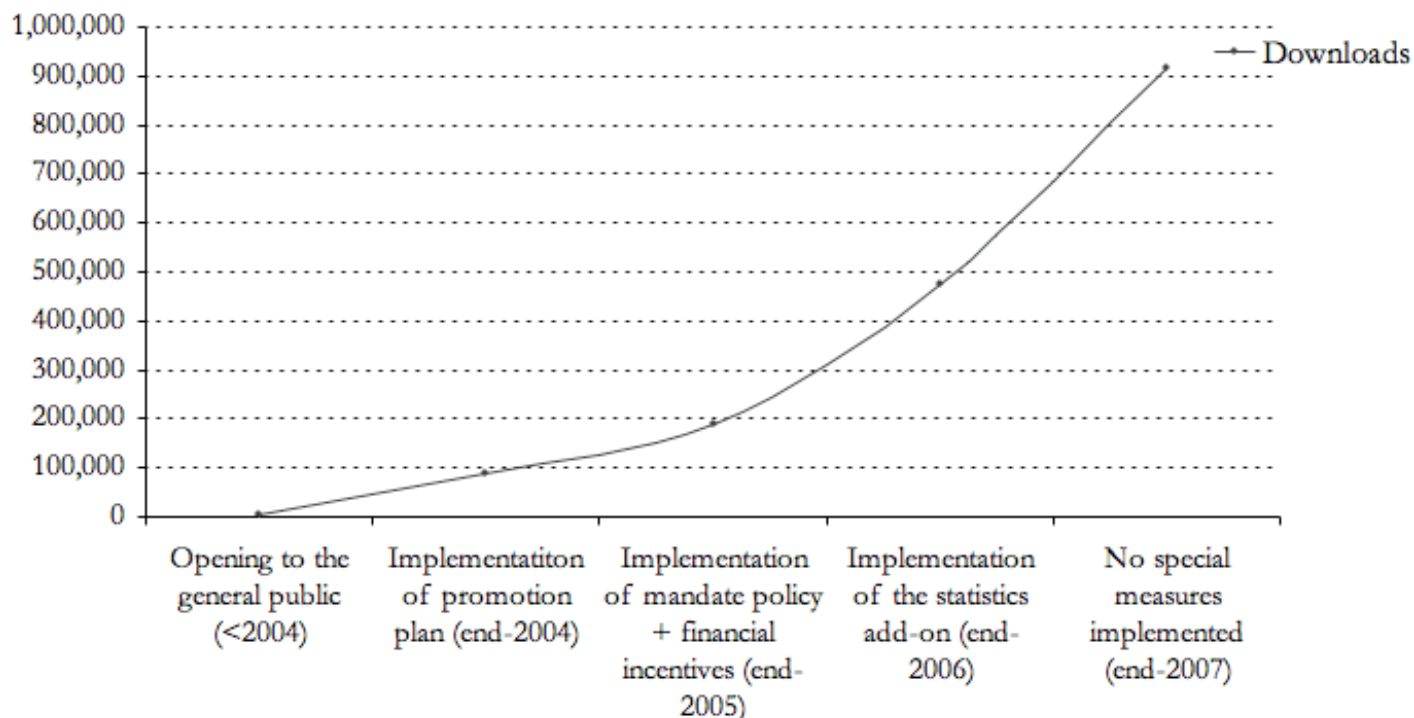

**Figure 2: Number of items and registered users in RepositoriUM
since its debut at the beginning of 2004.**

Figure 2 shows the number of items in the repository after a 12-month period of implementing each of the previously described measures. Figure 3 depicts the exponential nature of downloading behaviour. As the number of items in the repository increases, the overall number of downloads increases at even a higher rate.

Although the figures presented in this section seem to show that RepositoriUM has acquired a considerable amount of support from its users, both authors and readers, the figures won't mean much until we are able to quantify the total universe of depositors, as well as their research output, and compare those figures with the actual number of depositors and deposits in the repository [21]. The number of researchers at the University of Minho is not difficult to attain. Research centres usually keep good track of every researcher under their administration in order to properly manage the distribution of funding. However, having a clear idea of the actual research output is a different story. Today we have no accountable mechanisms through which to obtain the real scientific output of our academy. However, that situation is about to change. A national programme called Degóis[v] has recently been launched in which every researcher in Portugal is expected to register every aspect of his/her curriculum, including his/her real research output. Over the next few years, the calculation of real deposit ratios will allow us to confirm the true success of RepositoriUM.

Figure 3: Number of downloaded items since the beginning of 2004.

5 Other initiatives

The University of Minho has also been involved in a great number of other initiatives worth mentioning here. Although these initiatives were not part of the original strategic plan to increase the adoption of the repository, they show the commitment of this academy, and especially its Documentation Services, in taking part in all sorts of activities related to Open Access and institutional repositories.

One of these initiatives is the "Declaration of deans". In mid-October 2006, the Council of the Rectors of Portuguese Universities issued a statement that was presented at the Second Open Access Conference at the University of Minho. This statement pointed out that "the practical realities and the economics of the diffusion of scientific knowledge and cultural heritage have been radically changed with the spread of the internet. (...) In view of these new realities it is becoming clearer that the university's mission to disseminate knowledge will only be accomplished if the corresponding information is rapidly made available to society at large through the new paradigm of Open Access via [the] Internet. (...) For Portugal, Open Access may result in a greater visibility in the international scientific community and also facilitate the accessing of scientific information by companies and citizens, promoting larger scale transfer of knowledge and innovation."

As a result of these facts, the Council of Rectors of the Portuguese Universities have adopted the following position:[vi]

1. To support and adhere to the principles of Open Access by signing, through its President, the Berlin Declaration on Open Access to Knowledge;

2. To recommend all Portuguese Universities to establish, by themselves or on a cooperative basis, institutional repositories where researchers may deposit their scientific and academic publications;

3. To recommend that all Portuguese Universities formulate institutional policies;

4. To explore, together with internationally recognised scientific journals, ways to place in Institutional repositories papers authored by Portuguese researchers and published in those journals, thus preserving the legitimate priority to publish in those journals;

5. To recommend that the Ministry of Science, Technology and Higher Education (MCTES) enforce policies determining that publications resulting from research projects directly or indirectly funded by the MCTES be placed at least in an Open Access repository;

6. To support networking and interoperability between institutional repositories of Portuguese Universities and the establishment of a single portal website for accessing national scientific publications.

It is hard to measure the practical effects of such a declaration. However, informal conversations with members of other institutions confirm that many of the major national universities are now engaged in the implementation of their own institutional repositories.

The University of Minho has also promoted several initiatives regarding OA at the international level, mainly in Portuguese and Spanish speaking countries. The most relevant one was the writing and signature of the Minho commitment to Open Access in November 2006. This initiative was born during a workshop held at the 2nd Conference on Open Access to Knowledge and included signatories from Portugal, Brazil and Mozambique. The major outcome of this workshop was the creation of the ALEMPLUS[vii] initiative, an open committee that aims at:

- Contributing to increase the global impact of scientific research originating in the Portuguese speaking countries through Open Access;
- Mobilizing research and development efforts in Portuguese speaking countries towards an integrated action concerning Open Access initiatives in those countries;
- Raising awareness of government research, academic institutions and funding agencies to the Open Access initiatives and their benefits.

A second workshop took place in Rio de Janeiro, Brazil, in November 2007, during the Internet Governance Forum and hosted official representatives from Angola, Brazil, Cape Verde, Guiné-Bissau, Mozambique, Portugal and from the Executive Secretary of the CPLP (Community of Portuguese Speaking Countries). In this workshop, it was decided to continue to strengthen the political and technical dialogue in order to establish a network of institutions working on OA, and sign, in a future CPLP meeting, a formal political agreement in favour of OA in the CPLP countries.[viii] In the final declaration that resulted from this workshop, IBICT and the University of Minho have committed to offer technical assistance on the promotion of OA to all the countries that constitute CPLP.

An additional initiative for which the University of Minho has been preparing is the creation of a national search engine for institutional repositories. The idea behind this initiative is to increase visibility and access to national scientific results, promote the implementation of institutional repositories among Portuguese academia and enable the development of services over metadata at the national level. It is also expected that the national curricula system, Degóis, will be able to communicate at various levels with the centralised repository of metadata.

6 Conclusions

The implementation of an institutional repository can be a Herculean task, not so much due to technical difficulties or unsustainable funding requirements, but mainly because institutional repositories interfere with the traditional practices of scholars and researchers. Nevertheless, as soon as an institutional repository is set up, all of the academy's research output is expected to be placed in the repository in order to increase the academy's visibility, usage and impact (among other things, such as constituting the long-term memory of the academy).

The task of convincing researchers to deposit their publications in the institutional repository is, by far, a

repository manager's most demanding task. A great deal of research and imagination are needed to attempt to counter the initial reluctance of researchers to begin depositing their research materials in the institutional repository. Simply breaking the barrier of inertia is probably the most difficult challenge of all. Once that obstacle has been surmounted, peer pressure and the awareness of the advantages of using such a system should be sufficient to maintain a healthy deposit rate from academic researchers.

In summary, since the opening of RepositoriUM at the beginning of 2004, a great number of initiatives have been implemented with the sole purpose of increasing the repository's adoption. From the start, we have worked to foster substantial growth in all measurable aspects of the repository, such as the number of deposited items, registered users, communities, downloads and self-archiving ratios. Among the initiatives are the creation of a promotional plan, including plenty of internal talks, flyers, direct contact with department directors, training seminars, etc.; the creation of value-added services for users, such as the ability to consult downloading statistics, the creation of researcher web-pages, reports, etc.; engagement with other Open Access and institutional repository communities; and finally, the implementation of an institutional policy for deposit, combined with financial incentives to reward the communities with the highest number of deposited items. This last measure has proven to be the most effective of them all in breaking the initial inertia.

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Notes

i. <http://www.soros.org/openaccess/>.

ii. <http://www.dspace.org/>.

iii. You may see an implementation of the add-on at <http://repositorium.sdum.uminho.pt>. The repository level access/download statistics are available at <https://repositorium.sdum.uminho.pt/stats?level=general&type=access&page=downviews-series> and the item-based access/download statistics can be publicly inspected on any document page.

iv. <http://www.sdum.uminho.pt/confOA2005/> and <http://www.sdum.uminho.pt/confOA/>, respectively.

v. <http://www.degois.pt/>.

vi. <http://www.earlham.edu/~peters/fos/2006/12/open-access-declaration-of-portuguese.html>.

vii. ALEMPLUS is an acronym for "Acesso Livre EM Países LUSófonos", i.e. Open Access in Portuguese Speaking countries. ALEMPLUS is currently being lead by IBICT ("Instituto Brasileiro de Informação em Ciência e Tecnologia", i.e. Brazilian Institute for Information in Science and Technology). See <http://www.ibict.br/alemplus/> for more information.

viii. See <http://www.ibict.br/noticia.php?id=452> or <http://www.cplp.org/comunicados_det.asp?sid=232> for more information.