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The UGC-INFONET Program

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Abstract. The UGC-INFONET programme was designed to provide electronic access to scholarly literature to the Indian university system. The programme now includes in its scope more than 150 universities, and provides access to more than 5000 journals in all fields of learning. Thousands of undergraduate and postgraduate colleges are being offered electronic access through the related N-LIST programme. The genesis of these schemes, their present status, and possibilities for the future are discussed in this paper.

1. IUCAA

The Inter-University Centre for Astronomy and Astrophysics (IUCAA), which is an autonomous institution under the universities, is a centre for excellence in Astronomy and Astrophysics (A&A) for the astronomical community in the universities and colleges in India. There is a fairly large number of faculty and students working in A&A and related areas like gravitation theory. But astronomers are spread rather thinly through the university system, and unlike their counterparts working in other areas of science, they do not enjoy the best facilities to carry out their research. IUCAA was therefore developed as a centre which should be very well equipped to carry out state-of-the-art theoretical, observational and instrumentation research in A&A. These facilities would be used by resident faculty and students, but would also be opened to their counterparts in universities, who would visit from time to time and during the visits have full access to the facilities. These expectations have been aptly fulfilled: IUCAA now has a distinguished and highly productive faculty, research students who work in frontier areas and are placed in some of the best institutions in the world after their doctorate, a state-of-the-art computer centre, a very well stocked library and advanced instrumentation laboratories. IUCAA has a 2m optical and infrared telescope, is a partner in the South African Large Telescope (SALT), and also has access to other observing facilities in India and abroad.

While such research facilities exist in other institutions in the country, a unique feature of IUCAA is that it has over a hundred visiting associates from universities who spend a few weeks to a few months every year at IUCAA, quite often accompanied by students. The visiting associates carry out their research using the IUCAA facilities, and interact and collaborate with IUCAA faculty as well as many visitors from different universities and research institutions in India and abroad. IUCAA organizes a number of training and research workshops on its campus, as well as on other university cam-

puses every year. All this activity has led to a significant increase in research in A&A in universities, which was the primary aim in the set-up of IUCAA.

2. IUCAA Resource Centres

Some years after the setting up of IUCAA, the need was felt to have small centres in different locations in India, with some facilities which astronomers in the neighbourhood of a given centre could visit from time to time to use the facilities and to interact with the faculty from the host institution and other visitors. This led to the setting up of IUCAA Resource Centres (IRCs). When they were first set up more than twelve years ago the IRCs had e-mail, some simple computing facility, and a small library of books on A&A, physics and mathematics. Since e-mail and computers were not commonly available in universities at that time, the resources provided by the IRCs proved to be very helpful to the A&A community. Over the last several years the IRCs, which are now six in number, have developed into much better equipped places with a data centre, high-speed access to the Internet and vibrant programmes for lectures, seminars and workshops.

Some years after the IRCs were set up, their users requested that the IRCs be provided with electronic access to journals subscribed to by IUCAA, which receives a large number of international journals in A&A and physics. IUCAA was obtaining electronic access to the subscribed journals as they became available, and the idea was to extend this facility to the IRCs. The IUCAA library managed to negotiate a very reasonable arrangement with a small number of publishers to extend its electronic access to users in the IRCs. This indeed proved to be very useful to the people using the IRCs, but in a most unexpected way the arrangement led to an immensely large project for the entire university community in India.

In 2003, it was suggested to the University Grants Commission that the successful experiment made by IUCAA with electronic subscriptions to a limited number of journals for the IRCs be extended to other universities, which had faculty interested in astronomy. However, the UGC felt that the access should not be limited to just astronomical journals, and not to a limited number of universities. It was decided to attempt to provide all universities in India which depend on government funds with comprehensive electronic access in all fields of learning. How this large project was undertaken, and its status at the present time, is described in the following sections.

3. UGC-INFONET

Over the last few decades, university libraries everywhere have faced dwindling resources and rising costs. The problem is particularly acute in India, where even the best libraries now can boast only of a very limited subscription list and limited purchase of books. In the smaller Indian universities, access to research journals is almost non-existent. The community has therefore been deprived of resources which are critical for research, developmental work, and teaching. This situation is unacceptable, but it simply cannot be put right in any conventional manner, because available funds simply cannot keep pace with increasing demand and costs. Moreover, the infrastructure needed to house large libraries is becoming increasingly expensive, and the human resources needed to manage the collections competently are becoming difficult to get.

About seven years ago, the University Grants Commission (UGC), which funds many central universities, and provides developmental grants to a large number of state universities, decided to address the issue of scarce library resources using modern information and communications technology (ICT). The UGC initiated a programme broadly known as the UGC-INFONET,[1] with the aim of providing connectivity and access to e-resources to the universities. As a part of this programme, more than a hundred universities were provided with broadband connectivity and electronic access to more than 4000 research journals and databases, in all fields of learning including the humanities, social sciences, physical and biological sciences and mathematics. This was done in just a couple of years, so that a long-felt need was fulfilled in a relatively short time and at a modest cost. The programme has grown over the last six years, with a larger number of universities, and even many colleges, being provided access to a growing number of journals. The access to colleges, as well as cross-subscriptions between UGC-INFONET and the INDEST consortium are funded by the Ministry of Human Resource Development of the Government of India. It is instructive to examine the enabling mechanisms of the programme, and to see whether it can be extended to colleges and schools, to networks of research institutions, and even to other countries in the developing world.

The INFONET programme was motivated by the rapid expansion in the number of full-text journals which can be accessed over the Internet. Publishers of research and review journals now routinely provide such access to their current issues and to archives, but the facility has generally been made available as a supplement to conventional print subscriptions, typically at a reasonable incremental cost. Electronic access takes the user much further than the printed variety, since query and search mechanisms are provided, and access to back issues, sometimes going back to the first issue of a journal, which may have started publication a century or two ago, are possible. Moreover, journals can be accessed from any networked computer on a campus, and text can be downloaded and stored by users, which is very convenient. While providing electronic access, publishers have been encouraging a consortium approach, through which a group of organisations can have full electronic access to a publisher's complete collection, if between them the institutions have print subscriptions to a significant number of the journals. Such arrangements have also been considered for the universities, but there were two major difficulties in the way. First, at the start of the programme, around 2003/2004, most universities in India had practically no access to the Internet, and therefore were not in a position to use journals electronically. Second, the subscription base which the universities had was so poor that they were not in a good position to negotiate, even collectively, supplementary electronic access arrangements with publishers. The matter languished there until INFONET came online in 2003.

4. Connectivity

With the inception of the INFONET, the UGC set up an expert committee to decide on the best means to bring broadband connectivity to the universities. It was found by the committee that a centralised project directly funded by the UGC, with a single Inter-

[1]Information about this programme can be obtained from http://www.inflibnet.ac.in/ and http://www.ugc.ac.in/.

net service provider, and just one organisation administering the programme, would be the most efficient route. ERNET,[2] which is the pioneering organisation for providing connectivity to educational and research institutions India, was chosen as the Internet service provider. INFLIBNET,[3] Ahmedabad, which is an inter-university centre of the UGC, was chosen to administer and execute the programme. An expert committee was appointed by the UGC to provide coordination, to monitor execution, and most importantly of all, to arrive at strategies for upgrades and growth. Through this programme, in just two years, more than 150 universities were provided with broadband connectivity which, depending on the need of the university and the available infrastructure, ranged from 512 kbps to 2 Mbps of raw bandwidth. Where a terrestrial link was not possible, a broadband satellite link was provided. While such bandwidth may seem to be inadequate by current standards, it took very hard work to provide the links and to maintain them over a period of time because of the poor infrastructure and the lack of high-speed fibre links in areas where many of the universities are located. Moreover, even the limited bandwidth proved to be very useful, as it provided access to e-mail services, and to e-resources, which were not available on most campuses, except through dial-up links, before the INFONET programme was initiated. The bandwidth provided has been increased recently, as the infrastructure has improved and the costs have come down. Most campuses covered by the programme are now provided with 10 Mbps connectivity by INFONET, and many have additional connectivity of their own. Soon every campus will have 1 Gbps connectivity under the National Knowledge Network,[4] which will greatly facilitate the sharing and exchange of resources, and the operation of distance-learning programmes across the country.

5. Electronic Subscriptions

In parallel with the connectivity committee, the UGC set up another expert committee to consider the best ways for providing electronic access to the literature. It was soon realised that this was a rather difficult task, because of the many fields of learning to be covered, the many publishers involved, and the apparently astronomical cost of the project. Electronic access models offered by publishers were mostly linked to existing levels of print subscriptions, and were therefore not relevant to most universities because of their low print subscription levels. Publishers were ready to offer fully electronic models, but here the total costs were huge, because the same amount would have to be paid for a university regardless of the number and level of users. Solutions to such problems presented themselves through intensive discussions which the committee had with publishers linked to professional societies. It turned out that the business model for a large group of electronic subscribers could be quite different from a print-based electronic model.

Publishers serve electronic subscribers through data servers with mechanisms for user authentication and monitoring of usage. Once the hardware and software are installed and running, the incremental costs for bringing in additional subscribers are very

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[2]Education and Research Network, http://www.eis.ernet.in/.

[3]Information and Library Network, http://www.inflibnet.ac.in/

[4]http://www.euindiagrid.eu/index.php/infrastructure/national-knowledge.

small. These arrangements are particularly advantageous when a subscription on behalf of a large consortium is made by a single organisation, which also acts as a conduit between the publisher and individual universities for the resolution of any problems which may arise. In such a centralised arrangement which covers a large geographic area, publishers save all the costs and effort which would have gone into marketing to individual universities, and servicing subscriptions. There are, of course, no costs towards printing and postage. All these factors mean that even subscriptions offered at highly discounted rates to large consortia would bring high margins for the publisher. The crucial point here is that the reduced prices offered by the model would enable publishers to bring to their fold new customers who individually would never have been able to afford the publications, while reduced operating expenses due the new technology would keep the arrangement profitable. And as for the universities, they would obtain access to the literature to a depth and breadth which would be the envy of even many wealthy research institutions.

Subscriptions to various society publications were first put in place on behalf of about 50 universities, which had by 2004 obtained some level of Internet connectivity. This early success soon got the attention of large commercial publishers who had hundreds of journals in all fields in their stables, and here, too, mutually beneficial arrangements became possible. When subscriptions were made for 50 universities with such publishers, they offered free access to a number of other universities on a trial basis. This enabled additional universities to be brought into the ambit of the programme even while they were experimenting with their newly provided connectivity, without having to commit funds on their behalf until they were fully ready to access the literature. As the ICT infrastructure in a university was built up, it was transferred from the trial category to the subscription category, while others entered the trial group. The agreed tariff structure with society as well as commercial publishers is such that as the number of universities under the subscription increases, there is reduction in the cost per university. Such agreements have enabled the facility to be offered to an increasing numbers of universities, while only gradually ramping up the total cost of the project.

The INFONET e-subscriptions programme now covers nearly all major international publishers. More than 160 universities now have access to more than 5700 journals in all fields, and to archives which often stretch to the first volume of a journal. An important fact here is that over half of all titles are from the humanities and social sciences, which are areas traditionally thought to be neglected in consortium arrangements. Another special feature is the geographic footprint of the programme, which covers universities in every corner of the country. As a consequence, students and teachers in a university located in the northeast of the country, or in Jammu and Kashmir, have the same access to literature as their peers located in one of the metros. It would be difficult to overestimate the practical and psychological importance of this arrangement.

Besides journals, the e-subscriptions programme has also provided access to important chemical and biological databases, and to collections such as JSTOR and Project Muse, which aggregate large numbers of excellent, mainly humanities and social science journals from many different publishers. These resources are ordinarily so expensive that they would have forever remained outside the reach of most universities. Now the resources can be accessed from individual offices on so many university campuses.

6. Usage and Cost

It has been gratifying that the usage of the wealth of journals provided to the university system has been significant and growing. When the programme was initiated, many universities did not have computer networks in place, and access was only possible from one or two centres on a campus, usually the library or the computer centre. Even here the access was available only during working hours, and not after classes when it would have been most useful. There were very few trained people available to attend to technical problems associated with connectivity and access which arose from time to time. Most users in the universities were unfamiliar with electronic access, and had little support available from trained staff to enable them to make efficient use of the resources.

The situation changed for the better quite soon because of the ability of young people to adapt to new systems when these were really useful, the willingness of library staff to develop expertise, and the many workshops and training sessions conducted far and wide by INFLIBNET, as well as by the publishers themselves. The overall usage has been increasing steeply, but there is still a fairly wide dispersion in the pattern. The universities which have well-established research programmes of course show very high usage levels, but many universities which are relatively new and have small departments have also proved to be enthusiastic users, and the availability of the resources seems to have made a significant positive impact on the quality and the quantity of the research output. Some universities still are poor users, and a few in fact have not even initiated access, in spite of being members of the INFONET programme for several years. This range of usage and response is only to be expected from a rather diverse system, and it will only be a matter of time before every university uses the facilities at an acceptable level. Usage statistics are made available to INFLIBNET by the publishers, and analysis of the patterns helps to make the programme relevant, efficient and cost effective. The total number of downloads made by all member universities of the programme during the years 2004–2008 is shown in Figure 1, and a several-fold increase in the five-year period is seen. The increase in downloads is due to an increase in the number of member universities, improving ease of access and improvement in awareness amongst the end users.

Adoption of electronic access has led to enormous financial savings, with effective discounts as high as 80% over print versions. No physical space is needed to store current journals and archives, and very little day to day administrative support is required. Moreover, a given journal can be simultaneously accessed by many users, from the comfort of their departments, and copies of articles can be easily stored on disks and retrieved at will. The savings in cost and human resources needed in routine work means that the libraries can spend more on acquiring books and specialized material, and the staff can devote their time to providing creative support and undertake new programmes consistent with the changing functions of libraries in the 21st century.

7. Organization

The INFONET project is fully financed by the UGC, which appoints a National Steering Committee (NSC) to plan and oversee the programme. INFLIBNET provides the entire expertise and administrative support required to execute the extensive and complex undertaking. Through wide and continuing consultations, the NSC selects publica-

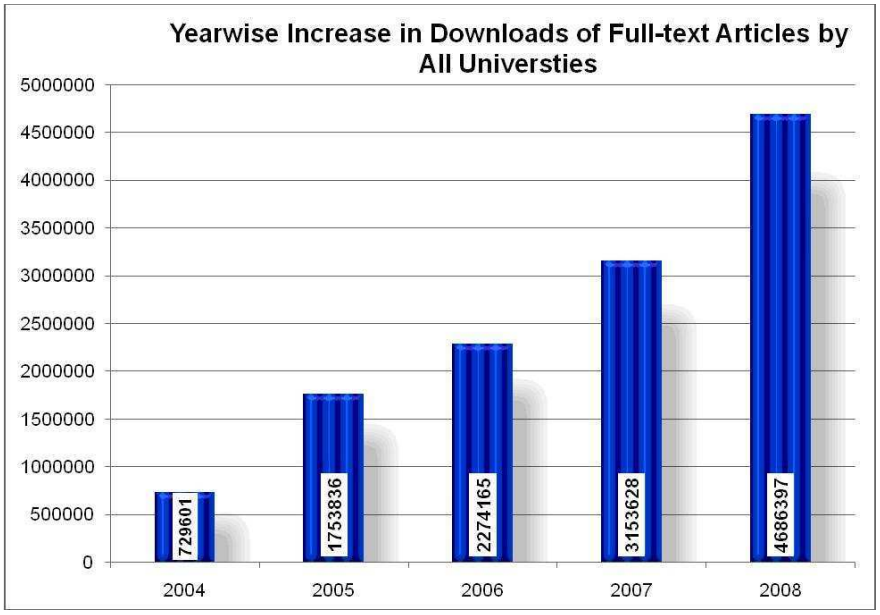

Figure 1. Growth in the number of downloads over the years.

tions for the consortium, negotiates prices with the publishers, and makes recommendations to the UGC. Once approval is received, subscriptions are placed by INFLIBNET. For servicing the subscriptions, the publishers have to deal with INFLIBNET alone, and not with hundreds of individual universities, which makes the programme very efficient. The universities access publishers' sites directly, but refer their queries and problems to INFLIBNET, so that they do not have to approach the many publishers individually. The system has worked very well for several years now, in spite of the steady expansion of the programme, and has proved to be robust enough for the introduction of new schemes like cross-subscriptions with other consortia, associate memberships, and expansion of the programmes to colleges, which are all described below.

8. Cross-Subscriptions and the College Program

There are several consortia in India which obtain e-resources for specific segments of the Indian educational and research establishment like engineering and technical education, medical science, agricultural sciences, etc. It is highly desirable for the different consortia to develop a scheme through which the resources available to one consortium could be shared by members of other consortia. In the ideal world, there would be a single consortium for the whole country, but given the very diverse requirements of the various consortia, and the many different funding sources through which these are met, it will be a while before a single consortium emerges. As a first step in the process of sharing, INFONET has set up a cross-subscription arrangement with the INDEST-AICTE consortium which is briefly described below.

The INFONET consortium provides e-resources to universities, which principally deal with postgraduate education and research. Undergraduate education in India is mainly provided by colleges, with each college being affiliated to some university. While a relatively small number of universities have no affiliated colleges at all, most have many colleges affiliated to them. The number of affiliated colleges can be as large as several hundred in the case of the larger universities. The colleges principally provide undergraduate education, but many do have postgraduate departments, with faculty and students engaged in research. While the number of active researchers per college may be small, the total number of such researchers in the country is substantial because there are more than twenty thousand colleges in all. The emergence of a programme for the colleges is briefly described below.

The cross-subscription and college e-resources programmes are managed by a project called the National Library and Information Services Infrastructure for Scholarly Content (N-LIST), which is jointly executed by INFLIBNET and INDEST-AICTE. Funds for this project are provided by the Ministry of Human Resources Development (MHRD) under the National Mission on Education through ICT initiatives.

8.1. Cross-Subscriptions

The INDEST-AICTE consortium caters mainly to institutions which provide engineering and technical education, like the Indian Institutes of Technology, National Institutes of Technology and various colleges of engineering. As such, the consortium provides electronic access to resources on subjects which are covered by these institutes. The INFONET consortium, on the other hand, provides access to journals covering physical, chemical and biological sciences, mathematics, statistics, social sciences, humanities, etc. The separation between requirements of the technical segment and the universities is however not clear cut and members of one consortium often need resources which are available to the other consortium.

The N-LIST programme caters to such needs by providing a cross-subscription arrangement through which some of the resources from each consortium are available to the other, at a price which the two consortia together negotiate with the publisher. Such an arrangement provides great leverage to the programme since researchers get access to resources which would not normally be available to them. At the present time only a small number of resources are accessible across the two consortia, because funds available for the cross- subscription are limited. It is expected that other consortia too will join these arrangements and over a period of time every researcher in the country will get access, in some manner or another, to all the resources subscribed by any large consortium funded by the government.

8.2. The College Program

It is not practical to provide individual electronic subscriptions to the many thousands of colleges in India through the INFONET programme. Vast funds would be required for such universal access, while subscriptions on the university pattern would not be justified because the number of users in any one college would be rather small. A different model has therefore been adopted for college subscriptions through the INDEST programme. INFLIBNET subscribes to resources which are thought to be appropriate for the research community in colleges, as well as to undergraduate students who wish to go beyond their routine studies. Individual colleges, which are registered for the purposes, access the resources through servers provided by INFLIBNET. Depending on

the kind of Internet connectivity that the colleges have, IP-based access is provided to the whole college, or registered individual users have access through a password. At the present time, access is being offered only to about 6000 colleges which receive funds from the government for their operations, but the access will soon be extended to other colleges, which are funded privately, through the scheme described below. The scheme is cost-free to the colleges.

8.3. Associate Members

The INFONET programme provides free access to universities which are provided funds by the central or state government for their operations. However, there are a large number of universities which are run through private funds, as well as research and other institutions which may receive funds from the government, but are not universities, who would like to get access to e-resources. To cater to such universities and institutes, INFONET has set up an associate membership scheme. Such a membership is provided for a token fee, and an associate member can obtain access to any of the resources provided by INFLIBNET on making payment at the same rate as paid by full members of INFONET. Such an arrangement allows associate members to get access to e-resources at a highly discounted price, and therefore they can obtain resources which would otherwise be unaffordable to them. These subscriptions have to be approved by the publishers, who make sure that their existing revenue streams from the approved universities and the research institutions are not affected by the arrangement. There are more than 80 associate members at the time of writing and it is expected that the number will grow significantly in the coming years, bringing the benefits of e-resources to a large segment of users in India.

9. Concluding Remarks

The INFONET is, in many ways, a symbol of the resurgence of the university system, and it is necessary for everyone to nurture and develop it. The programme has been executed in record time, and has produced tangible benefits at a cost which is a small fraction of the cost of moving along the traditional print route. The success has been in no small measure due to the total commitment and involvement of people in the UGC, the readiness of INFLIBNET and ERNET to take on the responsibility, and the ability of the committees involved to break new ground, encouraged by the forward-looking attitude of the publishing fraternity.

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