Current Trends and Progress of Institutional Repositories in BRICS Countries

Dr. Krishnamurthy, M and Sajana, C*

Associate Professor, DRTC, Indian Statistical Institute (ISI), Bangalore, mkrishna.murthy@hotmail.com

*Research Scholar, Bharathiar University, Coimbatore, sajana.drtc@hotmail.com

Abstract
Institutional Repositories (IRs) provides open access to research output of an institution by self-archiving, storing and preserving it in order to enable universal visibility to the institutional digital assets. The Registry of Open Access Repositories (ROAR) is one of the international, searchable indexing that enables the creation, location and the growth of open access IRs. Similarly, OpenDOAR is an authoritative directory of academic open access (OA) repositories. The present article aims to quantify existing parameters of institutional repositories in the BRICS countries indexed in ROAR and OpenDOAR using the graphical representations provided by the former and the latter IR directories. The result reveals that the growth and development of IRs, including parameters like software, repository types, content types and operational status in BRICS countries. The study provides overview of the current trends and development of Institutional Repositories (IRs) in BRICS countries.

Keywords: Institutional Repositories, Open Access, BRICS Countries

1. Introduction
Institutional Repositories (IRs) provides open access to research output of an institution by self-archiving, storing and preserving it in order to enable universal visibility to the institutional digital assets. In an academic or research setting IRs give seamless access to e-resources to the faculty, students and scientists which can serve their information needs. For instance in a university, e-resources like monographs, academic journal articles (preprints and post-prints), electronic theses and dissertations (ETDs) are included in IRs. Furthermore, the IRs may include other digital assets generated by academics, conference proceedings managerial documents, book chapters, courseware, notes or learning objects.

The library and information centres are dedicated in preserving and speedy dissemination of the scholarly resources of an institution to the patrons. But, the limited funds have turned to be a barrier to provide access to academic journals whose cost has increased. So, the institutional repository is a means to ensure that the published work of scholars is available to the academic community even after increases in subscription fees or budget cuts within libraries [1].

In the present global technological scenario, the demand for information has seen a rapid growth. And so is the need for dissemination and preservation of relevant, categorised information resources to the patrons which has also increased.
So, the IRs can act as a common platform to scholars of the institution to contribute scholarly resources to promote research activity. This supports the objective of IRs to uphold the organization’s goals. IRs has a number of benefits, including access to resources, visibility of research, and presentations of the contents [2]. Also, many countries have given considerable importance in creating Institutional Repositories. Therefore, to make the scholarly resources available and accessible globally and to ensure their long-term preservation the concept of open access and institutional repositories has emerged [3].

2. Definition of Institutional Repository

An Institutional Repository (IR) is a digital archive of the intellectual product created by the faculty, research staff, and students of an institution and accessible to end users both within and outside of the institution, with few if any barriers to access [4].

An Institutional repository is an Organization based set of services which the organization offers to the members of its community for the management and dissemination of digital materials created by the institution and its community members. It is most essentially an organizational commitment to the stewardship of these digital materials, including long-term preservation, where appropriate, as well as organization and access or distribution [5].

3. Institutional Repositories: Need and Objectives

The main objectives for establishing an IRs are to enhance the global visibility of the institution’s scholarship. The rhetoric about open access is that the presentation of the institution's published research output via a repository would inevitably improve its visibility and raise the profile of both the institution and the researchers involved, and it would potentially lead to greater citation frequency and impact of the published items [6]. The other main objectives of IRs are to:

- Single point access to digital content
- Open access resources
- Preservation of institution’s scholarly resources
- Enable building up a scholar’s recognition [7]
- Immediate open access to scientific facts, methods and results will speed up the advancement of science, technology and medicine (STM) and will more directly bring the profit of research to the public [8]
- Quantify the Institutional scholarly output.

4. ROAR and OpenDOAR

The Registry of Open Access Repositories (ROAR) is one of the international, searchable indexing that enables the creation, location and the growth of open access IRs and their contents. ROAR was created by EPrints at University of Southampton in 2003 [9].

The main objective of ROAR is to encourage the development of open access by providing timely, appropriate information about the status and growth of repositories around the globe.
Open access to scholarly resources maximises research access and thereby also research impact, making research more productive and effective [10].

OpenDOAR is an authoritative directory of academic open access repositories. OpenDOAR maintained by the Securing Hybrid Environment for Research Preservation and Access (SHERPA) project of University of Nottingham, lists the open access repositories around the world. Currently, ROAR lists out 4367 and OpenDOAR lists about 3320 IRs all over the world. The highest number of IR in each country as identified is listed in the following Table 1.

Table 1: BRICS Countries with Number of Institutional Repositories

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>G20 Countries</th>
<th>Number of IR in ROAR</th>
<th>No. of IR in OpenDOAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Brazil</td>
<td>142</td>
<td>92</td>
</tr>
<tr>
<td>2.</td>
<td>Russia</td>
<td>60</td>
<td>28</td>
</tr>
<tr>
<td>3.</td>
<td>India</td>
<td>109</td>
<td>76</td>
</tr>
<tr>
<td>4.</td>
<td>China</td>
<td>92</td>
<td>39</td>
</tr>
<tr>
<td>5.</td>
<td>South Africa</td>
<td>40</td>
<td>32</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>443</strong></td>
<td><strong>267</strong></td>
</tr>
</tbody>
</table>

5. BRICS Countries

BRICS is the association of five major emerging national economies: Brazil, Russia, India, China and South Africa [11]. The BRICS countries are all leading developing or the newly industrialized, fast-growing economies, distinguished by their large, and having significant influence on regional affairs. Also all five are G-20 members [12]. As on the year 2015, the
BRICS countries represent over 3.6 billion people, or half of the world population; all countries are in the top 25 of the world by population, and four are in the top 10. The five nations have a combined nominal GDP of US$16.6 trillion, equivalent to approximately 22% of the gross world product, combined GDP (PPP) of around US$37 trillion and an estimated US$4 trillion in combined foreign reserves [13].

![Fig. 2 BRICS Countries](https://commons.wikimedia.org/w/index.php?curid=6615692)

6. Methodology

The current Institutional Repositories of BRICS countries were identified and selected for the study from Directory of Open Access Repositories (OpenDOAR) and the Registry of Open Access Repositories (ROAR). The complete data and the graphical representations were derived from ROAR and OpenDOAR. The review of related literature and web search has carried out by the author. The relevant data for the study was collected from the respective websites maintained by the host institutions. The data collected from the institutional websites were analysed to find out the total document deposits to each IR, their subject coverage, the use of various Open Source Software (OSS) for their making, maintenance etc. The present paper intends to analyse various parameters of IRs in BRICS countries for understanding their latest trends and progress.

7. Institutional Repositories in BRICS Countries: Current Trends

7.1 Brazil

Brazil officially the Federative Republic of Brazil is the fifth largest country in both South America and Latin America. It is the largest country to have Portuguese as an official language and the only one in the Americas [14]. Brazil is the world’s ninth largest economy by nominal GDP and seventh-largest by GDP (PPP) as of 2015 [15]. As a member country of the BRICS group, Brazil until 2010 had one of the world’s fastest growing major economies, with its economic reforms giving the country new international recognition and influence [16].
The growth of records in ROAR and repositories in OpenDOAR is depicted in the figure 3. The records in the Institutional Repositories of Brazil showed an exponential growth since year 2003, with highest records in the year 2007, even though there was a very minimal records in the initial years. While, count of repositories in Brazil increased since 2006 with a steep growth in 2011. The data indicates that the Institutional Repositories have become significant in Brazil at an average during 2003-2006 and since then has been continuously growing.

The types of repositories in ROAR and OpenDOAR are indicated in figure 4. The most Repositories in Brazil are institutional with 52.11% in ROAR and 80.40% in OpenDOAR. Other prominent types of repositories are cross-institutional (disciplinary) and Governmental. The data indicates that most organizations (academic or research) in Brazil are using IRs to preserve their research related and other digital information resources.
The types of digital library software used in Brazil as indicated in ROAR (left) and OpenDOAR is showed in figure 5. The DSpace is the most used software in building Institutional Repositories in Brazil with more than 70% in ROAR and 76.10% in OpenDOAR. Other popular software used in building IRs are Open Journal System and ETD-db.

The content types in OpenDOAR Repositories of Brazil are presented in the figure 6. The journal articles, ETDs and books form the major content types in the Institutional Repositories. It can also be observed that content types like software and datasets are found to be the least out of the 92 repositories.
The most frequent languages used in OpenDOAR Repositories of Brazil are indicated in figure 7. The data indicates that there are three major languages namely Portuguese, English and Spanish. Wherein, the most prominent language used in the Institutional Repositories is Portuguese, unlike English as in repositories of other countries.

![Figure 7](image)

**Fig. 7**

The various subject-specific Institutional Repositories of Brazil in OpenDOAR are showed in figure 8. The data indicated that the majority of IRs are based on multidisciplinary subjects. Furthermore, the other major subject in the IRs includes science, health and medicine, computers and IT, Education, Law and Politics. While IRs in the field of Biology and Biochemistry, Earth and Planetary Sciences, Ecology and Environment, Mathematics and Statistics, Architecture, Civil Engineering, Electrical and Electronic Engineering, Mechanical Engineering and Materials, Fine and Performing Arts, Literature and Literature were observed to be very minimal.

![Figure 8](image)

**Fig. 8 Subjects in OpenDOAR - Brazil**

The operational statuses of Open Access repositories in Brazil are represented in the figure 9. The data indicates that most of the Institutional repositories are operational (87%). While, only very few IRs were found to be of trial and broken.

![Figure 9](image)

**Fig. 9 Open Access Repository Operational Statuses - Brazil**
7.2 Russia

Russia (officially Russian Federation) is a country in Eurasia [17]. Russia is the largest country in the world by surface area, covering more than one-eighth of the Earth’s inhabited land area [18]. The Russian economy ranks as the twelfth largest by nominal GDP and sixth largest by purchasing power parity in 2015 [19].

![Figure 10: Year wise growth of IR records and repositories as indicated in ROAR (left) in OpenDOAR (right) respectively in Russia](image)

The growth of records in ROAR and repositories in OpenDOAR is depicted in the figure 10. The records in the Institutional Repositories of Russia showed an exponential growth since year 2005, with maximum records in the year 2013, even though there was a very minimal records in the initial years of 2003-2005. While, count of repositories in Russia increased since 2006 with a steep growth in 2009. The data indicates that the growth of Institutional Repositories have become sluggish in Russia during 2008-2009 and mid 2012-2013.

![Figure 11: Types of repositories in Russia as indicated in ROAR (left) and OpenDOAR (right)](image)

The types of repositories in ROAR and OpenDOAR are indicated in figure 11. The most Repositories in Russia are institutional with 78.33% in ROAR and 96.40% in OpenDOAR. Other prominent types of repositories are cross-institutional and archive aggregating data from several subsidiary repositories. The data indicates that majority of organizations (academic or research) in Brazil are using IRs to preserve their research related and other digital information resources.
The types of digital library software used in Russia as indicated in ROAR (left) and OpenDOAR is showed in figure 12. The DSpace is the most used software in building Institutional Repositories in Brazil with more than 70% in ROAR and 71.4% in OpenDOAR. Other popular software used in building IRs are Eprints and Socionet.

The content types in OpenDOAR Repositories of Russia are presented in the figure 13. The journal articles, conference proceedings, ETDs, books and learning objects form the major content types in the Institutional Repositories. It can also be observed that content types like software and patents are found to be the least out of the 28 repositories.

The most frequent languages used in OpenDOAR Repositories of Russia are indicated in figure 14. The data indicates that there are two major languages namely Russian and English. Wherein, the most prominent language used in the Institutional Repositories is Russian, unlike English as in repositories of few other countries.
The various subject-specific Institutional Repositories of Russia in OpenDOAR are showed in figure 15. The data indicated that the majority of IRs are based on multidisciplinary subjects. Furthermore, the other major subject in the IRs includes Earth and Planetary Sciences, Mathematics and Statistics. While IRs in all the other fields like Agriculture, Biology and Biochemistry, Chemistry, Ecology and Environment, Physics, Astronomy, Health and Medicine, Arts, Humanities, History, Management etc. were observed to be minimal and unchanged.

The operational statuses of Open Access repositories in Russia are represented in the figure 16. The data indicates that almost all the Institutional repositories are operational (96.4%). While, only very few IRs were found to be trial IRs.

7.3 India

India, officially the Republic of India, is a South Asian country, is the seventh-largest by area and the second-most populous country. In 2015, the Indian economy was the world's seventh largest by nominal GDP and third largest by purchasing power parity [20]. India is one of the fastest-growing major economies and is considered as a newly industrialised country with its average annual GDP growth rate of 5.8% over the past two decades, and reaching 6.1% during 2011–12 [21].
The growth of records in ROAR and repositories in OpenDOAR is depicted in the figure 17. The records in the Institutional Repositories of India showed an exponential growth since year 2004, with highest records in the year 2006. While, count of repositories in India increased since 2006 with a steep growth in 2008. The data indicates that the Institutional Repositories have become significant in India at an average during 2003-2006 and since then has been continuously growing.

The types of repositories in ROAR and OpenDOAR are indicated in figure 18. The most Repositories in India are institutional with 66.97% in ROAR and 84.20% in OpenDOAR. Other prominent types of repositories are cross-institutional (disciplinary), aggregating and Governmental. The data indicates that most organizations (academic or research) in India are using IRs to preserve their research related and other digital information resources.

The types of digital library software used in India as indicated in ROAR are depicted in figure 19. The most used digital library software in India include: DSpace, EPrints, Greenstone, Z39.50 and other software (various).
OpenDOAR (right)

The types of digital library software used in India as indicated in ROAR and OpenDOAR is showed in figure 19. The DSpace is the most used software in building Institutional Repositories in India with more than 70% in ROAR and 59.20% in OpenDOAR. Other popular software used in building IRs are Eprints, Greenstone etc.

![Figure 19: The DSpace is the most used software in building Institutional Repositories in India with more than 70% in ROAR and 59.20% in OpenDOAR. Other popular software used in building IRs are Eprints, Greenstone etc.](image)

Fig. 19 Most Frequent Languages in OpenDOAR - India

The most frequent languages used in OpenDOAR Repositories of India are indicated in figure 21. The data indicates that there are many IRs in major Indian languages. Wherein, the most prominent language used in the Institutional Repositories is English and some in Hindi. While few other IRs are in Gujarati, Arabic, Kannada, Malayalam etc.

![Figure 20: Content Types in OpenDOAR Repositories – India](image)

Fig. 20 Content Types in OpenDOAR Repositories – India

The content types in OpenDOAR Repositories of India are presented in the figure 20. The journal articles, ETDs and conference proceedings form the major content types in the Institutional Repositories. It can also be observed that content types like datasets and patents are found to be the least out of the 76 repositories.

![Figure 21: Content Types in OpenDOAR Repositories – India](image)

Fig. 21 Most Frequent Languages in OpenDOAR - India

The most frequent languages used in OpenDOAR Repositories of India are indicated in figure 21. The data indicates that there are many IRs in major Indian languages. Wherein, the most prominent language used in the Institutional Repositories is English and some in Hindi. While few other IRs are in Gujarati, Arabic, Kannada, Malayalam etc.
The various subject-specific Institutional Repositories of India in OpenDOAR are showed in figure 22. The data indicated that the majority of IRs are based on multidisciplinary subjects. Furthermore, the other major subject in the IRs includes Technology, science, Chemistry, Biology and Biochemistry, Earth and Planetary Sciences, Physics & Astronomy, health and medicine, computers and IT, Library and Information Science, Social Sciences, Civil Engineering, Electrical and Electronic Engineering, Mechanical Engineering and Materials. While IRs in the field of Architecture, Arts & Humanities, Geography, History, Language and Literature, Education etc. were observed to be very minimal.

The operational statuses of Open Access repositories in India are represented in the figure 23. The data indicates that most of the Institutional repositories are operational (88.2%). While, only very few IRs were found to be of trial and broken.

7.4 China

China, officially the People's Republic of China, is a unitary sovereign state in East Asia and is the world's most populous country [22]. Since the introduction of economic reforms in 1978, China has become one of the world's fastest-growing major economies. As on 2016, China is the world's second-largest economy by nominal GDP and largest by purchasing power parity (PPP).
The growth of records in ROAR and repositories in OpenDOAR is depicted in the figure 24. The records in the Institutional Repositories of China showed a steep growth since the year 2008, with highest records in the year 2013, even though there was a very minimal records in the initial years of 1993-2005. While, count of repositories in China increased since 2005 with a steep growth in 2006. The data indicates that the Institutional Repositories have become significant in China at an average during 2006 and since then has been continuously growing.

The types of repositories in ROAR and OpenDOAR are indicated in figure 25. The most Repositories in China are institutional with 90.22% in ROAR and 97.40% in OpenDOAR. Other prominent types of repositories are cross-institutional (disciplinary) and aggregating. The data indicates that most organizations (academic or research) in China are using IRs to preserve their research related and other digital information resources.
The types of digital library software used in China as indicated in ROAR and OpenDOAR is showed in figure 26. The DSpace is the most used software in building Institutional Repositories in India with more than 85% in ROAR and 89.7% in OpenDOAR. Other popular software used in building IRs are Open Journal System, CSpace and Vufind.

The content types in OpenDOAR Repositories of China are presented in the figure 27. The journal articles, ETDs, conference proceedings and patents form the major content types in the Institutional Repositories. It can also be observed that content types like datasets and learning objects are found to be the least out of the 39 repositories.

The most frequent languages used in OpenDOAR Repositories of China are indicated in figure 28. The data indicates that there are two major languages namely Chinese and English. Wherein, the most prominent language used in the Institutional Repositories is Chinese, unlike English as in repositories of few other countries.
The various subject-specific Institutional Repositories of China in OpenDOAR are showed in figure 29. The data indicated that the majority of IRs are based on multidisciplinary subjects. Furthermore, the other major subject in the IRs includes Technology, Ecology and Environment, Physics and Astronomy. While IRs in the field of Architecture, Civil Engineering, Electrical and Electronic Engineering, Fine and Performing Arts, Business and Economics, Education, Psychology were observed to be very minimal.

The operational statuses of Open Access repositories in China are represented in the figure 30. The data indicates that almost all the Institutional repositories are operational (94.90%). While, only very few IRs were found to be broken.

7.5 South Africa

South Africa, officially the Republic of South Africa, is the southernmost country in African Continent. South Africa is the 25th-largest country in the world by land area. The World
Bank classifies South Africa as an upper-middle-income economy, and a newly industrialised country [23]. Its economy is the second-largest in Africa, and the 34th-largest in the world.

Fig. 31 Year wise growth of IR records and repositories as indicated in ROAR (left) in OpenDOAR (right) respectively in South Africa

The growth of records in ROAR and repositories in OpenDOAR is depicted in the figure 31. The records in the Institutional Repositories of South Africa showed an exponential growth since year 2004, with highest records in the year 2013. While, count of repositories in South Africa increased since 2006 with a steep growth in 2010. The data indicates that the Institutional Repositories have become significant in Brazil at an average during 2006 and since then has been continuously growing.

Fig. 32 Types of repositories in South Africa as indicated in ROAR (left) and OpenDOAR (right)

The types of repositories in ROAR and OpenDOAR are indicated in figure 32. The most Repositories in South Africa are institutional with 52.50% in ROAR and 90.60% in OpenDOAR. Other prominent types of repositories are cross-institutional (disciplinary) and aggregating. The data indicates that most organizations (academic or research) in South Africa are using IRs to preserve their research related and other digital information resources.
The types of digital library software used in South Africa as indicated in ROAR and OpenDOAR is showed in figure 33. The DSpace is the most used software in building Institutional Repositories in South Africa with more than 70% in ROAR and 68.80% in OpenDOAR. Other popular software used in building IRs are Eprints, ContentPro and ETD-db.

The content types in OpenDOAR Repositories of South Africa are presented in the figure 34. The ETDs and journal articles form the major content types in the Institutional Repositories. It can also be observed that content types like datasets and bibliographic references are found to be the least out of the 32 repositories.

The most frequent languages used in OpenDOAR Repositories of South Africa are indicated in figure 35. The data indicates that there are five major languages namely English,
Afrikaans, French, Sesotho and Dutch. Wherein, the most prominent language used in the Institutional Repositories is English followed by Afrikaans.

Fig. 36 Subjects in OpenDOAR – South Africa

The various subject-specific Institutional Repositories of South Africa in OpenDOAR are showed in figure 36. The data indicated that the majority of IRs are based on multidisciplinary subjects. Furthermore, the other major subject in the IRs includes health and medicine, Business and Economics, Education, Law and politics, management. While IRs in the field of General Science, Physics and Astronomy, Civil Engineering, Fine and Performing Arts, Social Sciences were observed to be very minimal.

Fig. 37 Open Access Repository Operational Statuses – South Africa

The operational statuses of Open Access repositories in South Africa are represented in the figure 37. The data indicates that almost all the Institutional repositories are operational (96.90%). While, only very few IRs were found to be of trial.

8. Major Findings

- All the BRICS countries showed exponential growth of records and repositories with maximum records during 2006-2013.
- Maximum Repository types are Institutional only.
- Also, DSpace is the most commonly used Digital Library Software to create IRs.
The journal articles form the basic content type in all IRs of BRICS countries followed by ETDs, books, and conference proceedings.

The various prominent languages of IR content include Portuguese, Russian, English, Chinese, English in BRICS countries respectively.

The majority of IRs in BRICS countries are based on multidisciplinary subjects followed by prominent subject like health and medicine, Technology, general science, Earth and Planetary Sciences, Physics and Astronomy, Law and Politics.

The data indicates a positive impact showing that the majority of the IRs are operational.

9. Conclusion

Institutional repositories improve learning, teaching and research and have great potential for improving visibility of institutional research. Moreover, to enhance the visibility to the established institutional repositories, they must be registered with open access registries such as ROAR, OpenDOAR and federated search services such as OAIster. BRICS countries as the world’s fastest growing economies have significantly implemented IRs for enhancing their research communication and preservation.

10. References

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