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Open Educational Resources (OER) initiatives: Global and Indian Quo Vadis

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Abstract:

Galloping speed of technological development and intense research activities in ICT over last couple of decades has facilitated opportunities of rapid expansion in creation, distribution and consumption of educational resources across the world. While fulcrum motivational factor for such technological advancement is indeed profit driven, a substantial gain has also been drawn by academic communities using the same set of technologies for greater social good. Open Source Software, Creative Commons, Open Access Initiatives have paved the way for Open Educational Resources (OER). With these impetuses, nations are trying to bridge the gaps between information have and haven't and reduce the digital divides amongst its communities. This discourse attempted to explore and review the historical perspective of OER, major global and national initiatives and attempted to peeped in to future scope of expansion.

Keywords: Open Access, OER, Open Educational Resources, OpenCourseWare, Online Courses, Digital Educational Content, MOOCs, Creative Commons, NMEICT, UNESCO

1. Introduction:

Growth of knowledge is connected with the technological development happened all over human civilization. Let us look at the growth of knowledge when paper was invented. It was one of the greatest mediums by which human being could transfer knowledge from generation to generation. So, it had happened over a period of long many centuries.

Last 40 years are marked by enormous development and technological improvisation in the domain of electronics and information technology. These technological developments have come as handy for transfer of knowledge through different medium like internet, as well as many others platforms, which sharing content over social media etc. Now that all these media are available, it has become easy for us to store and transfer knowledge easily. The question remains who hold the knowledge or who won information.

In human history, knowledge has been a property of Selected Few and this Selected Few tried to manipulate knowledge base and use it for greater mass for their own benefit. However, in recent few years it has been observed that Global initiative under the leadership of UNESCO (The United Nations Educational, Scientific and Cultural Organisation) has come up with remarkable project like Open Educational Resources (OER) where importance has been given on initiative of government and public funded research activities. Findings of these research activities are being made available freely to public.

Similarly, European Commission and the European Research Council (ERC), started "Plan S and cOAlition S" initiative to make research publications open access. Main principle of this plan is "With effect from 2021, all scholarly publications on the results from research funded by public or private grants provided by national, regional and international research councils and funding bodies, must be published in Open Access Journals, on Open Access Platforms, or made immediately available through Open Access Repositories without embargo".

2. Conceptual Frameworks:

For better comprehension of OER and related concepts, it is important to look into initiatives taken globally, however to start with, we need to specify the subject domain and highlight the conceptual framework to limit the scope of this discourse.

While OER in its several form and generations are already in practice since very long, the concrete global documented initiative comes in notice through UNESCO's Paris Declaration on OER (2012) which begins with the premise that "everyone has the right to education," referring to the Universal Declaration of Human Rights.

3. Literature Review:

Literatures for this article have been collected using "Online Information Access" method from Wikipedia, blog pages, electronic databases, etc. Reviews have been arranged thematically and distributed amongst two themes, as mentioned below.

Theme 1: Concept of Open access (OA)

Open Access (OA) is a set of principles and a range of practices through which research outputs are disseminated online, free of access charges or other barriers. Any kind of digital content i.e. texts, software, audio, video, can be OA.

There are three central statements on "Open Access",
- Budapest Open Access Initiative
- Bethesda Statement
- Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities

The Budapest Open Access Initiative (BOAI) was released on February 14, 2002, which is a public statement of principles relating to open access to the research literatures. The BOAI stated, "By "open access" to this literature, we mean its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited."

To extend the definition of open access, another initiative called Bethesda Statement on Open Access Publishing was released on April 11, 2003, which provided below mentioned statements.

"The author(s) and copyright holder(s) grant(s) to all users a free, irrevocable, worldwide, perpetual right of access to, and a license to copy, use, distribute, transmit and display the work publicly and to make and distribute derivative works, in any digital medium for any responsible purpose, subject to proper attribution of authorship, as well as the right to make small numbers of printed copies for their personal use."

"A complete version of the work and all supplemental materials, including a copy of the permission as stated above, in a suitable standard electronic format is deposited immediately upon initial publication in at least one online repository that is supported by an academic institution, scholarly society, government agency, or other well-established organization that seeks to enable open access, unrestricted distribution, interoperability, and long-term archiving (for the biomedical sciences, PubMed Central is such a repository)."

While BOAI did not specify how copyright owners will operationalize the open access concept, Bethesda Statement specified that copyright owners will grant users certain rights under licenses, and these rights shall be "free, irrevocable, worldwide, perpetual."

The Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities was released on October 22, 2003, in a conference on open access hosted in the Harnack House in Berlin by the Max Planck Society. This initiative provided two definitions of an open access contribution.

"Open access contributions must satisfy two conditions: The author(s) and right holder(s) of such contributions grant(s) to all users a free, irrevocable, worldwide, right of access to, and a license to copy, use, distribute, transmit and display the work publicly and to make and distribute derivative works, in any digital medium for

any responsible purpose, subject to proper attribution of authorship (community standards, will continue to provide the mechanism for enforcement of proper attribution and responsible use of the published work, as they do now), as well as the right to make small numbers of printed copies for their personal use."

"A complete version of the work and all supplemental materials, including a copy of the permission as stated above, in an appropriate standard electronic format is deposited (and thus published) in at least one online repository using suitable technical standards (such as the Open Archive definitions) that is supported and maintained by an academic institution, scholarly society, government agency, or other well-established organization that seeks to enable open access, unrestricted distribution, interoperability, and long-term archiving."

Suber (2004) stated, "The three major public definitions of "open access" are contained in the Budapest, Bethesda, and Berlin public statements. Even though these three definitions differ from one another in small ways, they agree on the essentials. Let me refer to them collectively, or to their common ground, as the Budapest-Bethesda-Berlin or BBB definition of open access."

Theme 2: Concept of Open Educational Resources (OER)

In 2001, the Massachusetts Institute of Technology (MIT) first talked about placing learning materials for free on the internet. At a press conference held at MIT on April 4, 2001, MIT President Charles M. Vest announced that "the MIT will make the materials for nearly all its courses freely available on the Internet over the next ten years". He made the announcement about the new program, known as MIT OpenCourseWare (MITOCW).

To highlight and illustrate multiple dimensions, different organizations and entities defined OER mentioned below.

The term open educational resources was first adopted at the 2002 UNESCO Forum on the Impact of Open Courseware for Higher Education in Developing Countries, sponsored by The William and Flora Hewlett Foundation. UNESCO (2002) defined the term OER as "the open provision of educational resources, enabled by information and communication technologies, for consultation, use and adaptation by a community of users for non-commercial purposes".

Atkins et al. (2007) defined OER as "full courses, open courseware and content, educational modules, textbooks, streaming videos, tests and assessments, open source software tools, and any other tools and materials used to support teaching or learning."

Hylen (2007) defined OER as "teaching, learning and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use or repurposing by others".

Wiley (2010) presents a "strengthened and clarified definition of OER." This definition includes three elements:
a) the concept of "free",
b) the four R's permissions (**r**euse, **r**edistribute, **r**evise, **r**emix); and
c) non-interfering technology and media choices.

Downes (2011) defined OER as "materials used to support education that may be freely accessed, reused, modified and shared by anyone."

Numbers of descriptive studies on OER have been conducted and the published literatures evidently reveal the boundless importance of OER for future technical and knowledge growth of human society. A few of those studies are reviewed below.

Yuan, et al. (2008) studied about opportunities and challenges of Open Educational Resources for higher education and stated, "Open Educational Resources (OER) initiatives aspire to provide open access to highquality education resources on a global scale. From large institution-based or institution-supported

initiates to numerous small-scale activities, the number of OER related programmes and projects have been growing fast".

Rolfe (2012) studied staff awareness and attitudes towards ''open educational resources'' among some academic staff in United Kingdom, and noticed a very low awareness rate where only 18% had heard of the term 'open educational resources'. Results also showed a strong tendency of faculty staff to freely share resources with colleagues immediately. This study revealed that female staff were significantly more active than male staff.

According to OER Africa (2022) "In its simplest form, the concept of Open Educational Resources (OER) describes any educational resources (including curriculum maps, course materials, textbooks, streaming videos, multimedia applications, podcasts, and any other materials that have been designed for use in teaching and learning) that are openly available for use by educators and students, without an accompanying need to pay royalties or licence fees. The term OER is largely synonymous with another term: Open CourseWare (OCW)."

4. Objectives of Study:

Though various studies have been conducted on the domain OER, these are focused especially on awareness, challenges, etc. There is a need of studying the availability of different OER platforms in the world and their features. Hence, the main objectives of this study include-

• Exploring the major OERs in abroad.

• Exploring the major OERs in India.

5. Discussion:

Open educational resources (OER) are freely accessible, openly licensed text, media, and other digital assets that are useful for teaching, learning and assessing, as well as, for research purposes. OER may include educational materials (including course modules), objects of learning like formulae, textual contents, openly licensed multimedia contents (e.g. videos, audio, image, etc.), software etc. Ideally OER should be freely and openly available resources and expected to be static, as well as, dynamic, as those changes over period of time due to ongoing research activities and upgradation of knowledge.

There are some OER directories which provide easy and quick information about its availability. These include-

   • Directory of Open Educational Resources (DOER) (http://doer.col.org/)
   • Directory by Fairleigh Dickinson University (https://library.fdu.edu/c.php?g=979331&p=7110256)
   • Directory by San Jacinto College District Libraries (https://sjcd.libguides.com/oer)
   • Directory by University of Nevada, Reno (https://guides.library.unr.edu/oer/find) etc.

OER Development by UNESCO: UNESCO, in association with the William and Flora Hewlett Foundation and Western Cooperative for Educational Telecommunications (WCET) conveyed "Forum on the Impact of Open Courseware for Higher Education in Developing Countries" in July 2002. This initial effort made countries aware about the potential of OER. Eventually UNESCO initiated debates on how to apply OERs in practice. Subsequently, in 2012 and 2017 UNESCO organised two World Congresses on OER. In its, 2012 Paris OER Declaration, UNESCO called on governments to openly license publicly funded educational materials. In November 2019, UNESCO, in its 40th General Conference adopted the OER Recommendation which is the only international standard setting framework in this area worldwide. Multilingual OER logo, which creates a common global visual idea, representing "subtle and explicit representations of the subjects and goals of OER" was adopted by UNESCO to support growing international awareness and implementation of open educational resources.

Copyrights: The conventional copyright laws restrict free usages of educational materials; hence, it becomes paramount to have alternative framework of Copyright protection. Creative Commons provides such flexibility to the authors, where they can enjoy their rights but allow academic community to freely use resources without any barrier. In other words, Creative Commons facilitated basic infrastructure to proliferate OER movement. It is notable that since 1980s, GNU General Public License are being used by Free and Open-Source Software (FOSS) community which are now being adopted by OER developers. Similarly, 'Rights Statements' provides a set of standardized rights statements that can be used to communicate the copyright and re-use status of digital objects to the public. As such, it is important to note that conventional copyright framework restricts freely use intellectual property for development of educational resources.

COUP Framework: The growing movement of OER has promoted research activities on OER across the globe. Generally, research on OER is categorized into four categories by COUP Framework. COUP Framework is the Open Education Group's approach to studying the impact of OER (like open textbooks) and open pedagogy in secondary and post-secondary education. As COUP stands for **C**ost, **O**utcomes, **U**sage and **P**erceptions.

5.1 OER initiatives in abroad:
While there are enormous initiatives happening all over the world, some of the major international OER initiatives developed and maintained by government, organizations, educational institutions and libraries are narrated below. The initiatives are chronologically (according to year of establishment) arranged continent and country wise.

5.1.1 Africa
5.1.1.1 Teacher Education in Sub-Saharan Africa (TESSA) (http://www.tessafrica.net/) was started in 2005 by a team from The Open University of UK, led by Professor Bob Moon. At initial stage, a consortium was formed with 14 Higher Education institutions from 9 African countries, and 4 international organisations. In 2010 TESSA was reconceptualised as a network, welcoming new partners and new users and started full operation with ten different versions of the resources. Presently it is one of Africa's most extensive multilingual websites for OER, licensed under Creative Commons. TESSA resources can be filtered by languages and countries. Presently contents of total four languages - Arabic, English, French and Kiswahili and from 24 countries are available in TESSA. This OER initiative is linked to the school curriculum, and designed to support teachers and teacher educators in developing active approaches to learning. Manuals for teachers and teacher educators help in developing professional skills, integrating and making effective use of resources in their classrooms as well as in their courses. TESSA materials can be used by any teacher or teacher educator. Materials are often integrated into pre-service teacher training programmes or to enhance and strengthen them, or into Government training programmes. Different universities of Africa and other countries and some international organizations are founding partners of TESSA consortium.

5.1.1.2 Siyavula (https://intl.siyavula.com/) was started in 2007 as a fellowship project within the Shuttleworth Foundation, with the purpose of making openly licensed content available for all grades and subjects within South Africa. Its mission is to create and enable engaging, integrated, high-quality learning experiences in Mathematics and the Sciences, to have a long-lasting, enriching impact on learners and teachers in South Africa and globally. The program provides learners with virtually unlimited questions that become progressively more difficult as correct answers are given. Because Siyavula's practice adapts to the needs of the person practising by changing the difficulty and sequencing of questions, learners can progress at their own pace. They receive immediate feedback on the questions they do, with step-by-step solutions, and errors and misconceptions are corrected in real time. Siyavula Practice can be used by anyone with a computer, tablet or mobile phone (both smart and feature phones are supported) and an internet connection.

5.1.1.3 OER Africa (https://www.oerafrica.org/) initiative established in 2008 with support from the William and Flora Hewlett Foundation, with the mission to "establish dynamic networks of African OER practitioners by sensitizing and connecting like-minded educators – teachers, academics, trainers, and policy makers – to develop, share, and adapt OER to meet the education needs of African societies." OER Africa aims to provide

a home for all African OER courseware. Four main focus area of this initiative are Agriculture, Foundation Skills, Health and Teacher education.

5.1.1.4 The African Storybook Initiative (https://www.africanstorybook.org/) is an open access movement to picture storybooks in the languages of Africa, which was launched in 2014 aiming at children's literacy, enjoyment and imagination. This website has thousands of openly licensed free picture storybooks in the languages of Africa. It also has tools for the translation, adaptation and creation of picture storybooks for children aged 2 to 10. Currently it has 3,250+ Storybooks, 7,390+ Translations and 220+ Languages.

5.1.1.5 Some other OAI initiatives in Africa taken by organizations and educational institutes include-

- African Health OER (https://www.oerafrica.org/african-health-oer-network)
- Open Resources for English Language Teaching (ORELT) (http://orelt.col.org/)
- The OER4Schools Professional Learning Resource (https://oer.opendeved.net/wiki/OER4Schools)
- Transforming Teacher Education and Learning (T-TEL) (https://t-tel.org/)
- Repository of Open University of Tanzania (http://repository.out.ac.tz/)
- Repository of University of South Africa (https://uir.unisa.ac.za/)
- Repository of Zimbabwe Open University (http://roar.eprints.org/)

5.1.2 United States of America (USA)

5.1.2.1 AgEcon Search - Research in Agricultural and Applied Economic (https://ageconsearch.umn.edu/?ln=en) started in 1995 by the Dept. of Applied Economics and the University Libraries at University of Minnesota, USA. This non-profit subject repository collects, indexes, and electronically distributes full text contents of scholarly research in the area of agricultural and applied economics including different sub disciplines. Contents of AgEcon Search network also include conference presentations, working papers, journal articles, government documents, theses and dissertations etc. As on recent data, it has 1,67,300+ records.

5.1.2.2 MERLOT (Multimedia Education Resource for Learning and Online Teaching) (https://merlot.org/merlot/) is an initiative by California State University, began in 1997. It is an online repository of open course materials supporting the international community of educators, learners, and researchers. All items have been contributed by the MERLOT member community, who have either authored the materials themselves, or who have discovered the materials, found them useful, and wished to share their enthusiasm for the materials with others in the teaching and learning community. MERLOT partners and members are devoted to identifying, peer reviewing, organizing and making available existing online learning resources in a range of academic disciplines for use by higher education faculty and students. As on May 2022, MERLOT has 98,850+ Learning Resources of several disciplines, 1,92,440+ Registered Members and 4,440+ Member Institutions.

5.1.2.3 OpenStax (https://openstax.org/) is a non-profit charitable corporation, initiated in 1999 at Rice University of Texas. Mission of this initiative is to enhance educational access and learning for everyone, by publishing openly licensed books, emerging and improving research-based courseware, establishing partnerships with educational resource companies. Since 2012, OpenStax has created peer-reviewed, openly licensed textbooks, which are available in free digital formats and for a low cost in print. Most of the books are also available in Amazon's Kindle and in the iBooks Store. In 2017, OpenStax announced about uniting with UK Open Textbooks and Katalyst Education to spread the use of their open content accordingly in UK and Poland.

5.1.2.4 National Science Digital Library (NSDL) (https://nsdl.oercommons.org/) was established in 2000, by National Science Foundation to offer organized access to high quality digital learning resources to the **S**cience, **T**echnology, **E**ngineering, and **M**athematics (STEM) education community. NSDL's collections are refined by a network of STEM educational and disciplinary professionals. Resource types available via NSDL

include instructional materials, activities, lesson plans, audio/video materials, images, web sites, simulations, etc.

5.1.2.5 MIT OpenCourseWare (https://ocw.mit.edu/) is a web-based, free and open publication of materials from all MIT (Massachusetts Institute of Technology) courses including audio/video lectures, online textbooks and supplemental resources. This is a permanent MIT activity and this OCW is accessed and used by millions of learners and educators every year around the globe. Since 2001, MIT OpenCourseWare has been creating new opportunities for millions of learners and educators. Currently, it provides about 2500 courses for 500 million visitors.

5.1.2.6 MedEdPORTAL (https://www.mededportal.org/) is a MEDLINE-indexed, open-access journal of teaching and learning resources in the health professions published by the Association of American Medical Colleges (AAMC), in partnership with the American Dental Education Association. This journal was started publishing in 2005. This portal invites educators to submit educational materials that have been implemented with target learners and each submission is reviewed by editorial staff and external peer reviewers. Virtual Learning Resources are also being provided by MedEd Portal during COVID-19 pandemic, which are free to download and free for adaptation to local settings.

5.1.2.7 The Community College Consortium for Open Educational Resources (CCCOER)
(https://www.cccoer.org/) was founded in 2007 at the Foothill-De Anza Community College district by then Chancellor Dr. Martha Kanter. In 2011, CCCOER became part of Open Education Consortium (now Open Education Global) and in 2016, CCCOER took a prime role in OER Degree Initiative of Achieving the Dream (ATD) network, which provides direct support to community colleges seeking to develop full degrees using only OER. CCCOER aims in promoting the adoption of open education to enhance teaching-learning at community and technical colleges. Presently, it has total 108 members from 36 states.

5.1.2.8 CiteSeerX (http://citeseerx.ist.psu.edu/index) was created by researchers Lee Giles, Kurt Bollacker and Steve Lawrence in 1997 at NEC Research Institute, New Jersey. In 2008, this initiative got a new shape at Pennsylvania State University's College of Information Sciences and Technology under the leadership of Professor Lee Giles. It is a public search engine and digital library for scientific and academic papers, primarily in the fields of computer and information science.

5.1.2.9 The World Digital Library (WDL) (https://www.wdl.org/en/) is an international digital library created by U.S. Library of Congress and supported by UNESCO, launched on April 21, 2009 at UNESCO headquarters in Paris. The WDL provides materials from all countries and cultures in web which are free of charge and in multilingual format. WDL items can be browsed by place, time, topic, type of item, language, and contributing partners. Partners of WDL include National Libraries of different countries, archives, museums, or other institutions with collections of cultural content that they contribute to WDL, and other partners like institutions, foundations, and private companies that contribute to WDL by sharing technology, convening or co-sponsoring meetings, or contributing financially. Contents are collected from these partners executing agreements with guidelines set by the WDL Content Selection Committee. Books, manuscripts, maps, and other primary materials on WDL portal are not translated but presented in their original languages. More than 100 languages are covered by WDL, including many lesser known and rare languages.

5.1.2.10 edX (https://www.edx.org/) is a MOOC provider, was founded by Harvard and MIT in May, 2012 which is devoted to transforming traditional education, removing the barriers of cost, location and access. It helps educators and technologists in building learning tools and creating innovative solutions to benefit students worldwide. Along with MIT and Harvard other well-known academic institutions (eg. Stanford University, Boston University, Hong Kong University, Tokyo University, IIM Bangalore, IIT Bombay etc.), international organizations and companies (Open Education Consortium, Microsoft, IBM, Catalyst etc.) are partnering with edX and offering courses on the edX website.

5.1.2.11 Open Textbook Library (https://open.umn.edu/opentextbooks) started in 2012 at University of Minnesota, USA. Through this platform, open textbooks are licensed by authors and publishers to be freely used and adapted. Those textbooks can be downloaded, edited and distributed at no cost. Currently Open Textbook Library is supported by the Open Education Network and is offering 1010+ open textbooks.

5.1.2.12 Johns Hopkings OpenCourseWare (http://ocw.jhsph.edu/) is a collection of open public health courses and materials that support JHSPH (Johns Hopkins Bloomberg School of Public Health) education. It contributes to the "shared intellectual commons" in academia, which promotes collaboration across JHSPH and among other scholars. Using this OCW, educators can develop curriculum and lectures and students can enlarge their current learning. JHSPH Online Courses involve the active exchange of information between faculty and students, assessment opportunities, and verification of learning outcomes.

5.1.2.13 OAsis (http://oasis.col.org/) is the open access online institutional repository of Commonwealth of Learning (COL), Canada for learning resources and publications. The publications found here are licensed under Creative Commons and can be freely downloaded for reuse and adaptation with attribution to COL.

5.1.2.14 Some other OAI initiatives in USA taken by educational institutes include-
- Harvard University: Digital Repository (https://dash.harvard.edu/)
- University of Michigan: Open Michigan (https://open.umich.edu/find/find-open-educational-resources)
- Penn State University Libraries: Repository of Open and Affordable Materials (ROAM) (https://roam.libraries.psu.edu/courses)
- Stanford University: Stanford Engineering Everywhere (SEE) (https://see.stanford.edu/Course)
- University of Washington : OpenUW (https://www.pce.uw.edu/online/free-online-programs)
- Yale University: Open Yale Courses (https://oyc.yale.edu/courses)

5.1.3 Europe
Several OER repositories have been developed in Europe by different institutes and organizations. Two major initiatives in Europe include-

- Delft University of Technology - OpenCourseWare (https://ocw.tudelft.nl/)
- The University of Nottingham - open courseware initiative (https://rdmc.nottingham.ac.uk/handle/internal/79)

5.2 OER initiatives in India:
While global initiatives have large impact in very large scale, Indian initiatives, which are more focused on local needs and customized towards requirements of manpower growth of the country. Several projects have come up with conceptual and financial support and patronization of Government of India. It is worthy to note that in addition to creating OER portals, several academic institutions created open access journals from early stage of OER movement, e.g. Indian Academy of Science, made all their journals freely accessible to the entire nation in early 2000. Similarly, NCERT Books are accessible to all since very long time. Following are few noteworthy Indian OER platforms and initiatives-

5.2.1 Initiatives under National Mission on Education through Information and Communication Technology (NMEICT)

5.2.1.1 E-Yantra (https://e-yantra.org/) is an initiative to spread education in Embedded systems and Robotics taken by IIT Bombay, sponsored by Ministry of Education (MoE), Govt. Of India through the NMEICT. It was conceptualized in 2002 by two professors of IIT Bombay, Kavi Arya and Krithi Ramamritham of Dept. of Computer Science and Engineering. The objective of this project is to provide students of engineering domain hands-on knowledge, who have insufficient access to labs and guides. This initiative has helped several colleges across India. Training for teachers and students is communicated through workshops where

participants are taught basics of embedded systems and programming. Another innovative method of this project is engaging teachers and students in hands-on experimentations with robots. e-Yantra also helps colleges to set-up Robotics labs and clubs. As per recent data, 2,07,300 + Students and 3250 + Colleges have been Benefited, 500+ Internships have been Offered and 400+ e-Yantra Labs have been developed by this initiative.

5.2.1.2   e-PG Pathsala (https://epgp.inflibnet.ac.in/) is an initiative of the MoE, Govt. of India under NMEICT, executed by the UGC and maintained by INFLIBNET Centre. It was launched in November 2015 and it is called a gateway to all post graduate courses. Presently it provides 20000+ e-Text, 19000+ Videos, 3200+ Experts, 30000+ Quiz, 70 Subjects and 720+ Papers. e-PG Pathshala can be accessed on web and is available on Google Play, App Store and Windows. It has three verticals:

- e-Adhyayan (e-Books)- This vertical provides 700+ e-Books for the Post-Graduate Courses.
- UGC MOOCs (Online Courses)- This vertical produces course on Post Graduate subjects in SWAYAM.
- e-Pathya (Offline Access)- This vertical provides software driven course / contents that facilitates students pursuing higher education in Post-Graduation level through distance learning as well as campus learning process.

 5.2.1.3   National Digital library of India (NDLI) (https://www.ndl.gov.in/) is a MoE project under NMEICT, started in 2015 and designed and developed by IIT Kharagpur, which was nationally launched on 19th June, 2018. It provides 24x7 free e-learning materials of all subject disciplines for learners of all educational levels which can be accessed from any internet connected device by anyone, anywhere and anytime through PC and mobile Apps. As in May 2022 NDLI has 8.1 crore contents, contributed by more than 410 digital sources including libraries of educational institutes, organizations, publishers and individual authors, worldwide. NDLI platform has 11 major Indian languages interfaces, 400+ language coverage, 71 lakhs+ registered users and 2,800+ NDLI Clubs. NDLI has two regional centres, for North-East India (located at Central Library of IIT Guwahati, Assam) and South India (located at Anna Centenary Library, Chennai).

5.2.1.4 SAKSHAT Portal (https://sakshat.ac.in/) is a one stop education portal which provides information about all Indian online learning platforms. This is an initiative by of MoE, Govt. of India, launched in October 2016 by the then President of India Dr. APJ Abdul Kalam.

5.2.1.5 SWAYAM - Study Webs of Active Learning for Young Aspiring Minds (https://swayam.gov.in/) is an Indian MOOC (Massive Open Online Course) platform launched by Govt. of India under NMEICT in July 2017. It aims at achieving three key principles of Education Policy - Access, Equity and Quality. This cloud-based IT platform facilitates hosting of all the courses of class IX to Post Graduation level to be retrieved anywhere, anytime by anyone free of cost. All the courses are prepared by reputed teachers in the country and accessible through any internet connected device/ mobile app. Presently Nine National Coordinators are involved in SWAYAM - AICTE (All India Council for Technical Education), CEC (Consortium for Educational Communication), IGNOU (Indira Gandhi National Open University), IIMB (Indian Institute of Management, Bangalore), NCERT (National Council of Educational Research and Training), NIOS (National Institute of Open Schooling), NPTEL (National Programme on Technology Enhanced Learning), NITTTR (National Institute of Technical Teachers Training and Research) and UGC (University Grants Commission). The courses hosted on SWAYAM platform are in 4 quadrants – (a) video lecture, (b) specially prepared reading material that can be downloaded/ printed (c) self-assessment tests through tests and quizzes and (d) an online discussion forum for clearing the doubts.

5.2.1.6   FOSSEE - Free And Open Source Software In Education (https://fossee.in/) is a project of MoE, Govt. of India under NMEICT, developed by IIT Bombay to promote the use of open source software (OSS) in educational institutions. It aims to reduce dependency on proprietary software in educational institutions. FOSS activities include The Textbook Companion (TBC), Lab Migration, FOSS Forum, conferences, seminars, hands-on workshops etc. Some projects/ tools promoted by FOSSEE to encourage students and

faculty to use them in education and research, include Python programming language, SOUL (Science OpensoUrce Software for Teaching Learning), R statistical tool, FOCAL (Free and open-source creative art library), Scilab software, ESim, openFOAM, OpenModelica etc.

5.2.1.7 Spoken Tutorial (https://spoken-tutorial.org/) is a project of MoE, Govt. of India under NMEICT, developed by IIT Bombay, providing educational audio-video tutorials. Its self-paced, multi-lingual courses ensure that anybody who have a computer and desire for knowledge, can learn at any time from any location and in a language of their own choice. All the content published on this website are shared under the Creative Commons license.

5.2.1.8 SWAYAM PRABHA (https://www.swayamprabha.gov.in/) is an NMEICT initiative to provide 32 high quality educational channels through DTH (Direct to Home) on 24x7 basis. Channels are uplinked from BISAG , Gandhinagar using 2 transponders of GSAT-15 Satellite and the web portal of SWAYAMPRABHA is maintained by INFLIBNET Centre. SWAYAMPRABHA provide curriculum-based courses for 9-12 classes, post-graduate and under-graduate level and life-long learners of India and abroad, which enable to deliver e-education in a most cost effective & inclusive manner. Like SWAYAM, contents of SWAYAMPRABHA also are provided by CEC, IGNOU, IITs, NCERT, NIOS, NPTEL and UGC. This channel is freely available on Dish TV (Zee), DD Free Dish and Jio Mobile App.

5.2.1.9 Virtual Lab (http://www.vlab.co.in/) is a MoE, Govt, of India project under the aegis of NMEICT, was implemented by IIT Delhi. It provides a fully interactive simulation environment to perform experiments, collect data, and answer questions to assess the understanding of the knowledge acquired. This project aims at providing remote-access to labs in numerous disciplines of Science and Engineering, sharing costly equipment and resources, which are otherwise available to limited number of users due to restrictions on time and geographical remoteness. Areas of Virtual Labs include many branches of Engineering, Physical Sciences, Chemical Sciences etc. Virtual Labs do not require any additional infrastructural setup to conduct experiments at user places, the simulations-based experiments can be accessed remotely through internet. Presently, along with IIT Delhi, other five IITs, one NIT, one IIIT, two universities and one college are participating this project.

5.2.2   Initiatives under NCERT (National Council of Educational Research and Training) and CBSE (Central Board of Secondary Education)

5.2.2.1 National Repository of Open Educational Resources (NROER) (http://nroer.gov.in/) was launched by the Department of School Education and Literacy, MoE, Govt. of India on 13 August 2013 in New Delhi during the National Conference on ICT (Information and Communication Technology) for School Education and it is managed by the Central Institute of Educational Technology (CIET), NCERT. This repository brings together everyone interested in school and teacher education. NROER hosts huge number educational resources (in video, image, audio, document formats) for Primary, Secondary and Senior Secondary classes of many subjects in different Indian languages.

5.2.2.2 NCERT textbooks (https://ncert.nic.in/textbook.php) is an online facility which delivers easy access to textbooks for classes I to XII of all subjects published by NCERT in Hindi, English and Urdu languages. These textbooks are copyrighted to NCERT, one can download and use as textbooks or for reference, but republication is strictly prohibited.

5.2.2.3 National Initiative for School Heads' and Teachers' Holistic Advancement (NISHTHA)
(https://itpd.ncert.gov.in/) is an integrated platform for teacher training, established by Department of School Education and Literacy, MoE as part of its National Mission to improve learning outcomes at the Elementary level under the Centrally Sponsored Scheme of Samagra Shiksha. This platform helps all teachers and other stakeholders in Educational Management and Administration, in different stages of school education as mentioned below.

NISHTHA (Elementary Level-Classes I-VIII) - Face to Face mode
NISHTHA 1.0 (Elementary Level-Classes I-VIII) - Online mode
NISHTHA 2.0 (Secondary Level- Classes IX-XII) - Online mode
NISHTHA 3.0 (FLN) For NIPUN Bharat ((ECCE to Class V) - Online mode

5.2.2.4 Central Board of Secondary Education (CBSE) (https://www.cbse.gov.in/) provides free digital copies of Text Books, Question Papers, Solutions, Syllabus, Teacher's Manuals for different classes and subjects through several platforms as mentioned below.

- CBSE exam portal (https://cbseportal.com/download/text-books)
- CBSE Academics (https://cbseacademic.nic.in/)
- Learn CBSE (https://www.learncbse.in/)
- CBSE (https://www.cbse.gov.in/ecbse/welcome.html) etc.

5.2.3 Initiatives by Centres/ Institutes/ State Educational Boards etc.

5.2.3.1 Consortium for Educational Communication (CEC) (http://www.cec.nic.in/cec/) is one of the major Inter University Centres (IUC), was established by the UGC, Govt. of India in 1991. It aims at addressing the needs of Higher Education through the powerful medium of Television along with appropriate use of developing ICT tools. Currently, CEC's repository provides several UG MOOCs and PPG MOOCs. CEC telecasts The Vyas Higher Education Channel on Swayam Prabha DTH, provides podcast service, facilitates Flipped classrooms and provides free access to unlimited educational curriculum-based lectures through CEC-UGC YouTube channel.

5.2.3.2 eGyanKosh (http://egyankosh.ac.in/) is a National Digital Repository developed by the Open and Distance Learning Institutions in India. Contents in eGyanKosh are protected by copyright, with all rights reserved by IGNOU (Indira Gandhi National Open University). Presently 55,300+ items of BA, BSc, BCom courses are being provided under communities like IGNOU FB Live Recorded Videos, IGNOU Self Learning Material, IGNOU YouTube Videos, Indian Journal of Open Learning etc.

5.2.3.3 IITBombayX (https://www.iitbombayx.in/), a non-profit MOOCs (Massive Open Online Courses) provider initiative, was developed by IIT Bombay for individuals from varying backgrounds. This platform offers four different kinds of MOOCs for various learning needs, such as EduMOOCs, SkillMOOCs, TeachMOOCs and LifeMOOCs.

5.2.3.4 Indian Academy of Sciences Repository (http://repository.ias.ac.in/) collects, preserves and disseminates research output created by the fellows of the IAS in digital format. It permits the IAS community to deposit their preprints, post prints and other scholarly publications, and organizes these publications for easy retrieval. Though publications of the IAS fellows stored in this repository can be accessed by anybody, submission of items is limited to the fellows of the Academy only.

5.2.3.5 NIScPR Online Periodicals Repository (http://nopr.niscair.res.in/) provides about total 53,900+ contents freely including full text articles from total 19 research journals published by CSIR-NISCAIR (National Institute of Science Communication and Information Resources) and 3 Popular Science Magazines.

5.2.3.6 National Programme on Technology Enhanced Learning (NPTEL) (https://nptel.ac.in/) is a project of MoE initiated in 2003 by seven IITs (Bombay, Delhi, Kanpur, Kharagpur, Madras, and Roorkee) along with the Indian Institute of Science, Bangalore. It's the largest online repository in the world licensed under Creative Commons, of courses in Engineering, Basic Sciences, and selected Humanities and Social Sciences subjects where recorded lectures taught in its member institutes are available online for open access. 'Online Certification' feature of NPTEL aims to make students employable in the industry or pursue a suitable higher education programme. Currently, NPTEL has 1,60,08,170+ registered students and 10,59,000+ successful certifications.

5.2.3.7 Shodhganga (https://shodhganga.inflibnet.ac.in/) is a digital storehouse of Indian ETD (Electronic Theses and Dissertations) preserved by INFLIBNET (Information and Library Network) Centre. Currently, 638 Indian Universities and a total of 43 Indian INIs (Institute of National Importance) and CFTIs (Centrally Funded Technical Institutes) are connected with Shodhganga through MOU (Memorandum of Understanding). The full text of all the documents submitted to Shodhganga are available to read and to download in open access worldwide. Currently, this integrated repository provides 3,56,600+ theses collected from 540+ universities. The submissions made to Shodhganga are licensed under Creative Commons. The INFLIBNET Centre is also maintaining Shodhgangotri which is a repository of the synopses and research proposals of the PhD programmes in Indian universities.

5.2.3.8 Some State educational boards provide OER repositories containing books, video lessons, questions papers, teacher's manuals for different classes, different subjects and in different mediums of languages. These repositories are also accessible through National Digital Library of India platform. Table-1 displays a statewise list of such repositories.

Table 1: Indian State-wise OER Repositories by Educational Boards

State	Organization(s)	URL	Nature of OER
Andhra Pradesh	SCERT	https://apscert.gov.in/	Text Books, Teacher's manuals
Assam	Board of Secondary Education, Assam	http://www.sebaonline.info/	Video Lessons
Chhattisgarh	• Board of Secondary Education • SCERT	https://cgbse.nic.in/ http://scert.cg.gov.in/	• Videos, Question papers • Text Books, Question papers
Gujarat	Secondary and Higher Secondary Education Board	http://www.gsebeservice.com/	Text Books, Question papers
Jammu & Kashmir	State Board of School Education	https://jkbose.nic.in/	Text Books
Karnataka	Secondary Education Examination Board	https://www.ktbs.kar.nic.in/	Text Books, Question papers
Kerala	SCERT	https://scert.kerala.gov.in/	Text Books, Question papers
Madhya Pradesh	Board of Secondary Education	http://www.educationportal.mp.gov.in/main.aspx (Click online textbook)	Text Books, Question papers
Maharashtra	State Board of Secondary and Higher Secondary Education	https://www.mahahsscboard.in/	Text Books
Nagaland	Board of School Education	http://www.nbsenagaland.com/Q_bank_idx.htm	Question papers
Odisha	Board of Secondary Education	http://www.bseodisha.ac.in/	Text Books, Question papers
Punjab	School Education Board	http://www.pseb.ac.in/en	Text Books, Question papers
Rajasthan	Board of Secondary Education	http://rajeduboard.rajasthan.gov.in/books/index.htm	Question papers
Tamil Nadu	Department of School Education	https://textbookcorp.tn.gov.in/textbook1.php	Text Books, Teacher's manuals
Telangana	SCERT	https://scert.telangana.gov.in/	Text Books
Tripura	SCERT	https://www.scerttripura.org/index.php	Text Books, Videos
Uttar Pradesh	SCERT	https://www.scert-up.in/	Text Books, Teacher's manuals
West Bengal	• West Bengal Board of Primary Education • West Bengal Board of Secondary Education • West Bengal Council of Higher Secondary Education	https://www.wbbpe.org/ https://wbbse.wb.gov.in/Web/Home?l=Z%2F%2F2JeEw6P%2FkXiUjdLauQg%3D%3D https://wbchse.nic.in/html/index.html	• Text Books, Teacher's manuals • Text Books, Question papers • Text Books, Question papers

SCERT: State Council of Educational Research and Training

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6. Findings:

In abroad, USA is found being developing maximum numbers of OER repositories followed by Africa. In India also, high growth and existence of OER have been seen under sponsorship of Ministry of Education, Govt. of India. NMEICT has been increasingly contributing towards "Open Access" through its numerous OER projects, involving ICT in teaching-learning process. As an institute, IIT Bombay also has been found taking a pioneer role in OER mission.

7. Scope & Challenge of Future:

The above portrayal of global and Indian OER imitative highlights that a major portion of academic literature have been made available in English language. However, there exists large scope of improvement in the domain of regional language OERs. Such OERs would require to be more specific to local needs and should help to improve human resources and skills village level, specifically in developing nations.

One reason for such limited number of OERs in local and regional languages could be lack of availability of OCR (Optical Character Recognition) software. Other challenges are to develop appropriate programming in local languages, complications of interface development, etc. While remarkable initiatives in this direction has been taken by African countries, more focused projects are now required in India.

Scope of study include:
- Hindrance in developing regional language OER.
- Copyright related challenges.
- Challenges related to software/digital platform.
- Distribution/dissemination challenges.

8. Conclusion:

Globally digital divide remains a major concern and access to digital resources are challenges for most of the people of developing nations. Similarly, quality and reliability of OER contents remain another important concern for the global academic community.

However, advantages and enormous flexibility of digital contents, which can be made available through the OER platforms certainly have more edges over its limitations. As such OER provides opportunities to access educational contents, anytime and anywhere. OER also make it possible to modify and upgrade contents seamlessly without hindering to learning process, as well as, gives a gigantic flexibility to incorporate textual, visual and audio-visual contents. Moreover, all these could reach to targeted audience instantly without losing seconds between creation and consumption. These added advantages of OERs would help the nations to build their most valuable intangible assets, i.e. knowledge.

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