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ADVANCED RESEARCH ASSET CREATION (ARAC) MODEL WITH RESEARCH DATA MANAGEMENT (RDM) FRAMEWORK FOR HIGHER EDUCATION INSTITUTES IN INDIA

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Abstract

Research outcome and research data being two important factors of any research for the respective higher education institutes (HEIs) in order to continue research progressively which will play a vital role in the development of our society and have valuable impact up to national and global level. Huge amount of time, effort, resources and budget are spent on any research by HEIs, Universities and government. So it is very essential to preserve and create asset of all the important aspects of every individual research in order to progress towards achieving the research goal. Need for the hour is not just an institutional repository but a quality oriented efficient research system or model which can transform the broken, distributed and individual researcher oriented research to integrated and convert to continuous progressive result oriented research over the time with multiple researchers which ultimately create a valuable outcome and create high impact in the research community. Considering the mentioned factors, this article proposes advanced research asset creation (ARAC) model which is capable of handling and preserving every bit of the research outcome and research data resulting in continuous progressive research until the research goal is achieved which benefits institutions and research community with all the quality and security parameters thereby fetching popularity and reputation for the Institution. ARAC model also allow different university to interconnect and connect at national and global level with all the guidance on sharing the research resources. Researchers, Faculties and Librarians play a very important role in building ARAC model research system.

2010 Mathematics Subject Classification: 94-11.

Keywords: Research data; Advanced research asset creation (ARAC) model; Research data management (RDM); Higher education institution (HEIs); Researchers; University.

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I. Introduction

Figure 1 and Table 1 shows the Ph.D. awarded information taken from the Times of India newspaper [4] and number of Universities growing in India as per the AISHE 2018-19 (All India Survey of Higher Education) report from MHRD (Ministry of Human Resource Development) link [3]. As per the news on 3rd June 2019 in Times of India newspaper [4], UGC (University Grants Commission) is trying to assess the past Ph.D.'s (Doctor of Philosophy) for quality. Also it is mentioned that "Lack of a centralized record system of research topics being pursued by scholars is the reason behind increasing Ph.D. '*s*" and "Many times, scholars in different parts of the country are unaware of similar research bring conducted elsewhere, that leads to identical studies. This has led to an increase without any value addition".

According to MHRD AISHE 2018-19 survey report 40813 students were awarded Ph.D. level degree during 2018 and 34400 students during 2017. 34.3% are from State Public University followed by 21.6% from Institute of National Importance, 21.6% from Deemed University- private and 13.4 % from State Private University. The trend from past few years shows increase in enrolment of Ph.D. which is 117301 in 2014-15 to 169170 in 2018-19.

Table 1. Number of University Growing From 2013-2019.

Major University Type	Number of University					
	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
State Public University	309	316	329	345	351	371
State Private University	153	181	197	233	262	304
Deemed University Private	80	79	79	79	80	80
Institute of National Importance	75	75	75	100	101	127
Central University	42	43	43	44	45	46
Deemed University Government	36	32	32	33	33	34

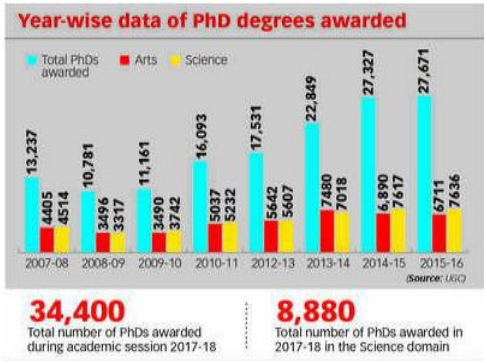


Figure 1. Total PhDs awarded from 2007-08 to 2015-16.

II. ARAC Model

ARAC model is mainly has two interfaces one at Institutional level and another at University level. ARAC model main research outcomes are research articles and research data at University and Institutional level. It make sure all the research work done by every post-graduation student and Ph.D. research scholar has the research outcome which are in the form of quality oriented research article/paper at University and Institutional level without any duplication and plagiarism. In order to achieve this a new set of article names, abbreviations and associated workflows are explained in Table2 which is part of the Article management system (AMS) component of ARAC model (which is explained in the ARAC model component section III).

A. Pin articles/Pin papers: This can also be written as "PINarticles/PINpapers". "*P*" stands for Ph.D. or M.Phil. Research and "IN" stands for "Institution". Research carried out by research scholars should be published as "Pinarticles/Pinpapers" at the Institutional level where they are doing research. Upon quality review for novelty and approval the same paper is promoted and published at University level (to which institution is affiliated) as "Uniarticle/Unipaper" which is explained in the same section.

B. Minarticles/Minpapers: This can also be written as "MINarticles/MINpapers". "M" stands for Master's or post-graduation and "IN" stands for "Institution". Research/project work carried out by Master or post-graduation students should be published as "Minarticles/Minpapers" at the institutional level where they are doing research project work. Upon

quality review for novelty and approval the same paper is promoted and published at University level (to which institution is affiliated) as "Muarticles/Mupapers". Important note is if Ph.D. or M.Phil. Scholar is one of the author who was part if this work then it is considered as "Pinarticle/Pinpapers" at institutional level and "Uniarticles/Unipapers" at university level.

C. Muarticles/Mupapers. This can also be written as "MUarticles/MUpapers". "M" stands for Master's or post-graduation and "U" stands for "University". "Minarticle/Minpaper" undergo go qualitative review and upon approval published at university level as "Muarticles/Mupapers".

D. Uniarticles/Unipapers. This can also be written as "UNIarticles/UNIpapers". "UNI" stands for University research article where research is carried out by Ph.D. or M.Phil. Scholar at its affiliated institution.

With this understanding it is clear now what paper is published at institution level and University level and entry criteria for university level. Review assignment and approval to be handled in the ARAC model system having peer reviewer and approver from both University and Institution end. However any article can be submitted to any conference and can be published in any Journal outside the University. When any article is published at university level its corresponding thesis, dataset are preserved with agreed access and security policies and guidelines. The advantage of this system is we are doing research progressively until the research goal is achieved.

Table 2. New categories of research paper proposed in ARAC model.

Type of articles	Alias	Abbreviation	Published at
Pinarticles/Pinpapers	PINarticles/PINpapers	P - Ph.D. or M.Phil. Research scholar IN-Institutionarticles or papers	Institution level where research is conducted
Minarticles/Minpapers	MINarticles/MINpapers	M- Master's or post-graduation IN-Institution articles or papers	Institution level where research is conducted
Muarticles/Mupapers	MUarticles/MUpapers	M- - Master's or post-graduation U-Universityarticles or papers	University level to which institution is affiliated
Uniarticles/Unipapers	UNIarticles/UNIpapers	UNI-University Ph.D. or M.Phil. Research scholar's University articles or papers	University level to which institution is affiliated

III. ARAC Model Components

As earlier mentioned ARAC model is mainly have two interfaces one at Institutional level and another at University level as shown in Figure 2.

1. University level Components:

A. Article Management System (AMS). Consists of articles at University level ("Uniarticles/Unipapers", "Muarticles/Mupapers"). These articles are the peer reviewed and approved articles from both University and its affiliated institution.

B. Thesis Management System (TMS). Consists of thesis corresponding to articles published at University level with agreed access and security policy and guidance.

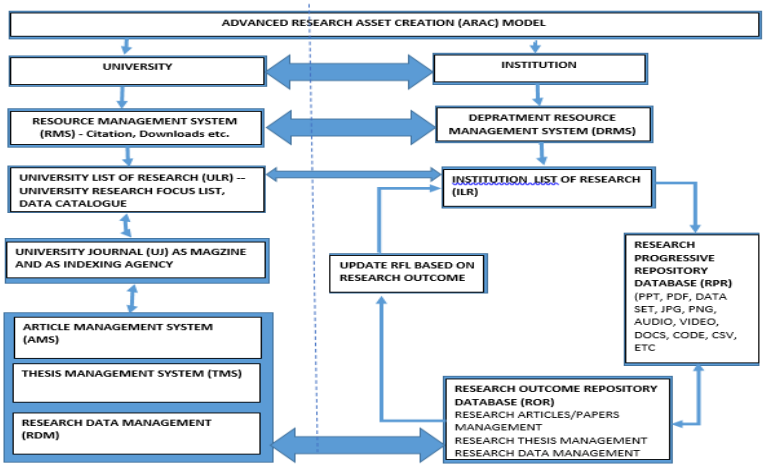
C. Research Data Management system (RDM). Consists of dataset and code corresponding to articles published at University level with agreed access and security policy and guidance. This is to support future research and open access, however it is not a mandatory for any institution to move its dataset and code if it is private, confidential and sensitive.

D. Resource Management System (RMS). Profile information, achievements, certificate sharing, conferences, books, networking, following, discussions, citations, downloads, rewarding and many more relevant concepts can be introduced.

E. University List of Research (ULR). University level research focus list which is updated frequently based on the outcome of the progressive research, new research initiated by institution or by funded research project University level, Data catalogue and many more relevant information.

F. University Journal (UJ). Every year monthly or quarterly or half yearly or annually Journal magazine can be published by the university depending on their decision. This can be shared with all important stakeholders, media and with all the other University. This gives visibility of the amount of research work done and focus on building more upon that. This system creates Indexing agency and Journals at University level.

Figure 2. ARAC Model.



2. Institutional level:

A. Departmentwise Resource Management System (DRMS). It consist of department names, Profile of faculty and researchers, citations, achievements, certificate sharing, conferences, books, networking, following, discussions, downloads, rewarding and many more relevant concepts can be introduced.

B. Institute List of Research (ILR). It consists of Department wise Institutional research focus list. This is updated frequently based on the outcome of the progressive research, new research initiated by institution or by funded research project.

C. Research progressive repository (RPR). This Repository is the most dynamic repository where researchers are more active and the support activities of Institution librarians are required. Researchers and mentors carry out research and all important relevant information uploaded here. It might be reference material, code, dataset, learning materials, presentations, progress update, relevant audio and video files, machine readable files, results, any object file, image files and many more relevant information with the support of the relevant comments and reason for the specific research work with metadata. Multiple version of the same files can be uploaded with maintaining version history which should be supported from the system. Research data management (RDM) [1], [5] is one of the main activity which

need to be carried out by the researchers and the faculties of the institution with the help of library staff. RDM deals with collecting, analyzing, publishing, reanalyzing and reusing data.

D. Research Outcome Repository (ROR). This repository contains the final outcome of individual research in terms of articles, thesis and data in the path of the specific research in the institutional list of research (ILR) and updated accordingly. This repository mainly contains Institution articles ("Pinarticles/Pinpapers", "Minarticles/Minpapers"), corresponding Thesis, final presentation from the researcher, dataset and code. This system supports peer review and approvals. It connects with the affiliated university repository where the articles upon review and approval from both the end reflected in University repository as university articles ("Uniarticles/Unipapers", "Muarticles/Mupapers"). Thesis and data also synched to University repository depending upon the access policy and security guidelines. Based on the research outcome the institution list of research (ILR) is updated for the further research to progress from the updated list.

IV. ARAC Model Networking

All the institutions ARAC model affiliated to one university connect at the same University ARAC level. So University ARAC level is the common interface for all its institution to interact, collaborate and work together to form a research community at the university level. At the same time different universities can also collaborate each other with their own agreement of understanding at university ARAC level with all the access policy and security guidelines. Master university ARAC model level as shown in Figure 3 can be created at national level under the Government department "UGC-University Grant's Commission" of India collaborating with all the universities within the nation to work together for a common cause. This is very helpful for research community to find the quality oriented original research work to continue of their own interest in future scope, avoid duplicate research work and at the same time it create a high valuable research and new knowledge in the research system. This organized way of research system will have a control on the research quality content and continuous research motivating rest of the world. The same model can be

implemented in other countries and each country can collaborate at Master University ARAC model level and can create a valuable impact at global level.

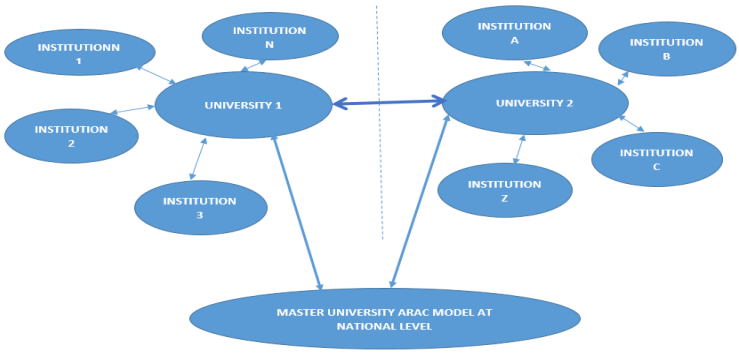


Figure 3. ARAC Model Networking.

V. Future Work

Future work on this paper would focus on to develop some intelligence using data science, artificial intelligence, machine learning, deep learning concepts and techniques to use the model efficiently as we have introduced research data management in the model. Also further exploration can be done for the actual implementation of ARAC model and finding out how various domains of research data can be accommodated into it and as well as the requirements and challenges to implement the same.

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