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Kazakhstan Develops Smart Cities

Institutional Repositories as Backbones of Digital Kazakhstan

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ABSTRACT

As a young and developing city, Astana and its people are preparing their way to become a smart city. A smart city "improves the quality of life for its citizens through technological means" (Guerra, 2017). Kourtit, Nijkamp &Arribas (2012) define smart cities as highly productive cities as they perform to have highly educated people. This paper introduces the development of Institutional Repositories as possible technological component of a smart city. In Kazakhstan, the government is pushing towards providing better online access to its citizens. It is also embarking on digital library projects being spearheaded by the National Academic Library. With such projects being developed, how sufficient in terms of open- access information do the five largest cities of Kazakhstan have? State universities have their own institutional repository projects that may be a good inclusion to the smart city project. A survey of Astana University libraries and other four major cities was conducted to find out the number of existing Institutional Repositories that could possibly support the goal of the government to realize its full potential to be an innovative smart city. Furthermore, the paper will highlight challenges each library is currently facing in building an institutional repository with a goal of improving the

open-access environment in Kazakhstan. Results showed that not all smart cities in Kazakhstan have established institutional repositories.

Keywords: smart city, institutional repositories, open access, Kazakhstan

INTRODUCTION

Digital Kazakhstan is a state program which aims to augment the quality of life of man by introducing to and integrating digital technologies with the citizens' daily lives. As technologies play a vital role in improving the people's lives, they also have great effect in the field of education. The educational sector will directly benefit from this technological trend as students, faculty and researchers will have a faster and convenient way of getting relevant results through the accessible online tools available in public or academic libraries. The state prepares its nationals to be information and digital literate making them highly competent and competitive (Digital Kazakhstan, 2018). According to the statistics, 76.8% of Kazakhs use the internet. Most people carry a mobile device with them. Literacy rate is very high with 99.8% (Statista, 2017). With this soaring literacy rate, is Kazakhstan ready to embark into building up smart cities?

SMART CITIES

An ambitious and urbanized city is innovative and smart (Gasco-Hernandez, 2018). As mentioned by Gasco-Hernandez (2018), technology is an essential tool to make a city "inclusive, productive, self-sufficient, innovative, and community-oriented." These five characteristics sum up the look of a worth-lives smart city. Nam & Pardo (2011) are of the view that smart cities are from when "investments in human/social capital and IT infrastructure fuel sustainable growth and enhance a quality of life, through participatory governance." This only means that smart cities develop not only the tangible assets but also the intangible ones that take birth in human intellect. In a follow-up study by Gil-Garcia, Pardo & Nam (2015) say that a successful and working smart city should be assessed based on different qualifying components and one of them is ICT and other technologies.

The other components are:

1. public services
2. city administration and management
3. policies and other institutional arrangements
4. governance, engagement and collaboration
5. human capital and creativity
6. knowledge economy and pro-business environment
7. built environment and city infrastructure
8. natural environment and ecological sustainability, and
9. data and information

These components, when placed together, will help build a strong smart city.

OBJECTIVES OF THE STUDY

With this advent of smart city, how can libraries deliver and establish itself as a driving force in developing a smarter city? A smart city is inclusive and it requires effective services that a cultural center just like a library could provide. Libraries are great partners in informing and engaging its citizens through its programs and services (Mersand, Gasco-Hernandez, Gil-Garcia, Burke, Sutherland & Figueroa, 2018). They should have smart libraries which serve as a central hub for continuous learning and knowledge sharing. Smart libraries are governed by smart people that offer smart place and smart services (Schöpfel, 2018). Libraries are now seen as centers that could be avenue for social participation and collaboration, a place where smart people can sharpen their critical thinking skills. Innovative programs, workshops, and trainings are often part of a library service to enhance learning.

The aim of this paper is to introduce the development of Institutional Repositories as possible technological component of a smart city. With projects being developed, how sufficient in terms of open-access information do the five largest cities of Kazakhstan have? State universities have their own institutional repository projects that may be a good inclusion to the smart city project. A survey of Astana University libraries and other four major cities was conducted to find out the number of existing Institutional Repositories that could possibly support the goal of the government to realize its full potential to make innovative smart cities. Furthermore, the paper will highlight challenges that each library is currently facing in building an institutional repository with a goal of improving the open-access environment in Kazakhstan.

KAZAKHSTAN EXPERIENCE

The movement of Open-Access is fairly developed in Kazakhstan. Some libraries have the experience in creating open-access digital libraries. The National Academic Library of Kazakhstan based in Astana has created the Kazakhstani National Electronic Library (kazneb.kz). This project is undergoing development and has already been launched by the government. The academic libraries are striving hard in establishing their Institutional Repositories. In Kazakhstan, the total number of universities is 125 (Center of the Bologna Process and Academic Mobility, 2018). Looking through the repositories registry like OPENDOAR, we can only find six universities with institutional repositories (OpenDOAR, n.d.). This situation means that Kazakhstan needs to improve the system of providing open-access information to the scholarly works.

According to the government strategy 2050: *"On the Internet, it is necessary to post video lessons and video lectures from the best teachers of secondary schools, colleges and universities. This will allow all Kazakhstanis, living in remote settlements, to gain access to the best knowledge and competencies…"*(Strategy2050, 2013). This tell us that the government has taken a serious step to ensure that equal access to information can be gained by all the people.

THE OA INITIATIVE IN KAZAKHSTAN

Of about 125 universities (Center of the Bologna Process and Academic Mobility, 2018) in Kazakhstan, we were able to send 74 (59.2%) survey questionnaire invitations but only 10 (8%) university libraries responded and 9 (7.2%) of them have Institutional Repositories. Considering

this number, four academic libraries are from Astana itself. Since the smart city pilots in five major cities of Kazakhstan namely: Astana, Karaganda, Ontystuk (Shymkent), Almaty and Aktobe this paper will look into their development (Abaev, 2017).

Most academic institutions use DSpace as their software to preserve and provide open-access digital content. According to the DuraSpace registry, six universities in Kazakhstan are using DSpace (DuraSpace, n.d.). DSpace is the largest open-source software trusted by most educational and private institutions.

OpenDOAR, a directory of open-access repositories, shows that there are eightopen access repositories included those from Kazakhstan universities (Table 1). There are 6 Institutional Repositories, 1 Governmental Repository, and 1 Disciplinary Repository.

Table 1: OpenDOAR Repositories in Kazakhstan

	Institutional Repository	Governmental Repository	Disciplinary Repository
1.	1.Digital repository of KAZGUU University	Digital Library	Kazakhstan Human Rights Commission
2.	Karaganda State Medical University Repository		
3.	Nazarbayev University Repository		
4.	Repository of Almaty Management University		
5.	Repository of L.N. Gumilyov Eurasian National University		
6.	Repository of E.A.Buketov Karaganda State University		

The data from ROAR, an OA repository registry maintained by The University of Southampton, UK shows that from Kazakhstan, there are only six open-access repositories available. The list can be accessed here: http://roar.eprints.org/view/geoname/geoname=5F2=5FKZ.html.

Table 2. Survey Results

University	City	Year Established	Number of Items in the Collection	Types of Materials in the Collection
1	Almaty	2017	1993	journal articles
2	Karaganda	2018	194	journal articles, theses

3	Almaty	2017	174	journal articles, book chapters
4	Uralsk	2015	1,090	journal articles
5	Astana	2012	12,500	journal articles, conference proceedings, unpublished documents
6	Astana	2018	445	journal articles
7	Astana	2017	274	journal articles
8	Astana	2014	2,951	theses, journal articles, capstone projects, conference proceedings, poster presentations, university-sponsored journals

Table 2 is a summary of academic libraries with established Institutional Repositories. The oldest of them started in 2012 with more than 12, 500 items in their collection. The Astana-based library (University 1) includes journal articles, conference proceedings and unpublished documents in the collection. The academic library was established in 2014 (University 8) with almost 3,000 documents in it repository, which include theses, poster presentations, journal articles, and many other items.

THE AUTONOMOUS ORGANIZATION OF NAZARBAYEV UNIVERSITY

The regulations on Open-Access Archives (repository) of the Autonomous Organization of Education Nazarbayev University was signed by the Managing Council in August 15, 2014. The Nazarbayev University Institutional Repository is an institutional electronic archive for long-term storage, accumulation and provision of long-term and reliable open-access to scientific research results and intellectual out bursts of the academic community of Nazarbayev University.The aims and objectives: Long-term preservation of deposited digital materials for the future generations; improved access to scholarly products making them open to NU Community and the general public; supporting NU research and publications through visibility, usage and impact.

Structure of NU IR has been created on the same lines of Nazarbayev University. There are several communities that represent the NU Schools namely:

1. Graduate School of Business
2. Graduate School of Education
3. Graduate School of Public Policy
4. School of Engineering
5. School of Humanities and Social

6. School of Medicine
7. School of Mining and Geosciences
8. School of Science and Technology
9. Center for Preparatory Studies

NU also has research centers like the National Laboratory of Astana and NU Research and Innovation System.There are also collections of community for University Medical Center, Library and IT Services and for NU partner namely the Kazakhstani National Geographic Society. Each year NU holds a large number of international conferences, seminars and workshops and all conference proceedings can be found in collections of "Materials of forums, conference and projects" and "NU Distinguished visiting speakers". There are also available collections of scholarly articles of the first open-access students research journal "NUGSE Research in Education".

CHALLENGES

Collecting academic articles from the researchers and faculty members is a huge challenge. First of all, the NU has not yet adopted the Open-Access Policy, which will require the faculty member or researcher of NU to submit their articles in IR in support of the open-access idea. The NU community is not yet ready to support the open-access movement, because some faculties are afraid to share their publications due to copyright issues and it's difficult to get the pre-print and post-print versions of articles from the authors.

Secondly, there are problems in collecting theses from the NU Schools, because not all schools provide the Master's theses to be submitted in NU IR. In a local study conducted by Yap, Groen, Kamilova, Terzi &Zvonareva (2018) not all theses were submitted mainly because there are criteria set by each school for them to submit it to the repository. Another reason would be, some theses have confidential information from the private organizations which should not be publicly available.

USAGE

The Google Analytics report shows that during the period of February 2015 to September 2018 there are 14, 334 users from different countries such as Kazakhstan, the United States, Russia, the United Kingdom, China and France among others. Table 3 indicates the number of users per country.

Table 3. The number of users of NU IR (by country), period is February, 2015–September, 2018

No.	Country	Users
1	Kazakhstan	8,278
2	United States	2,461
3	Russia	1,064
4	United Kingdom	624

5	China	613
6	France	352
7	Germany	271
8	South Korea	262
9	India	223
10	Turkey	186

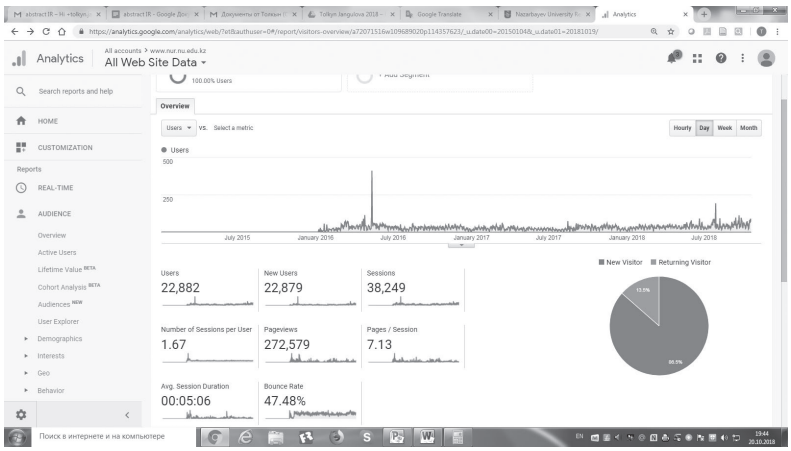

Figure 1. Report from Google Analytics, February 2015 to September 2018 year

Figure 1 shows the number of new users, the amount of pageviews and average session duration of each user from 2015-2018.

Table 4. Items that are most accessed and downloaded from the NU IR

Title of most accessed items	Number of access
Double-auction-based energy trading for small cell networks with energy harvesting	547
Trilingual education in Kazakhstan: challenges for secondary school teachers	328
Effective teaching strategies: A brief overview	296
Эффективные стратегии преподавания: краткий обзор	229
Aerosol formation in CO_2 capture plants - molecular dynamics simulation	228

Table 4 shows that non-English items are also being accessed by the users. The top most accessed is an article in the field of engineering while the second and third comes from field of education. The last fifth one is a master's theses in the field of chemical engineering.

Discussion

The greatest question is how to measure the sufficiency of a local information? Institutional Repositories are just among the many ways on how a university or institution can contribute

to the targets of the city or state. Having eight repositories listed in OpenDOAR may not be enough for now considering that there are 125 universities and other specialized institutions in the country. Twenty seven years after gaining independence from the Soviet empire, it is a good start that these universities are able to establish institutional projects leading to Open-Access culture. Kazakhstan's goal to have smart cities are good indicators to reach the unreachable through interconnection. A developing nation like Kazakhstan will be the next center of attention in the coming years.

The cities of Uralsk, Almaty, Karaganda and Astana have been good advocates of OA initiatives. Unfortunately, there is no information about any OA initiatives here taken in the smart cities of Shymkent and Aktobe. These two cities should start puttingup their own institutional repositories. The top five cities that access the repositories are Astana (80.37%), Almaty (10.50%), Shymkent (2.28%), Karaganda (2.28%), and Aktobe (0.91%).

Given the examples of universities with institutional repositories, the Autonomous University of Nazarbayev is on its way to offer open-access materials to the public. Although it is typical for a university to struggle in collecting documents from university researchers, there has been a good collaboration between schools and librarians in encouraging those to be open and share their scholarly works. The goal of the repository is to cater to its citizens and it is living its objectives by providing access to more than 8, 000 users.

The NU IR receives an average of 9.84 views per day. The School of Science and Technology has the most number of shared documents although their theses output is very small. This is followed by the School of Engineering and School of Humanities and Social Sciences. In terms of author-driven submissions, SergiyBubin (68) shared the most. It is followed by Zhumabay Bakenov (59) and Ludwik Adamowicz (57).

CONCLUSIONS

Smart cities are conceived to ensure that the success of the society and its citizens would depend on how research and information shape the knowledge economy with the use of technical tools and technologies. The delivery of open-access platforms by the universities particularly of the libraries pave the way for the increased access to information. We do not measure a developing nation based on how many projects they have performed but on its impact on the society at large. Using smart city as the basis to become a fully-developed nation, it is right to establish that the country of Kazakhstan is at a level where it recognizes what it wants to achieve but challenges limit their collective action. The experiences of the academic libraries particularly of the Nazarbayev University Library is a good example on how it advocates open-access. The establishment of its Institutional Repository is a testament to its commitment to make its research open, thus helping its city to grow and become smart.

Future Directions

Kazakhstan has yet to approve the Open Access Policy to apply for all universities in providing open-access to the new knowledge. Kazakhstani universities have to help together to establish their institutional repositories which will provide open access to the scholarly publications for all users in the country.

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