



**MONGOLIAN UNIVERSITY OF
SCIENCE AND TECHNOLOGY**

МОНГОЛ УЛСЫН ШИНЖЛЭХ УХААН ТЕХНОЛОГИЙН ИХ СУРГУУЛЬ

Smart university is a key indicator of the development of smart and innovative cities

Prof. Narantsetseg Yadmaa,
Graduate School of Engineering, MUST



Planning education, building **THE FUTURE**

THE INSTITUTE

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Higher education reforms: institutional restructuring in Asia

<http://www.iiep.unesco.org/en/publication/higher-education-reforms-institutional-restructuring-asia>

Higher education reforms: institutional restructuring in Asia



Author(s)

Varghese, N.V.

Languages

English

Series

New trends in higher education

Year

2009

Pages

201 p.

ISBN

978-92-803-1335-2

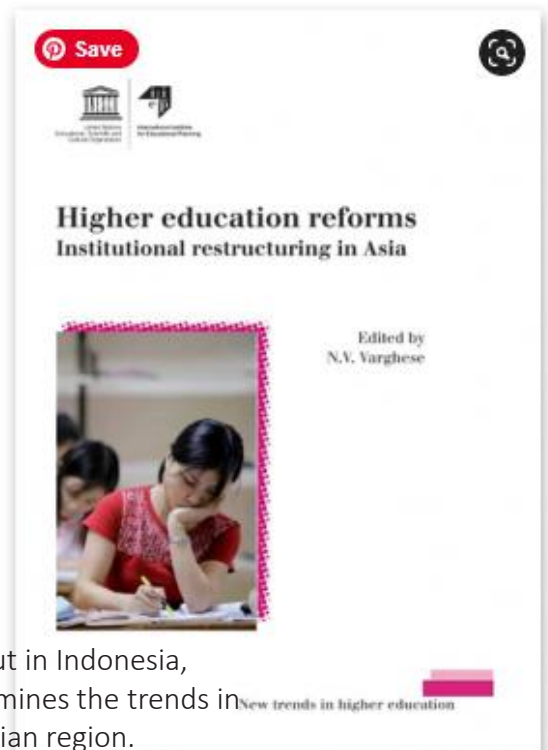
Theme

[Governance, transparency, and accountability](#)

Online version

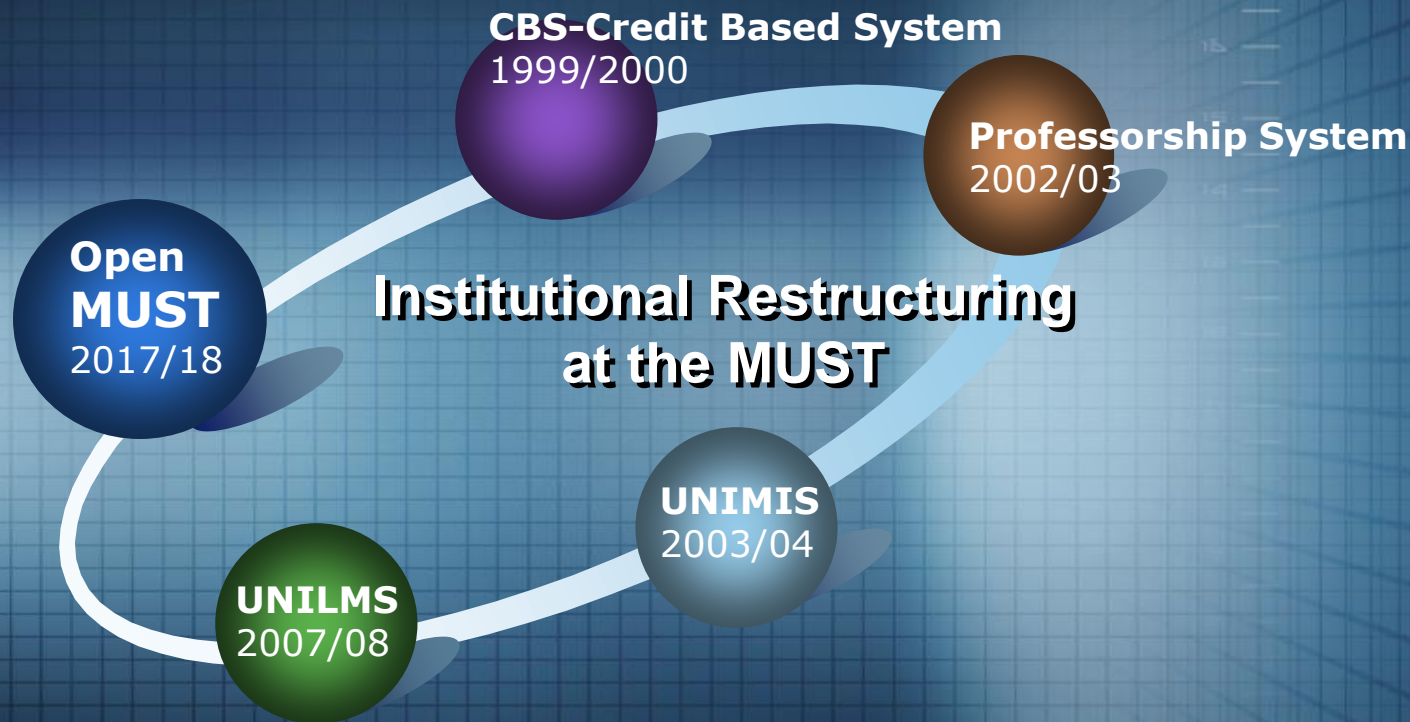
↓ ENGLISH

This book, based on the IIEP research carried out in Indonesia, Malaysia, Mongolia, Thailand and Vietnam, examines the trends in institutional restructuring in countries of the Asian region.



Higher education reforms

/accepted by experts of IIEP, UNESCO/



Three foundations of higher education reform:

ACTIVITY#1: CREDIT BASED SYSTEM

FEATURES OF ACADEMIC CREDIT SYSTEM

FLEXIBLE LEARNING PLANNING



Selection of Courses
Selection of Teachers and Own Schedule
Planning the Learning Circles
Life Long Education

CREDIT CLEARING, CREDIT TRANSFER



Tuition Fee based on Work Load
Teachers Credit Evaluation
Inter University Credit Transfer
Double and Dual Degree Programs

LEARNING PROCESS MANAGEMENT



Syllabus
Curriculum
Short and Long term education
Statistics and Reporting

QUALITY ASSESSMENT



Graduation Diploma
Certification of Skills
Feedback Management
Credit Mobility

ACCREDITATION

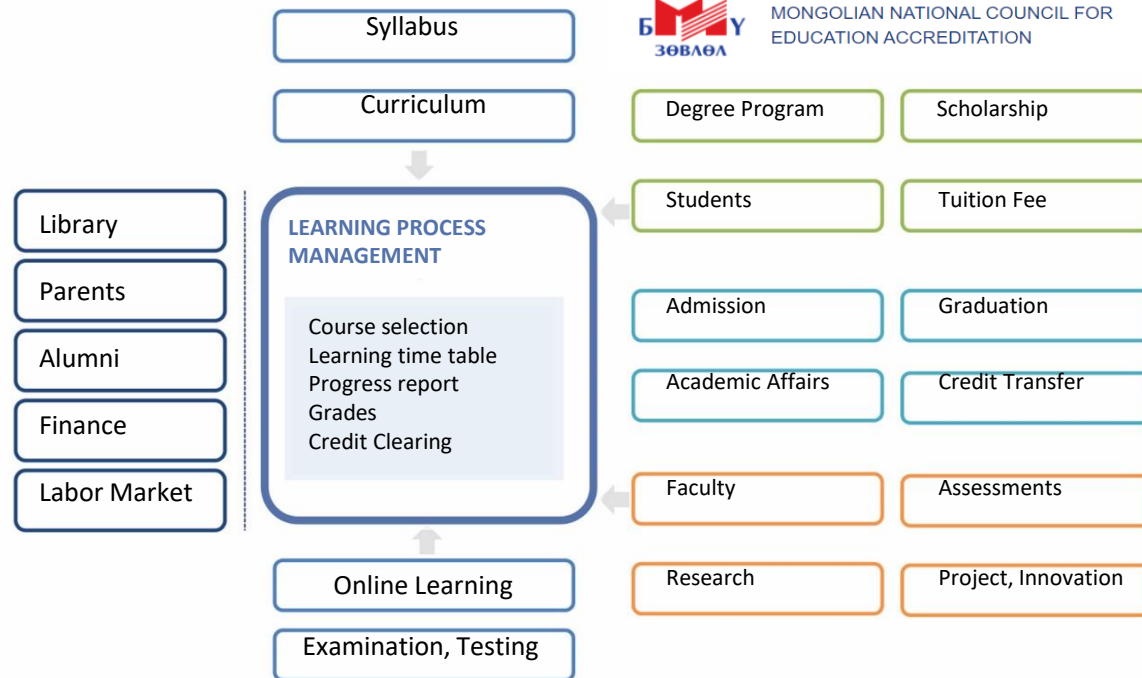


Evaluation of Program and Institution
Certification of Learning Outcome
International Accreditation
University, program ranking

CBS-Credit Based System
1999/2000



MONGOLIAN NATIONAL COUNCIL FOR
EDUCATION ACCREDITATION



International accreditation organizations:



Engineering
Technology
Accreditation
Commission



ASIA PACIFIC ACCREDITATION
AND CERTIFICATION COMMISSION

CLOUD UNIVERSITY CONSORTIUM /CUC/

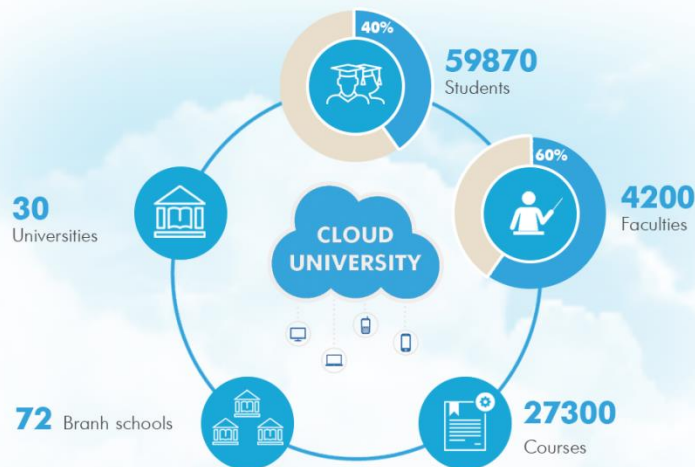
UNIVERSITY INFORMATION MANAGEMENT SYSTEM



This Background Report of the Global High-Level Policy Forum “Online, Open, and Flexible Higher Education for the Future We Want: Policy challenges” in Paris noted down:

Example of Good Practice in Accreditation: “In Mongolia, work in progressing on a Cloud University project which will integrate academic credit systems with online and distance learning, create online collaboration among all Mongolian universities, and set up social networking of university, students, professors, graduates, parents, and employers”

International Accreditation Organizations



CLOUD UNIVERSITY system is adopted to use for different universities such as technical, medical, financial and etc.

Universities that use Cloud University:



МОНГОЛ УЛСЫН ШИНЖЛЭХ УХААН
ТЕХНОЛОГИЙН ИХ СУРГУУЛЬ
ДОРНОД ИХ СУРГУУЛЬ

ҮНДЭСНИЙ БАТЛАН ХАМГААЛАХЫН
ИХ СУРГУУЛЬ

ИХ ЗАСАГ ОЛОН УЛСЫН
ИХ СУРГУУЛЬ

ХУУЛЬ САХИУЛАХЫН
ИХ СУРГУУЛЬ

ОЛОН УЛСЫН ЭДИЙН ЗАСАГ
БИЗНЭСИЙ ДЭЭД СУРГУУЛЬ



ТЕХНИК ТЕХНОЛОГИЙН
ДЭЭД СУРГУУЛЬ

МОНГОЛ УЛСЫН СОЁЛ
УРЛАГИЙН ИХ СУРГУУЛЬ

САН ДЭЭД СУРГУУЛЬ

ТЭЭВРИЙН ДЭЭД
СУРГУУЛЬ

МАНДАХ БҮРТГЭЛ
ДЭЭД СУРГУУЛЬ



Student ▾

Professor ▾

Study activity ▾

Online learning

Graphic ▾

Statistic information ▾

ХАБЭА ▾

MN

EN

Study [Home](#) / [Main section](#)

QS зэрэглэлийн үндсэн үзүүлэлтүүд

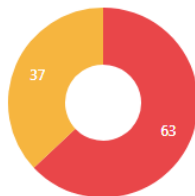
БАГШ

ОЮУТАН

ТӨЛБӨР

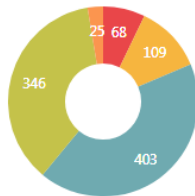
Нийт багш - 951

- 37% (350)
Доктор
- 63% (601)
Магистр

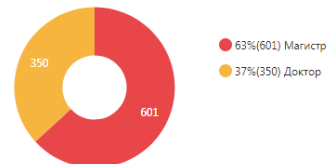


Багшийн албан тушаал

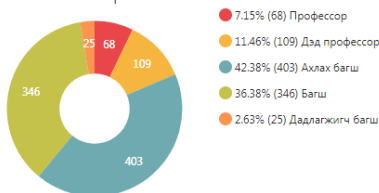
- 7.15% (68)
Профессор
- 11.46% (109)
Дэд профессор
- 42.38% (403)
Ахлах багш
- 36.38% (346)
Багш
- 2.63% (25)
Дадлагажигч багш



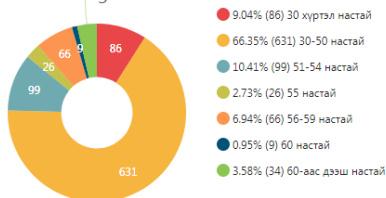
Total professors - 951



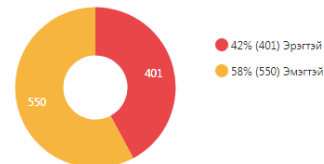
Professor's position



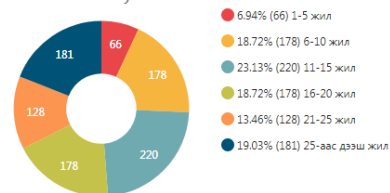
Age



Teachers sex ratio



Worked year



Quality Management System Top Universities Ranking

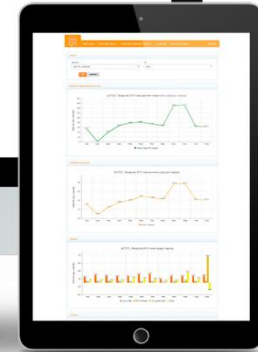
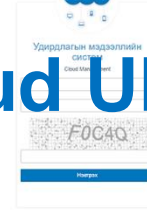
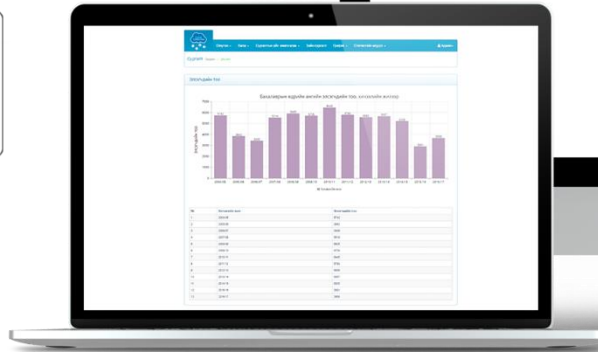
/expert evaluation/

Open
University
MUST

Cloud UNiMIS



Self evaluation
system



UNiMIS
2003



Transnational
Research Ecosystem
/2015/



U-FINANCE
/2005/



E-Library
2004/12



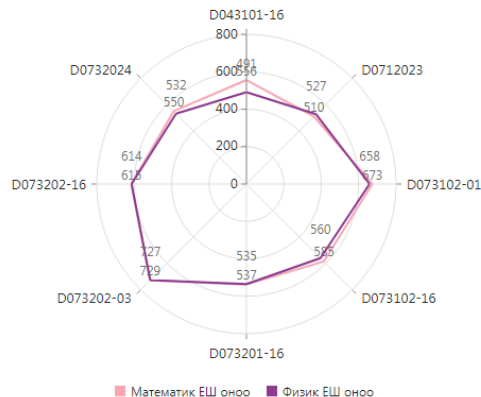
HRD /2008/

Average general entrance examination /БАС/

Элсэгчдийн ерөнхий шалгалтын дундаж

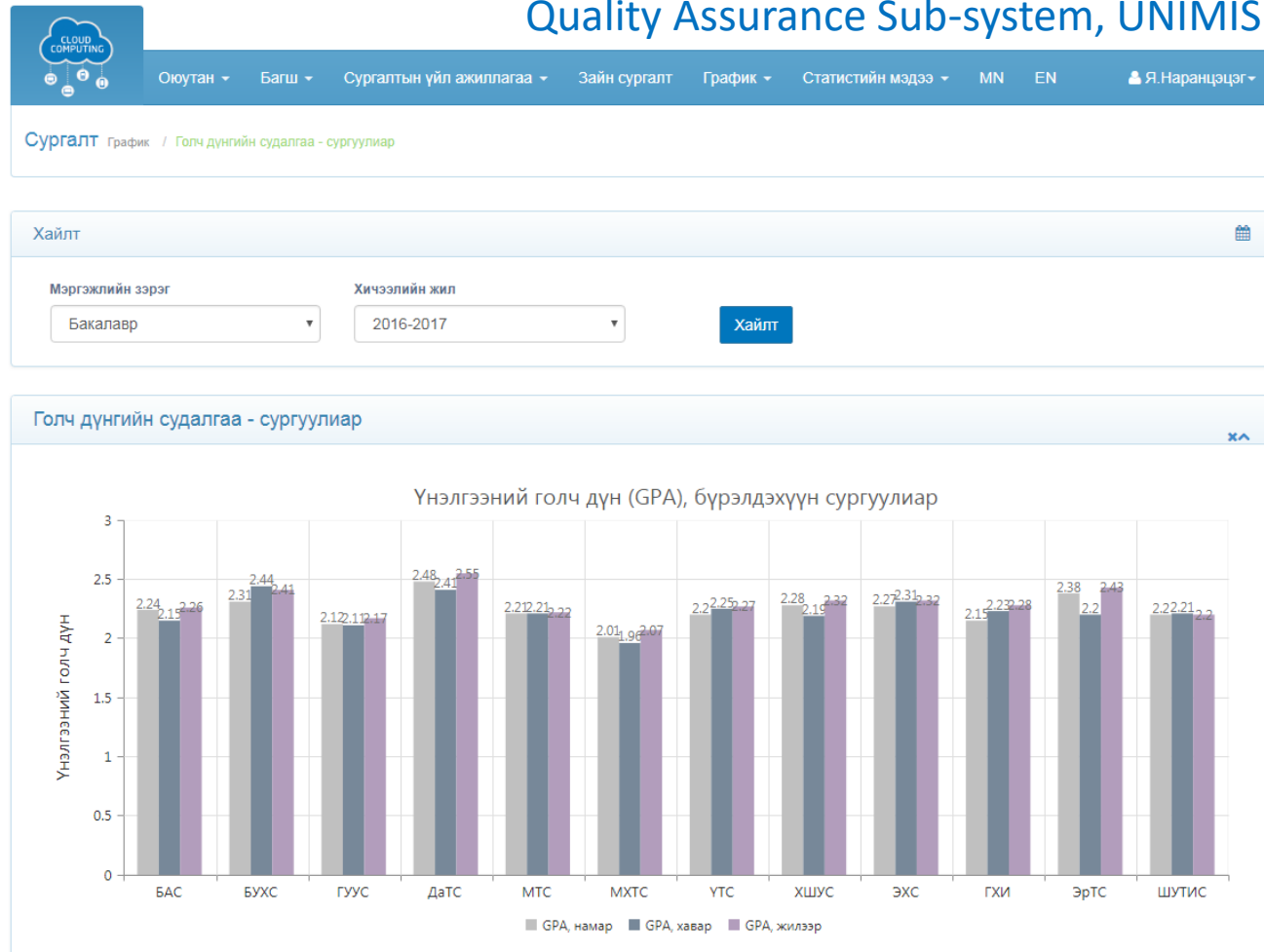


Элсэгчдийн ерөнхий шалгалтын онооны дундаж /мэргэжлээр/



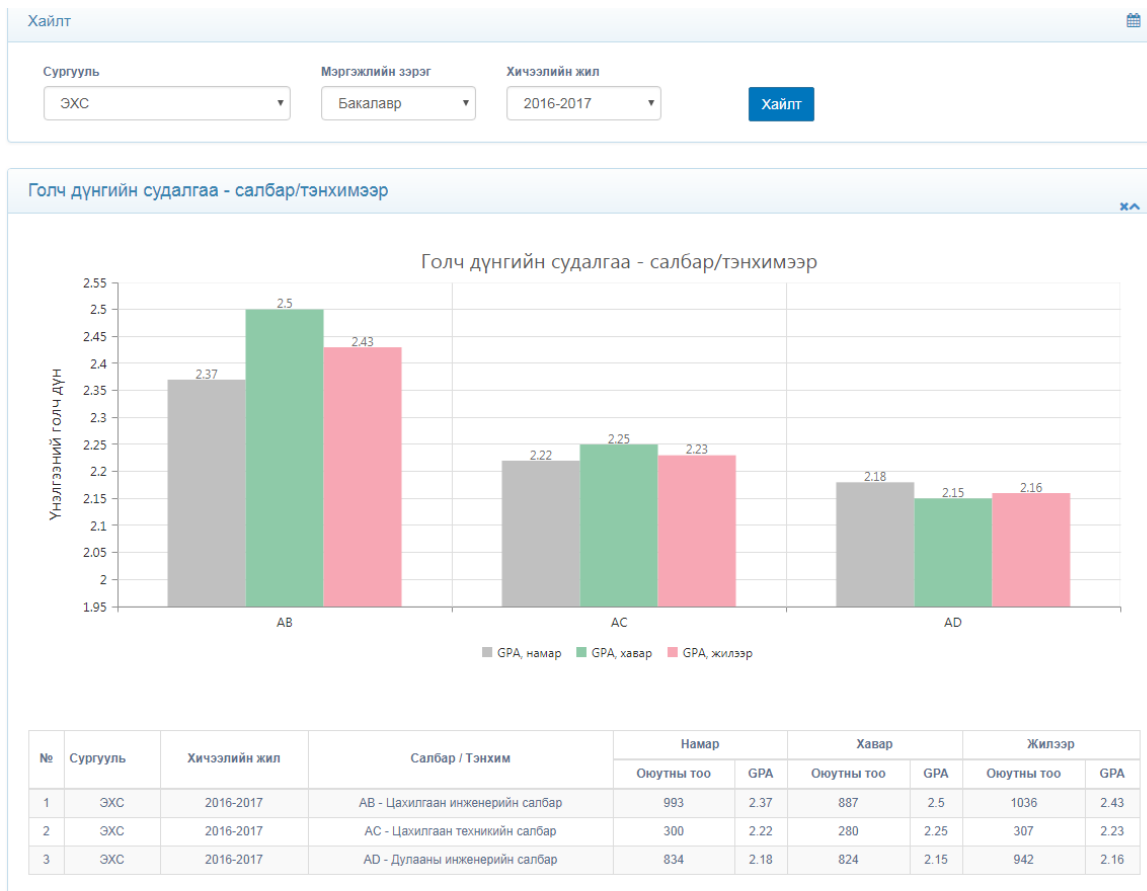
№	Мэргэжлийн индекс	Мэргэжил	Элсэгчдийн тоо	Математик		Физик		Англи хэл		Орос хэл		Хими		Хар зураг		Нийгэм	
				Дундаж	О.тоо	Дундаж	О.тоо	Дундаж	О.тоо	Дундаж	О.тоо	Дундаж	О.тоо	Дундаж	О.тоо	Дундаж	О.тоо
1	D043101-16	БАРИЛГЫН МЕНЕЖМЕНТ	23	556	23	491	12	553	23	503	2	0	0	483	13	516	19
2	D0712023	УСНЫ НӨӨЦ ЭКОЛОГИ	30	510	30	527	30	463	20	0	0	498	3	512	21	492	18
3	D073102-01	АРХИТЕКТУР /ЯПОН 2+2/	22	673	22	658	19	587	19	579	1	604	3	654	20	568	3
4	D073102-16	Архитектур	149	585	148	560	113	573	116	641	4	452	8	620	146	518	52
5	D073201-16	ХҮРЭЭЛЭН БҮЙ ОРЧНЫ ИНЖЕНЕР	87	537	87	535	85	507	60	0	0	487	6	505	54	510	50
6	D073202-03	БАРИЛГЫН ИНЖЕНЕР /ЯПОН 2+2/	35	729	35	727	35	592	32	547	1	578	11	620	28	578	13
7	D073202-16	БАРИЛГЫН ИНЖЕНЕР	241	615	237	614	235	534	161	474	4	528	18	528	168	534	102
8	D0732024	УСНЫ БАРИЛГА БАЙГУУЛАМЖ	1	550	1	532	1	226	1	0	0	0	0	0	0	0	0

GPA analysis /by school and semester, academic year/



Quality Assurance Sub-system, UNIMIS

GPA analysis
/by school and
semester, academic
year/



Lecturer Analysis No1

Хайлтын хэсэг

Хичээлийн жил:

2016-2017

Улирал:

Намар

Салбар/Тэнхим:

Виртуал технологийн тэнхим

Багш:

Д ЦОГТБАЯР /U.VT14/

Хичээл:

S.CS101 - Компьютерийн хэрэглээ I

Дүнгийн дэлгэрэнгүй судалгаа

Хайх

S.CS101 хичээлийн үсгэн үнэлгээний эзлэх хувь, стандарт /2016-2017 - I/



S.CS101 хичээлийн үсгэн үнэлгээний эзлэх хувь, стандарт /2016-2017 - I/

№	Хичээлийн код	Багшийн код	Хичээлийн жил	Улирал	Үнэлгээ	Үнэлгээний эзлэх хувь	Оноутны тоо
1	S.CS101	U.VT14	2016-2017	1	A	0 %	0
2	S.CS101	U.VT14	2016-2017	1	B	16.46 %	13
3	S.CS101	U.VT14	2016-2017	1	C	44.3 %	35
4	S.CS101	U.VT14	2016-2017	1	D	25.32 %	20
5	S.CS101	U.VT14	2016-2017	1	E	%	13
6	S.CS101	U.VT14	2016-2017	1	F	12.66 %	10
7	S.CS101	U.VT14	2016-2017	1	W	%	19
НИЙТ:						98.74 %	110

Жич: Дүнгийн шинжилгээ хийхэд E, W үнэлгээ ороогүй болохыг анхаарна уу.

Lecturer Analysis No2

ШИНЖЛЭХ УХААН ТЕХНОЛОГИЙН
ИХ СУРГУУЛЬ

Сайн байна уу, Р.ТӨРБАТ

Нүүр

Багш

Хичээл

Нэгтгэл

Багш нарын гүйцэтгэсэн кредит

Нехаж хичээл заасан багшийн бүртгэл

Дүнгийн шинжилгээ 1

Дүнгийн шинжилгээ 2

Дүнгийн шинжилгээ 1 / Хичээллээр/

Дүнгийн шинжилгээ 2 / Хичээллээр/

Чухал холбоосууд

Хичээлийн жил

VIII долоон хоног

2017-2018

Хавар

March 2018

Su	Mo	Tu	We	Th	Fr	Sa
					1	2
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24

Хайлтын хэсэг

Хичээлийн жил:

2016-2017

Улирал:

Намар

Салбар/Тэнхим:

Виртуал технологийн тэнхим

Багш:

Д.ЦОГТБАЯР /U.VT14/

S.CS101 хичээлийн дүнгийн шинжилгээ /2016-2017, 1/

Scatter plot /хамаарлыг илэрхийлсэн график/

Багшийн дүнгийн шинжилгээ

Оюутны тоо	76
r - Корреляцийн коэффициент	0.14

Улирлын шалгалтын 30 оноо

■ Багшийн 70 оноо ■ 70,30 онооны шулуун

Хайлтын хэсэг

Хичээлийн жил:

Улирал:

Салбар/Тэнхим:

Хичээл:

2016-2017

Намар

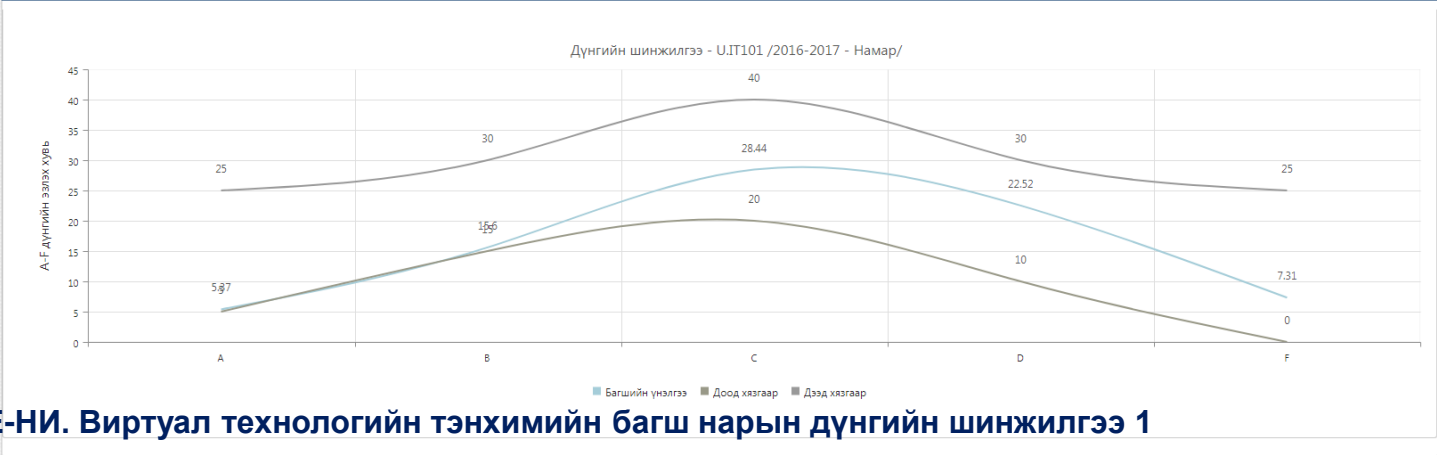
Виртуал технологийн тэнхим

У.ИТ101 - Мэдээллийн технологийн хэс

Дүнгийн дэлгэрэнгүй судалгаа

Хайх

У.ИТ101 хичээлийн үсгэн үнэлгээний зэлэх хувь, стандарт /2016-2017 - 1/



Е-НИ. Виртуал технологийн тэнхимийн багш нарын дүнгийн шинжилгээ 1

У.ИТ101 хичээлийн үсгэн үнэлгээний зэлэх хувь, стандарт /2016-2017 - 1/

№	Хичээлийн код	Хичээлийн жил	Улирал	Үнэлгээ	Үнэлгээний зэлэх хувь	Оюутны тоо
1	У.ИТ101	2016-2017	1	А	5.37 %	49
2	У.ИТ101	2016-2017	1	В	15.6 %	163
3	У.ИТ101	2016-2017	1	С	28.44 %	309
4	У.ИТ101	2016-2017	1	Д	22.52 %	244
5	У.ИТ101	2016-2017	1	Е	%	151
6	У.ИТ101	2016-2017	1	F	7.31 %	86
7	У.ИТ101	2016-2017	1	W	%	206
НИЙТ:						1208

Жич: Дүнгийн шинжилгээ хийхэд E, W үнэлгээ ороогүй болохыг анхаарна уу.

Е-НИ. Виртуал технологийн тэнхимийн багш нарын дүнгийн шинжилгээ 2

ШИНЖЛЭХ УХААН ТЕХНОЛОГИЙН
ИХ СУРГУУЛЬ

Сайн байна уу, РТӨРСАТ

Нүүр

Багш

Хичээл

Нэгтгэл

Багш нарын гүйцэтгэсэн кредит

Нехөж хичээл заасан багшийн бүртгэл

Дүнгийн шинжилгээ 1

Дүнгийн шинжилгээ 2

Дүнгийн шинжилгээ 1 / Хичээлээр/

Дүнгийн шинжилгээ 2 / Хичээлээр/

Чухал холбоосууд

Хичээлийн жил
VIII
 долоон хоног

2017-2018
 Хавар

March 2018

Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17

Хайлтын хэсэг

Хичээлийн жил:

2016-2017

Улирал:

Намар

Салбар/Тэнхим:

Виртуал технологийн тэнхим

Хичээл:

U.IT101 - Мэдээллийн технологийн хэр

U.IT101 хичээлийн дүнгийн шинжилгээ /2016-2017, 1/

Scatter plot /хамаарлыг илэрхийлсэн график/

Багшийн 70 оноо

70,30 онооны шулуун

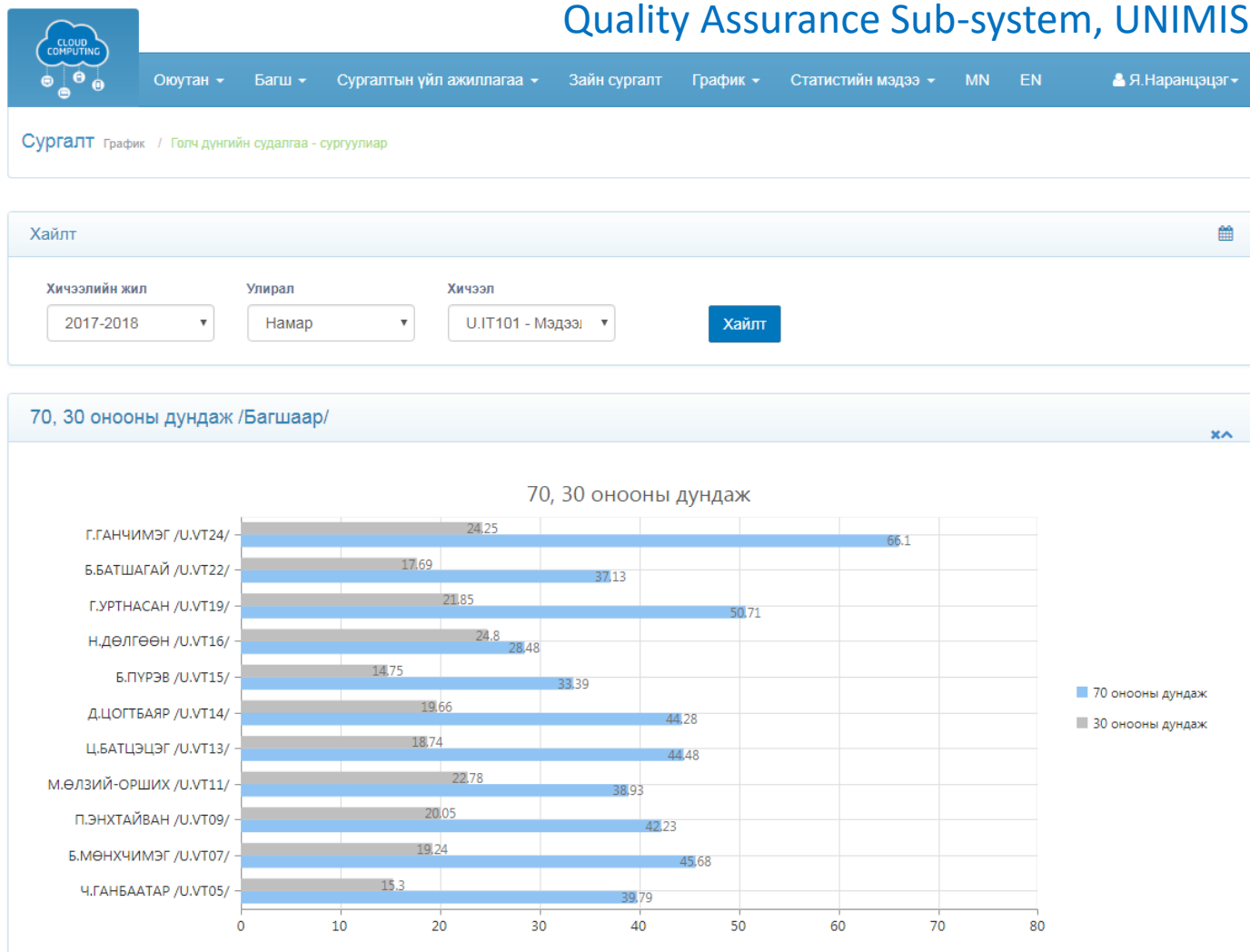
Багшийн дүнгийн шинжилгээ

Оюутны тоо	868
r - Корреляцийн коэффициент	0.06

Корреляцийн коэфф.

-0.10 ≤ r ≤ -0.19
-0.20 ≤ r ≤ -0.40
-0.41 ≤ r ≤ -0.60
-0.61 ≤ r ≤ -0.80
-0.81 ≤ r ≤ -1.00
r = -1
0
0.10 ≤ r ≤ 0.19
0.20 ≤ r ≤ 0.40
0.41 ≤ r ≤ 0.60
0.61 ≤ r ≤ 0.80
0.81 ≤ r ≤ 1.00


Average of 70:30 points
Subject code:
U.IT101



Student Satisfaction Surveys

ШИНЖЛЭХ УХААН ТЕХНОЛОГИЙН
ИХ СУРГУУЛЬ

Сайн байна уу, Б.МӨНХТУЛГА



B141050539

Нууц үг солих

Гарах

Нүүр

Оюутан

Хувийн мэдээлэл

Сургалтын төлөвлөгөө

Санал болгох төлөвлөгөө

Төлбөрийн мэдээлэл

Сорил, явцын оноо

Дүнгийн мэдээлэл

Номын сан

Тэтгэлэг шинэ

Санал асуулга

Санал асуулга 2

Хичээл

Чухал холбоос

VIII

долоо хоног

Хичээлийн жил

2017-2018

Хавар

March 2018

Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17

Оюутны сэтгэл ханамжийг тодорхойлох асуумж

Энэхүү санал асуулгын зорилго нь сургуулийн сургалтын үйл ажиллагааг сай Та өөрийн саналтай тохирох тоог дугуйлна уу. Тухайлбал:

- 5 - Бүрэн санал нийлж байна
- 4 - Санал нийлж байна
- 3 - Хэлж мэдэхгүй байна
- 2 - Санал нийлэхгүй байна
- 1 - Огт санал нийлэхгүй байна

Санал асуулга

Санал асуулгын зорилго: Сургалтын үйл явц, түүний үр дүн, уг хичээлийг зааж буй багшийн заав арга барил, гүйцэтгэл.

- 5 - Бүрэн санал нийлж байна
- 4 - Санал нийлж байна
- 3 - Хэлж мэдэхгүй байна
- 2 - Санал нийлэхгүй байна
- 1 - Огт санал нийлэхгүй байна

M.AU333

Компьютерийн график, төсөл зохионж

M.AU370

Бакалаврын дипломны төсөл

M.TD316

Үйлдвэрийн цахилгаан хангамж

№	Асуулт
1	ШУТИС-д элсэх үед сургуулийн талаар өгсөн мэдээлэл, чиг баримж
2	Зөвлөх багш бүрэн дүүрэн зөвлөж чаддаг
3	Сургалтын албаны ажилтнуудаас мэдээ мэдээлэл авахад хялбар б
4	Хичээлийн анги, танхим тохилог дулаан, агааржуулалт, цэвэрлэгээ,
5	Хичээл унших нам гүм, тав тухтай орчин хангалттай байдаг
6	Хичээлийн танхимд сургалтын техник хэрэгсэл ашиглах боломжтой
7	Лабораторийн хичээлд ашиглагдах багаж, тоног төхөөрөмж хангалт
8	Сургуулийн ариун цэврийн өрөө цэвэрхэн байдаг
9	Анги танхимын суудлын тоо хүрэлцээтэй байдаг
10	Номын сангийн үйлчилгээ сайн байдаг
11	Номын сангийн хувьд ном товхимол, гарын авлага, мэдээллийн хэр
12	Номын сангийн ширээ, сандал хангалттай байдаг
13	Интернетийн орчин шаардлага хангадаг
14	Оюутны зөвлөл, холбоодын үйл ажиллагаа сайн байдаг
15	Манай сургуулийн сургалтын чанар сайн

Санал илгээх

KNOU is the Only National Open University in Korea

**1**

The First
Open University in Korea

**47**

Number of Regional Campuses
and Learning Centers

**1972**

Year of Establishment

**1,191**

Number of
Educational Courses

**19,563**

Number of Graduates
who hold Multiple Degrees

**105,668**

Number of
Enrollment

Why KNOU?

Optimal Flexibility for Work and Study

U-KNOU Campus, a mobile-optimized learning platform of KNOU, allows students to learn anytime and anywhere, giving them increased opportunities to work and study simultaneously. Ninety percent of KNOU students work while attending KNOU.

High-quality Education

Based on 50 years of distance education experience and KNOU's own broadcasting infrastructure, the university is providing high-quality educational lectures.

Reasonable Cost

KNOU's tuition is approximately one-tenth of other conventional universities's average tuition which minimizes the burden for students.

Leading a Lifelong Learning Society

KNOU serves as a platform for lifelong learning where students at all ages, from teenagers to those in their 90s, can learn anytime and anywhere.

https://ustat.knou.ac.kr/spotfire/wp/render/MKgRo1wJy_uLKW0-0T/analysis?file=/datahub/MUST_1020&waid=jzXewx-tqE2NYj5_29gOv-08023468e9oCNI&wavid=0knou.ac.kr/spotfire/wp/startPage

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ACTIVITY#2

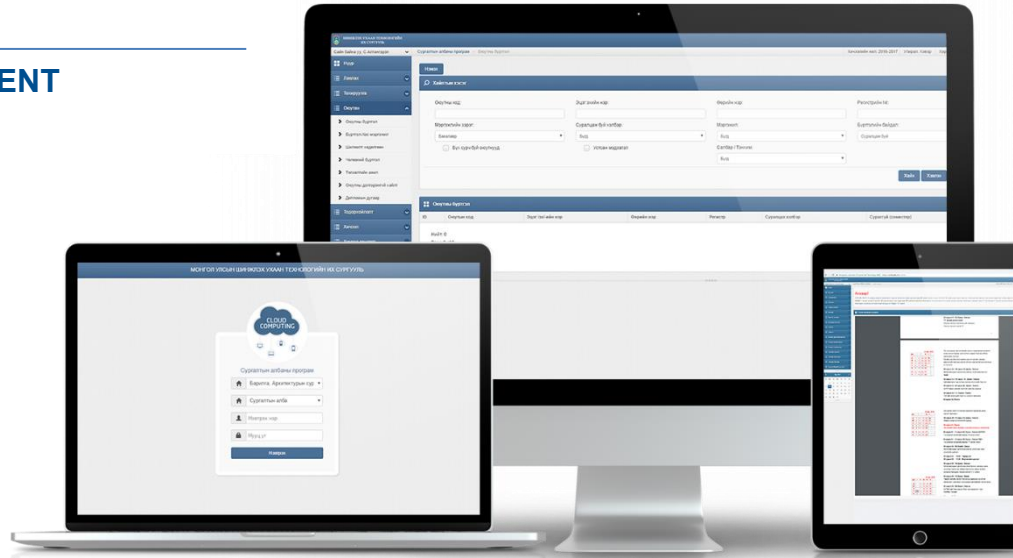
UNIVERSITY'S MANAGEMENT INFORMATION SYSTEM



Professor's Web



Student's



Banks



UNILMS



Transnational Research Ecosystem



Self evaluation system



E-Test System



Human Recourses System



Education evaluation center



General authority for state registration



QMSSystem



U-OFFICE



Alumni Web

ACTIVITY#3

INTEGRATED PLATFORM FOR ONLINE EDUCATION

UNIVERSITY ENTRANCE EXAM SIMULATION AND EVALUATION SYSTEM



Number of courses **6**

Number of test questions **7871**

ONLINE LEARNING MANAGEMENT SYSTEM



Number of courses **232**

Number of e-content **852**

MOOC MONGOLIAN ONLINE OPEN COURSES



Number of courses for higher education **277**

Number of courses for life-long learning **92**

Number of courses for general education **3**



E-LEARNING MANAGEMENT SYSTEM

INTER UNIVERSITIES E-LEARNING MANAGEMENT SYSTEM

For 2007 we started e-learning in Mongolian University of Science and Technology. Based on this system we are ready to serve e-learning in other Mongolian universities. It will be benefit to share best e-contents of best teachers.

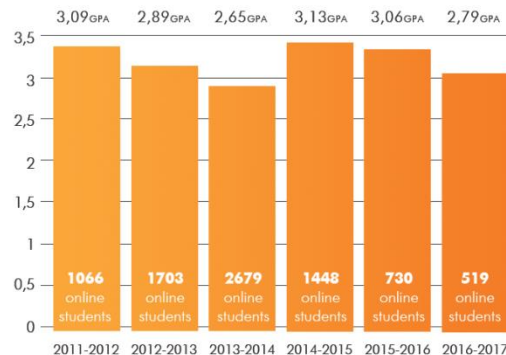


500+ E-Content

29 degree programs

13145 Online students

994 Teachers using online learning system



We established cooperation with foreign online and open universities. And become member of International Online Education Organizations.



Partner Universities:



Workplace E-Learning Management System



NATIONAL AUDIT OFFICE

ТӨРИЙН АУДИТЫН СУРГАЛТ, ХӨГЖЛИЙН СИСТЕМ



Удирдлагын мэдээллийн дэд
систем



Сургалтын удирдлагын дэд систем



Мэдлэгийн үнэлгээний E-Тестийн
систем



Чанарын баталгаажуулалтын дэд
систем



E-Хичээл боловсруулалтын дэд
систем

Нэвтрэх

<http://surgalt.audit.mn/pages/login>

TRANSNATIONAL RESEARCH ECOSYSTEM

Our idea behind the open research ecosystem is - Build better relationships in research, life in business.

In our open research ecosystem, we are trying to build research teams from different professionals, with different experiences and from different universities and countries.



SHARING

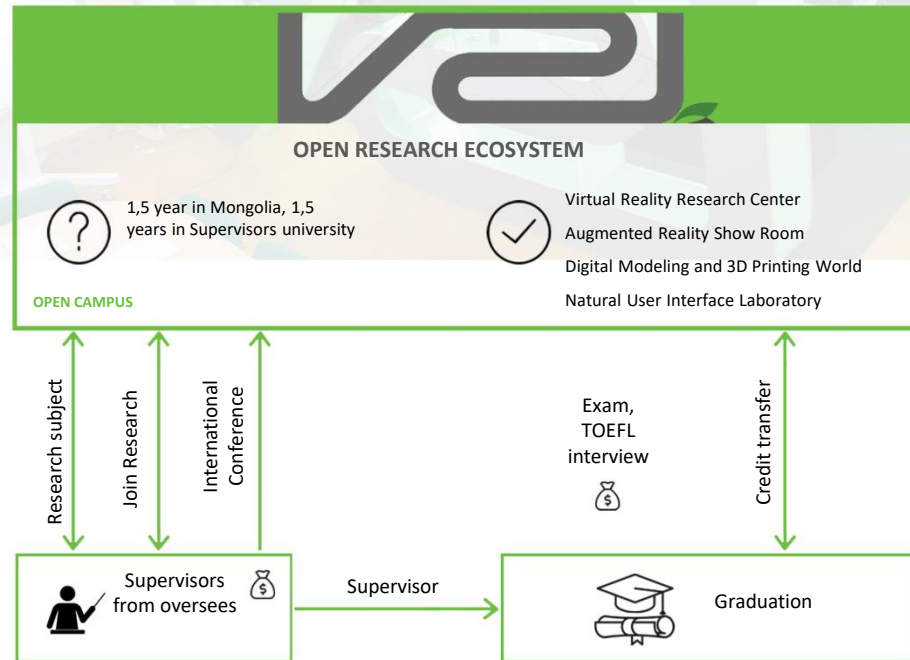
Best Equipment
Innovation Ideas and HR
Funding and Financing

COLLABORATION

Entrepreneur and Researchers
Researchers
Students and Entrepreneur etc.

SKILL DEVELOPMENT

Start-Up companies
International Projects
Outsourcing



Transnational Programs:



岩手大学
IWATE UNIVERSITY



St. Poelten University of
Applied Science



2002/03: **Professorship System**

INTERNATIONAL RESEARCH JOINT PROJECT



FINLAND

Tampere University of Applied Science /TAMK/
Joint On-Line course: Sustainable Development and Mining

EUROPEAN UNION

ERASMUS+Project:
"Paving the way to interregional mobility and ensuring relevance, quality and equity of access"
PAWER

EUROPEAN UNION

ERASMUS+ Higher education capacity building
SMARTCITY: Innovative Approach Towards a Master Program on Smart Cities Technologies

EUROPEAN UNION

ERASMUS+Program
Multi-National Project GREB:
Modernization of the Curricula in sphere of smart building engineering Green Building

MONGOLIA

E-Open Institute, MUST

- o Cloud Universities Management Information System /Cloud UNIMIS/
- o Learning Management System /UNILMS/
- o "e-Content developing of Mongolian Open On-Line Courses /MOOC/

KOREA

Korean National Open University:
Joint Project KNOU & MUST: "The On-line courses developing for Life Long Learning /LLL/

UNESCO-UNITWIN

JAPAN

Iwate University:
M-JEED 1000 Engineers

Alexander Technological Educational Institute (ATEITH) of Thessaloniki

[Al-Farabi Kazakh National University](#)



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Outline

Highlights

Abstract

Keywords

1. Introduction

2. Methods and materials

3. Results and findings

4. Discussion

5. Conclusion

Author statement

Declarations of Competing Interest

Acknowledgements

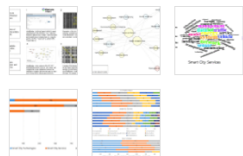
Appendix : Review of selected articles in each research topic

References

Vitae

Show full outline

Figures (5)



Technological Forecasting and Social Change

Volume 170, September 2021, 120893



Understanding the linkages of smart-city technologies and applications: Key lessons from a text mining approach and a call for future research

Chiehyeon Lim ^a, Gi-Hyung Cho ^b, Jeongseob Kim ^{b,*,} & ^c

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Highlights

- A machine learning technique is applied to the data-driven review of smart cities.
- Twenty-three research topics for smart city technologies, services, and policies are inter-related.
- The evolution of smart city research and its geographical variances are

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Understanding the linkages of smart-city technologies and applications: Key lessons from a text mining approach and a call for future research

Chiehyeon Lim^a, Gi-Hyoug Cho^b, Jeongseob Kim^{b,*}^a Department of Industrial Engineering & Graduate School of Artificial Intelligence, Ulsan National Institute of Science and Technology, Ulsan, South Korea^b Department of Urban and Environmental Engineering, Ulsan National Institute of Science and Technology, 50 UNIST-gil, Ulsu-gun, Ulsan, 44919, South Korea

ARTICLE INFO

Keywords:

Smart city
Smart technologies
Smart services
Smart policies
Urban planning
Text mining

ABSTRACT

There have been many attempts to transform cities into smart cities worldwide. However, it is difficult to understand and describe smart cities from different perspectives, given the widespread application of the concept of smart city in diverse disciplines, such as urban planning, electronic engineering, and computer sciences. This work conducted a comprehensive smart city literature review based on text mining of 3,315 papers on smart cities published in journals indexed in the Science Citation Index Expanded and Social Sciences Citation Index databases. These include “all papers” classified as research articles published from 1999 to April 2020. Our findings show the state of the art of research on smart cities, including (i) smart city literature statistics from 1999 to 2019, (ii) 23 research topics related to smart cities, and (iii) geographical variations in smart-city research. Based on these findings, we offer theoretical and practical implications of (1) missing fields of studies, (2) future research directions, and (3) the applicability of text-mining techniques to literature reviews. We believe that this work, which aims to establish a common ground for understanding smart cities from multiple disciplinary perspectives, will encourage further research and development regarding smart cities.



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Understanding the linkages of smart-city technologies and applications: Key lessons from a text mining approach and a call for future research

4. Discussion

This section includes a discussion of the theoretical, practical, and methodological implications of our findings. Based on the review of the growing body of smart city literature, we present several missing perspectives and suggestions for future studies.

4.1. Strengthening multidisciplinary aspects through urban

Smart city research, which comprises three areas—technologies, services, and policies—has strong characteristics. Urban planners who make and implement plan are required to have basic knowledge of the smart and service systems to communicate effectively with engineers and scientists. Scientists and engineers working for smart cities

understand the potential negative consequences of their technologies and services on societies to realize a people-centered smart city. Effective collaboration between policy makers, urban planners, engineers, and businesspeople could be a prerequisite for successful smart city creation. However, it is not easy for experts from different disciplines to collaborate because language usage, thinking and communication methods, and problem-solving approaches are different in each area of expertise.

The networks of research topics identified in this study in Fig. 2 provide clues for successful cooperation in the multidisciplinary smart city discipline. As noted earlier, each research topic is linked to the three most relevant topics in terms of keywords of research. *Models and applications* and *System architecture* have the highest degree of centrality and are linked to almost all research topics. In spite of their centrality in the research network, these two topical areas are strongly oriented toward engineering studies; consequently, it is somewhat difficult to

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create a link between smart city technologies and policies through these topics. Thus, considering the current research networks, it is necessary to build a new field to connect various research topics of smart cities, and “urban analytics” could be one of the fields of study with the highest potential. As shown in Fig. 2, *Big-data analytics* and *Machine learning* had no connection with four sub-topics of Smart City Policies; however, *Urban analytics* could effectively link the policies, technologies, and service systems. In the *Urban analytics* field, data scientists who focus on managing and analyzing big data generated from smart city sensors and services systems could play an important role in supporting effective communication among experts in various fields. Recently, many universities have introduced new graduate education programs for urban analytics (i.e., Urban Analytics at the University of Hong Kong and University of Glasgow, Smart Cities and Urban Analytics at the University College London, Applied Urban Analytics at the University of Manchester, and Applied Urban Science and Informatics at the New York University). Students trained in these educational programs will be able to become key professionals in the field of smart city. As one of the emerging disciplines related to smart cities, continuous research and development on theories and practices in urban analytics should be conducted. More specifically, a curriculum and ethical standards with regard to urban analytics should be established and evaluated, and an artificial intelligence algorithm effectively applicable to urban big data analysis, such as high-resolution spatiotemporal analysis, should be developed.

Strengthening multidisciplinary aspects through urban analytics

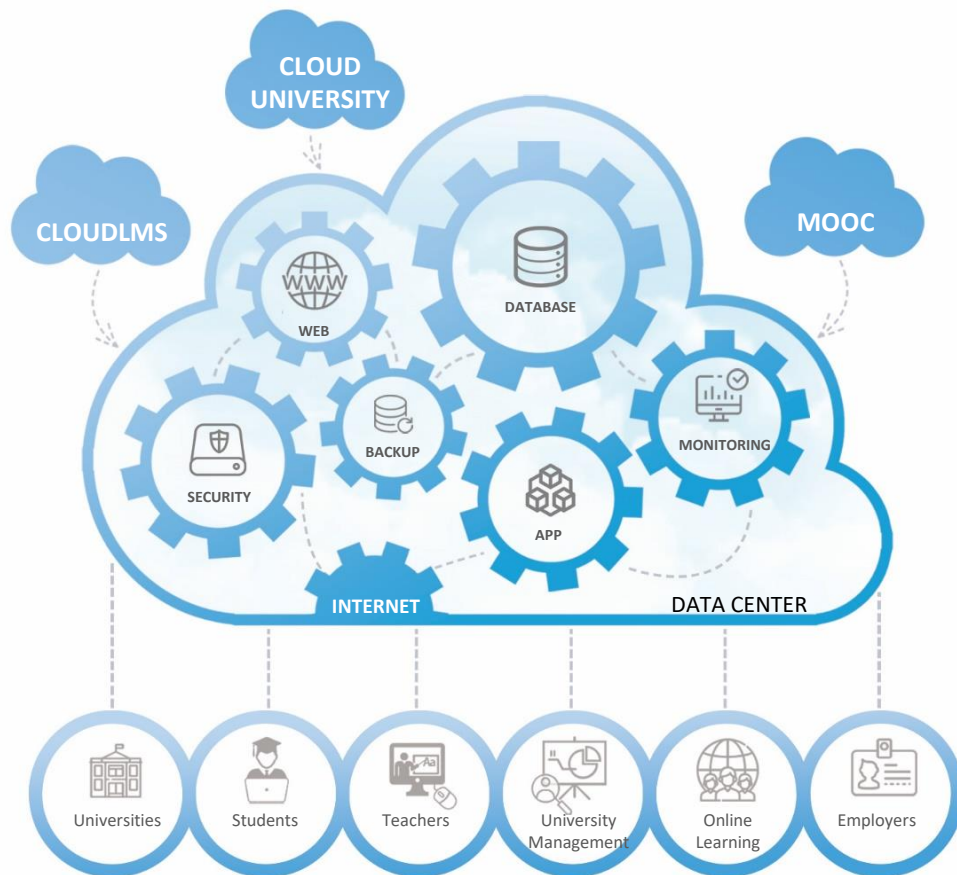
Smart city research, which comprises three research categories-technologies, services, and policies-has strong interdisciplinary characteristics. Urban planners who make and implement a smart city plan are required to have basic knowledge of the smart city technology and service systems to communicate effectively with engineers and data scientists. Scientists and engineers working for smart cities also need to understand the potential negative consequences of their technologies and services on societies to realize a people-centered smart city. Effective collaboration between policymakers, urban planners, engineers, and business people could be a prerequisite for successful smart city creation. However, it is not easy for experts from different disciplines to collaborate because language usage, thinking and communication methods, and problem-solving approaches are different in each area of expertise.

Recently, many universities have introduced new graduate education programs for urban analytics. Students trained in these educational programs will be able to become key professionals in the field of smart cities. As one of the emerging disciplines related to smart cities, continuous research and development on theories and practices in urban analytics should be conducted. More specifically, a curriculum and ethical standards with regard to urban analytics should be established and evaluated, and an artificial intelligence algorithm effectively applicable to urban big data analysis, such as high-resolution spatiotemporal analysis, should be developed.

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HIGHER EDUCATION INFORMATION INFRASTRUCTURE

All Mongolian Universities share same information infrastructure to exchange university related information, online learning platform, e-contents.

Benefits to share infrastructure: (in case **50** universities)



Total cost of ownership of network data center and security less **50** times

System development time **20** years faster

More e-contents

10 times more System improvement requirements

"ТОГТВОРТОЙ ХӨГЖИЛ - ДЭЭД БОЛОВСРОЛ"
УЛСЫН ХОЁРДУГААР ЗӨВЛӨГӨӨН

GOVERNMENT POLICY ON ICT IN HIGHER EDUCATION

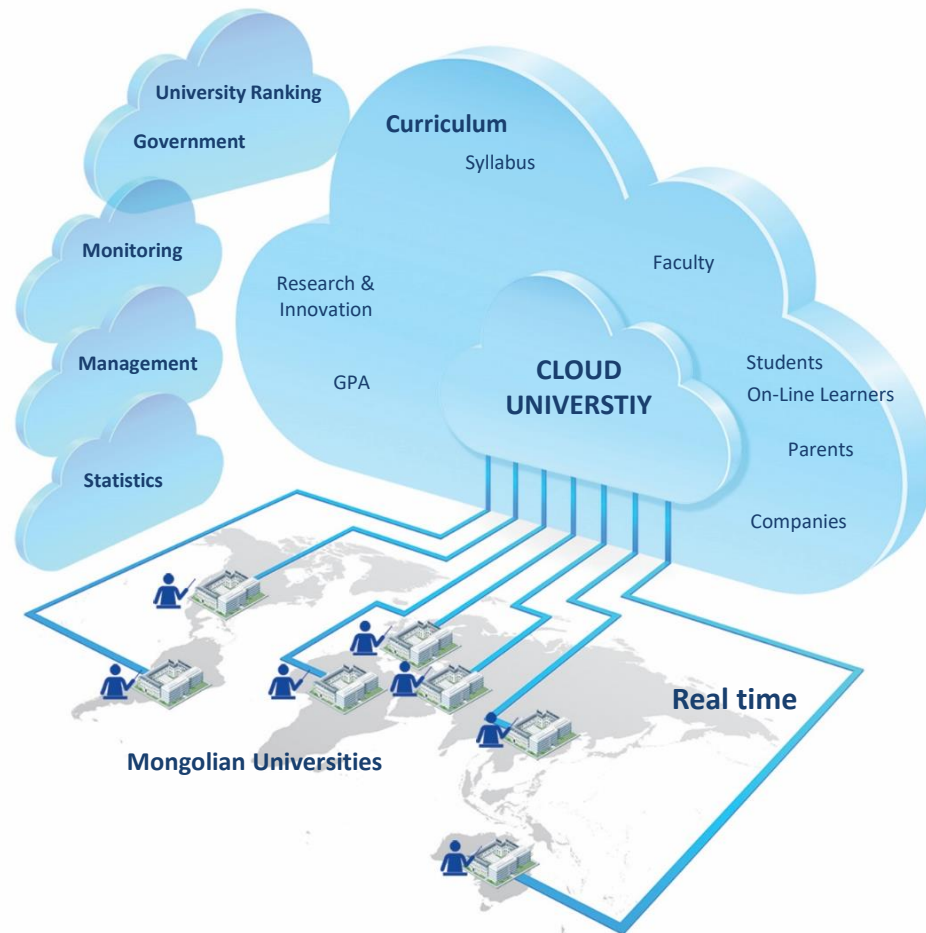
Rapid economic expansion has led to increased demand for higher education (HE) in Mongolia. The Government of Mongolia has emphasized the value of economic competitiveness. Education leaders and decision makers at all levels still complain that much of the data and information that they need is not available; not available when needed.

SOME MINISTERIAL ORDERS:

2007 **MINISTERIAL ORDER №183**
“... To establish inter-universities E-Open School...”

2014 **MINISTERIAL ORDER № A/299**
“... All higher educational institutions have to use academic credit system...”
“... No less 20% of all courses must be transferred to online courses...”

2014 **MINISTERIAL ORDER № A/359**
“...To establish higher education information system based on Cloud UNIMIS system...”





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GO TO INNOVATION