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Forty Years of Distance Education: Challenges and implications at the Open University of Sri Lanka

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Abstract

Commencing its activities in 1980, the Open University of Sri Lanka (OUSL) has expanded over the years embracing emerging technologies periodically, undergoing a series of technological adoptions gradually through Generations of Distance Education (GDE). The aim of this study is to assess the current status of OUSL, based on Taylor's conceptual framework of GDE, identify the challenges faced during these technological transformations, and how those challenges were mitigated during its forty years of existence as a single-mode national open and distance learning university in Sri Lanka. This study employs a qualitative research design based on reflective practices of the researchers, narrative accounts of past decision makers, reflections of academics and administrators, and cross-referenced with documentary evidences. The findings show how the OUSL has advanced towards the fifth GDE, amidst challenges and finally propose mitigation strategies that would be useful for future technological interventions.

Keywords: Open and Distance Learning, Generations of Distance Education, Open University of Sri Lanka, Online Learning, Reflective practices

Introduction

The Open University of Sri Lanka (OUSL), with forty years of experience as the premier Open and Distance Learning (ODL) University in the country, is unique in Sri Lanka since it offers study programmes only through ODL.

Beginning in 1980 as a national single mode university, it took over the functions of the two already established Distance Education (DE) institutions; External Services Agency (ESA) and the Sri Lanka Institute of Distance Education (SLIDE) – (Kotelawele & Samarasundara, 1987; Raheem, 2010).

The ESA established in 1972 under the purview of the University of Sri Lanka was then the only Sri Lankan University which registered candidates for external examinations conducted by the University.

Regular DE was introduced to Sri Lanka through the establishment of SLIDE by the Ministry of Education in 1976. Its objective was to provide tertiary education in the fields of mathematics, science, management and technical studies for those denied higher education in six conventional universities at that juncture. The teaching methodology was printed material with periodical face-to-face sessions to discuss the study material, laboratory work at selected centres and continuous assessment through assignments.

In taking over the functions of these two institutions the OUSL, took responsibility of delivering the existing study programmes offered by the SLIDE and the ESA through the two Boards of Studies; Board of Study for Management, Science and Technology (MST) and the Board of Study for Humanities and Social Sciences (HSS). Gradually, the OUSL commenced delivering its own study programmes while phasing out the existing study programmes.

The OUSL has expanded over the years embracing emerging technologies periodically, and has undergone a series of technological adoptions gradually through Generations of Distance Education

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(GDE). The following four Research Questions (RQ) will be investigated based on Taylor's conceptual framework of GDE (2001):

- RQ1: How has the OUSL progressed with respect to GDE for the past four decades?
- RQ2: What are the challenges faced during the technological transformations of GDE?
- RQ3: What are the mitigation strategies used to overcome these challenges? and
- RQ4: What are the proposed mitigation strategies for future technological interventions?

Conceptual framework

Many researchers have classified DE into generations based on aspects such as the technology used at a particular time period (Caladine, 2008), and pedagogy (Anderson & Dron, 2011). Nipper (1989) was the first who suggested a framework based on historical development of technologies where he identified three GDEs; Correspondence model based on print technology, Multimedia model based on print, audio and video technologies and Computer mediated communication model based on two-way communication via computers. Subsequently, many writers have constructed generations somewhat differently building on Nipper's work. For instance, Moore and Kearsley (1996) describe the third generation based on a systems approach, while telelearning (audio/video conferencing) approach was used by Taylor (2001). Nevertheless, Taylor suggested a fourth generation based on flexible online teaching (Taylor, 1995), and a fifth generation in 2001 based on the Internet based "intelligent" digital technologies (intelligent flexible learning model). His fifth generation is the expanded version of the fourth. The characteristics of this conceptual framework are given in Table 1.

Table 1: Models of Distance Education - A Conceptual Framework (Taylor 2001, p. 3)

	Characteristics of Delivery Technologies					
Models of Distance Education and Associated Delivery Technologies	**Flexibility**			**Highly Refined Materials**	**Advanced Interactive Delivery**	**Institutional Variable Costs Approaching Zero**
	Time	**Place**	**Pace**			
FIRST GENERATION The Correspondence Model						
• Print	Yes	Yes	Yes	Yes	No	No
SECOND GENERATION The Multimedia Model						
• Print	Yes	Yes	Yes	Yes	No	No
• Audiotape	Yes	Yes	Yes	Yes	No	No
• Videotape	Yes	Yes	Yes	Yes	No	No
• Computer-based learning (e.g. CML/CAL/IMM)	Yes	Yes	Yes	Yes	Yes	No
• Interactive video (disk and tape)	Yes	Yes	Yes	Yes	Yes	No
THIRD GENERATION The Telelearning Model						
• Audio tele-conferencing	No	No	No	No	Yes	No
• Video-conferencing	No	No	No	No	Yes	No

Continued

Table 1: Continued

Models of Distance Education and Associated Delivery Technologies	Characteristics of Delivery Technologies					
	Flexibility			Highly Refined Materials	Advanced Interactive Delivery	Institutional Variable Costs Approaching Zero
	Time	Place	Pace			
• Audiographic Communication	No	No	No	Yes	Yes	No
• Broadcast TV/Radio and audio-teleconferencing	No	No	No	Yes	Yes	No
FOURTH GENERATION The Flexible Learning Model						
• Interactive multimedia (IMM) online	Yes	Yes	Yes	Yes	Yes	Yes
• Internet-based access to WWW resources	Yes	Yes	Yes	Yes	Yes	Yes
• Computer-mediated communication	Yes	Yes	Yes	Yes	Yes	No
FIFTH GENERATION The Intelligent Flexible Learning Model						
• Interactive multimedia (IMM) online	Yes	Yes	Yes	Yes	Yes	Yes
• Internet-based access to WWW resources	Yes	Yes	Yes	Yes	Yes	Yes
• Computer-mediated communication, using automated response systems	Yes	Yes	Yes	Yes	Yes	Yes
• Campus portal access to institutional processes and resources	Yes	Yes	Yes	Yes	Yes	Yes

Research Methodology

This study employs a qualitative research design as the principal mode of inquiry and focuses on the reflections of the reflective practitioners. Reflective practice, reflexivity and first-person inquiry are extensively used in research to know the process of "learning through" and "from experience" towards attaining new insights of self and/or practice (Boyd & Fales, 1983; Jarvis, 1992).

The concept of "reflective practice" was initially proposed by Dewey (1933) and subsequently strengthened by Schon (1983) to facilitate the reflective practitioners to conduct research through

- "reflection-on-action" where the investigation is carried out after the event (after-the-event thinking) and
- "reflection-in-action" where the investigation is carried out while going through the event (thinking while doing).

In this study, we as reflective practitioners used the "reflection-on-action" to think back to the earlier events and used the past experiences to study and identify mitigation strategies for future technological interventions.

The data collection methods used were:

- reflections of two researchers actively involved in the course design and development process while serving as master trainers, educational technologists and reviewers of the OUSL

learning material including print, audio-visual, online and Open Educational Resources (OER). Their reflections when moving from one generation to another provided in-depth analysis to this study as pragmatists (Creswell, 2014)
- reflections of informal anecdotes of ten OUSL academics and three senior administrators actively involved in these technological transformations
- narrative accounts of three former decision makers, and
- documentary evidences.

We used content analysis for analyzing data to identify the major categories as challenges and mitigation strategies.

Results and Discussion

The following research question will be explored first, using Taylor's (2001) conceptual framework illustrated in Table 1.

RQ1: How has the OUSL progressed with respect to GDE for the past four decades?

First generation of Distance Education – The Correspondence Model

The OUSL showed characteristics of first GDE when it was established, showing characteristics of correspondence teaching using single technology and lack of direct learner interaction with the institution (Bates, 2005; Nipper, 1989).

Upon reflecting on the commencement of its first degree programme a senior academic expressed the following:

> *I was involved in the launch of the first ever degree programme at the OUSL; Bachelor of Science degree programme offered by the Board of Study in Management, Science and Technology (at that time); from the enrolment of students in 1983 and its launch in 1984. Considerable efforts were taken to initiate the programme as one of the first staff members with limited infrastructure facilities and human resources. We were carrying out many tasks considering the need of the occasion. So we were like "jack-of all trades" attending to all the chores* (Senior academic – 1).

Almost all the recruited academics were from conventional universities except for a very few staff members who were directly absorbed from SLIDE and ESA to the OUSL. Designing self-instructional material for the OUSL learners was a challenge at the beginning as all the writers were either professors from conventional universities who were consultants at the OUSL (Jayatilleke, Kulasekera & Coomaraswamy, 2009) or the newly recruited academics who were from conventional universities and they were not aware of writing for distance learners (Jayatilleke, 1997). They worked as subject experts and developed hand-written copies of the content (Coomaraswamy, 1999) as described by a senior academic.

> *I used to take hand written copies to the data processing unit to computerize the documents. The data entry operators typed the copies using mainframe computer terminals. These computers were very basic and didn't have many options. We couldn't change the fonts; even into italics. So the scientific terms had to be re-typed using electric computers or typewriters. The figures/illustrations were drawn by the draftsman using tracing papers and these drawings were pasted into the blank spaces of the final manuscript.*

> *… So the whole process was a tedious task with involvement of several personnel at different intervals; doing manual tasks mostly. Hence, the initial delivery of the course material took almost one year after the registration of students* (Senior academic - 2).

The following quotation was extracted from the convocation address delivered by the founder professor of law, the former Head of the Department of Legal Studies of the OUSL, Professor Savithri Goonesekere, the second Professor of Law in the country. She recalled her experience with the Bachelor of Laws; the second undergraduate programme offered by the OUSL in 1984.

> The Board of Studies of Humanities and Social Sciences, as the faculty was called then, did not have a single computer. We considered ourselves as extremely advanced in technology when we could prepare our manuscripts on an electric typewriter. Professors at that time were lesson writers, translators, copy editors, and proof-readers. When we detected that last typographical error, as we scrutinized a manuscript for the last time, we had to find instant solutions. We would type the correct word and paste the corrected cut out carefully on the typed page. And so we produced manuscript after manuscript in a range of subjects hot off the press for the often faceless mass of students, who in turn accepted our inadequacies with tolerance, friendship and understanding (Goonesekere, 2001, p. 133).

The staff who were absorbed from the SLIDE and the ESA were fairly knowledgeable of DE. So the newly recruited staff at that time received on-the-job training through mentoring by the seniors who were from the SLIDE and the ESA.

> Training of educators is a serious problem. Most educators who come into distance education come with backgrounds in conventional education. Inculcating in them the concept and methodologies of distance education is a task to be undertaken if distance education institutions are to progress rapidly (Kotelawele & Samarasundara, 1987, p. 739).

This challenge was overcome only after the establishment of the Educational Technology (ET) Division in 1988; addressing the system needs rather than targeting individual needs as identified in the continuum of needs of the Bolam's model of continuing education (Bolam, 1986).

Though the establishment of an ET division was prescribed under a separate Ordinance of the OUSL, as it is unique and plays a pivotal role in course development in an ODL university, it was merely an audio-visual unit at its inception functioning as a resource centre with donated and purchased audio-visual tapes.

Reflecting on the conduct of initial staff development programmes, they were either supported by international agencies through collaborations and partnerships or under specific capacity enhancements projects as there were then neither experts nor infrastructure facilities within the OUSL. Almost all academics were trained through these international collaborations where eminent scholars in the field of DE were either invited to conduct capacity building programmes at the OUSL or academics were provided overseas training in the leading ODL universities such as British Open University, and Sukhothai Thammathirat Open University (STOU), Thailand, through various donor agencies such as UNESCO, Swedish International Development Cooperation Agency (SIDA) and Overseas Development Administration (ODA)/Department for International Development Project (DfID) etc. A senior academic recalls:

> *I can remember participating in course writing workshops in the late 1980s conducted by very eminent scholars like Dr. Otto Peters, Mr. Ian Mitchelle, and Professor Chaiyong Brahmanwong. Now only we realized how prominent these figures in the DE were and I feel how privileged I was to have had the opportunity to learn from them* (Senior academic – 3).

The existing practices in writing course material at the OUSL were strengthened radically under the ODA/DfID Project which lasted for three years from December 1995-December 1998 (Coomaraswamy, 1999; Weerasinghe, 1999). Most of the processes were established, streamlined, and Quality Assurance (QA) mechanisms for course material were initiated. Changes created by this project had a profound effect on the OUSL and the following are visible outcomes:

- Created a pool of academics who have mastered the skill of writing self-instructional material.
- Designed a house style for all course material with templates for layout.
- Updated course writing guidelines; Bridging the Gap (Kulatunga et al., 1995) and guidelines for layout of OUSL print material; House Style (Samarawickrama, 1996).
- Commenced developing a Knowledge-Based System (KBS) with futuristic vision but had to be restricted to the initial design stage of a prototype of the traditional Management Information System (MIS), which never materialized due to the re-allocation of funds to other priority areas as a cost saving strategy (Johnson & Johnson, 1999; Weerasinghe, 1999).

Second generation of Distance Education – The Multimedia Model

The second GDE is characterized by multimedia delivery with highly developed and refined teaching-learning resources including print course material with audio-video cassettes and early computer-based learning (Taylor, 2001).

This second GDE was also achieved through collaborations and partnerships to conduct professional training programmes on audio-visual productions. These collaboration were UNESCO and Asian Mass Communication Research and Information Centre (AMIC). These programmes were initially conducted outside the OUSL as the infrastructure facilities and the technical staff were not fully in-place then with the support from the leading national training institute; Sri Lanka Television Training Institute (SLTTI) with local media professionals.

As a result, the OUSL commenced multi-mode delivery using multiple media as academics started producing audio-visual resources for their courses especially the Department of Language studies, the Department of Legal Studies and the Faculty of Natural Sciences. According to Ratwatte (2010), the Department of Language studies has been using printed course material with audio cassettes to teach English from 1982 and introduced video cassettes in 1995.

> Lack of equity of access to newer technologies such as the use of videos to foster small group interactions has also held OUSL language educators back from using such innovations after its initial venture in 1995 (Ratwatte, 2010, p. 109).

Most of the audio-visual resources produced by the Faculty of Natural Sciences were related to Laboratory/field experiments and were shown during laboratory sessions. As online access to these resources was not available as of today, those audio-visual resources were made available through the audio-visual resource centres located at three regional centres (Jayatilleke, 2009; Jayatilleke & Dassanayake, 2005).

The first course using the integrated approach was the Environmental and Applied Microbiology of the B.Sc. degree programme, which was enhanced extensively under the ODA/DfID project and incorporated videos. Having undergone the process of course development, the course team chair emphasized the following:

> There should be continuing efforts by the OUSL to develop the discipline and commitment of staff to undertake the production of quality instructional materials. A quality assurance system or unit

> should be set up at OUSL to monitor and ensure that quality related activities are being performed effectively (Coomaraswamy, 1999, p. 63).

Thus the quality culture was embedded into the OUSL practices as one of the outcomes of the ODA/DfID project. The committee structures responsible for monitoring the quality standards of the OUSL learning resources were established in 1998. The University Course Development Committee (UCDC) is the apex committee representing Deans of the faculties and chairpersons of Faculty Course Development Committees (FCDC).

Production of audio-visual resources increased in momentum when the ET division was further enhanced to a state-of-the-art studio complex with the collaboration of Japan International Cooperation Agency (JICA) in 1993. Audio-visual technical staff with professional qualifications were also recruited to support this expansion. They were trained in Japan under the JICA fellowship scheme for a period of three months.

This expansion paved the way to conduct in-house capacity building programmes and to enhance audio-visual productions under the leadership and guidance of then Director/ET Division who was also a professional producer.

> *I faced the most challenging task when I started to develop my own video. I had to change my role as a facilitator/teacher to a Director of a video programme, while managing my academic work at the Department. I had to write the script, get permission from necessary authorities to film their locations, work with a team of AV technical officers and graphic artists to complete the video, and finally to undergo a comprehensive review process before releasing the video for students. It took about several months to complete my 20 minutes video* (Senior academic – 4).

During this period we observed a peak in producing audio-visual programmes winning many local and international awards, but gradually slowed down due to many challenges (Jayatilleke, 2009).

Third generation of Distance Education - The Telelearning Model

According to Taylor (2001), the third generation is the 'Tele' learning model based on applications of telecommunication technologies to provide opportunities for synchronous communication such as audio tele-conferencing, video-conferencing, audiographic communication (simultaneous voice and graphic communication), broadcast TV/ Radio and audio tele-conferencing.

In this context, the OUSL has not tapped the full potential of these highly interactive communication technologies for teaching and learning purposes. Video-conferencing and audiographic communication were not used at all and audio tele-conferencing and broadcast TV/Radio were used to a lesser extent. These broadcast programmes were recorded audio-visual productions rather than the live broadcasts except for one series of radio broadcast on early child development.

Some video programmes produced by the OUSL were televised in the National TV channel Rupavahini in 1990s under the "*Open University in Focus*" through the special education service free of charge and later under a TV sponsorship during peak airtime. Some of the productions were also televised in the International Television Network (ITN) and these programme were mostly documentaries, and some were docu-dramas dramatizing actual legal cases ("Dharmadikaranaya") and were very popular with the general public thereby gaining much recognition of the OUSL.

A series of very popular radio broadcasts were also produced in 1990s by the Department of Education on early child development. This 5-minute programme was broadcast live in the morning on National Radio Broadcast Service to discuss "how to nurture your child". However, this was not sustained due to the difficulty in finding sponsorships.

According to a former Director of Regional Educational Services (RES), audio conferencing facility was used in early 1990s to connect four regional centres; Colomo, Kandy, Matara and Jaffna with the Faculty Board members during the civil war period when communication was impossible through telephones. This facility was used for a limited time period but could not be sustained due to technical difficulties and poor knowledge on the usage of this technology.

Fourth generation of Distance Education - The Flexible Learning Model

The fourth GDE is the intelligent flexible learning model based on high quality interactive multimedia (IMM) via CD-ROMs and access to an extensive range of teaching-learning resources through the World Wide Web and Computer-mediated communication (Taylor, 2001).

The OUSL has leap frogged to the fourth GDE overtaking the third GDE as the technologies were either not used or not sustainable. Sustainability was made possible through several capacity building workshops conducted by the Commonwealth Educational Media Centre for Asia (CEMCA) on multimedia. A senior academic recalls:

> *I participated in the Multimedia development workshop organized by CEMCA. The software used was the Macromedia Director 8. To produce an IMM using Director was not very user friendly for a novice academic. I somehow developed one IMM by going through a very big manual of Director. Individual teachers did not have personal computers for their own use at that time. Even the media technical staff were not given the training during these workshops to support the academics and there was no mechanism to continue the multimedia development after the training. These problems may have discouraged teachers to continue with multimedia technology although those technologies were introduced to the OUSL* (Senior academic – 5).

A few academics, who had undergone the training on IMM workshop, have developed their competency and developed IMM for their courses. The Microbiology course was one.

> … learners' feedback evaluations carried out in 2003, still indicated learners' difficulty in comprehending abstract bacterial genetic processes, which are lengthy explanations in print course material. …Therefore, with the purpose of explaining dynamic abstract concepts in microbiology, an interactive multimedia (IMM) was developed as a supplement to the print course material … (Kulasekera, Jayatilleke & Coomarawamy, 2011, p. 114).

Yet again, the CEMCA, organized a capacity building workshop on e-learning through the Staff Development Centre (SDC) of the OUSL for the academics of national/private universities the OUSL in 2003.

Following this workshop, the initial Learning Management System (LMS) was established using an open source software - 'Manhattan' by the then Director/IT, and six voluntary academics commenced online learning (Jayatilleke, 2005; 2010). Progress at that time was very slow and the usage of this online facility by the OUSL community, both teachers and learners was not very promising. Finding time and lack of skills and infrastructure facilities were identified as some of the challenges (Jayatilleke, 2010).

Extensive expansion of online learning was made possible through the Capacity Enhancement (OUSL-CE) component of the Distance Education Modernization Project (DEMP) from 2003-2009. This Project was supported by the Sri Lankan Government and funded by the Asian Development Bank (ADB) to develop infrastructure facilities, build capacity of staff and provide modern technology as a measure to increase the access to higher education through DE in all tertiary education institutes at a national scale. As a result, the OUSL too was strengthened to a greater extent, including the studio complex. It was upgraded in 2010 with high-definition digital equipment replacing original Betacam equipment.

The Instructional Design and Development (IDD) counterpart team of the OUSL-CE proposed a Faculty-driven model with a Faculty Instructional Design Coordinator (IDC) which was a new concept introduced by the OUSL-CE to liaise online design and development activities in 2007. However, this model was not successful due to the difficulty of coping with multi-tasks by IDCs. Then a second model was proposed with three types of online courses; supplemental, blended and exclusively online courses along with assigning the ET Division the responsibility of designing and developing, and ensuring the quality assurance of online courses (DEMP, 2008; Jayasooriya, Bandarage, Lister & Jayatilleke, 2008). This model was approved at the Senate for adoption across faculties and is still practiced successfully.

Having experienced online learning for seventeen years, we have observed some innovative teaching strategies:

- Development of remote-controlled online laboratory platform where learners can perform experimental tasks remotely utilizing real equipment and electronic instruments such as a signal generator and oscilloscope (Nandana & de Mel, 2016; Nandana, de Mel & Priyankara, 2015; Samaranayaka & de Mel, 2017).
- Development of a hybrid system using Quick Response (QR) code labels printed near the contents of the course material which require more explanations. To view supplementary multimedia contents, these QR codes required to be scanned via a QR code reader application with the aid of a Smartphone. The code redirects to a relevant material that is stored in the cloud storage (Haroon & de Mel, 2017).
- Development of a mobile learning application for tablet computers (Jayatilleke, Ranawaka, Wijesekera & Kumarasinha, 2018).
- Development of a blended online course to teach English writing skills using the Process Approach (Pullenayegem, 2019).

The OUSL also embarked on offering exclusively online courses since 2007:

- The first stand-alone course of the OUSL "Teacher Educator as an Educational Technologist" by the Faculty of Education in 2007 (Karunanayaka, 2008, 2009).
- The first Continuing Medical Education (CME) course in Sri Lanka on "Cardiovascular Health" for general medical practitioners in 2008 (de Silva & Kulasekara, 2012).
- Two other stand-alone CME courses on Old Age Psychiatry and Men's Sexual and Reproductive Health.
- A cross-border exclusively online International Course on "Online Tutoring and Mentoring" facilitated by OUSL and four international e-mentors from the University of New Mexico for the participants of Sri Lanka, Pakistan and Mauritius in 2014 (Jayatilleke & Gunawardena, 2016; Jayatilleke, Kulasekara, Kumarasinha & Gunawardena, 2017).
- A 'Refresher course for Medical Laboratory Technologists' by the Faculty of Health Sciences since 2018.

Fifth generation of Distance Education – The Intelligent Flexible Learning Model

According to Taylor (2001), the fifth GDE is an extension of the fourth GDE with automated functionalities. This model aims at establishing an 'e-University' concept, based on high degree of automation and learner control to asynchronous online learning capitalizing the potential of internet and IMM. It was conceptualized in terms of three fundamental foci:

- e-Information repositories
- e-Applications (e-enrolment, e-administration, e-commerce, e-publishing, e-teaching and learning) and
- e-Interface (Taylor, 2001).

Reflecting on the past practices at the OUSL, it is evident that the OUSL has initialised the basic form of e-Information repository even during the first GDE. It has computerized its student records partially by the DP Unit using mainframe computers since its inception. The OUSL was the first university in Sri Lanka to develop an electronic database system in the late 1980s to handle academic programme applications, course registrations, examination records, and to manage its large volume of student records (Johnson & Johnson, 1999).

The OUSL Library too has developed a computerized record system of its holdings in 1990s and maintains dynamic records of students borrowing (Johnson & Johnson, 1999) that caters to the needs of staff and a large body of learners dispersed throughout the country through the network of regional and study centres.

Nevertheless, on careful examination of the past technological transformations, it was apparent that the DEMP had a profound effect on the efficiency of the operational functions of the OUSL. As a result, the OUSL has managed to reach the fifth GDE with many automated functionalities.

The abandoned MIS was recommenced under the OUSL-CE project of the DEMP and developed extensively with different functional sub-systems. The main enhancements were observed in the IT division, the library, and the Centre for Educational Technology and Media (CETMe - earlier ET Division) and the progression is illustrated in Table 2.

Table 2: Progression of e-functionalities at the OUSL

Division	Automated functionalities	Progression of e-functionalities

IT Division	e-Information repositories	• establishment of OUSL MIS (OMIS) with several sub-systems using local servers
		  • a new financial management system, including General Ledger, Accounts Payable and Purchase Orders, Human Resources and Pay Roll modules
		  • document management and human resource systems
		  • student administration system (MyOUSL) enabling students to view their records such as payment status, examination results, and notices
		• established the OUSL OMIS intranet to access information such as circulars, policy documents, minutes of meetings etc. as e-copies in the central campus
		• integrated Library LMS with the OMIS

	e-Applications	• initiated downloadable online applications via the OUSL web since 2009 • commenced online student enrolment since 2017 replacing manual entries
	e-Administration	• connected all the computer terminals in the central campus via Local Area Network (LAN) with internet facilities enabling free OUSL email (Allou) • extended connection to the nine regional centres through a Wider Area Network (WAN) enhancing staff communication • established free Wi Fi access points in the main campus and regional centres

Continued

Table 2: Continued

Division	Automated functionalities	Progression of e-functionalities
IT Division	e-Administration	• facilitated cloud-based web conferencing ZOOM technology to conduct meetings during the COVID 19 outbreak period • Initiatives have taken to migrate OMIS and OUSL LMS to cloud-based system.
	e-Teaching and learning	• initiated interactive web conferencing system using Big Blue Button enabling lecturers in Colombo centre to connect with remote learners • facilitated cloud-based web conferencing ZOOM technology during the COVID 19 outbreak period in 2020 in order to encourage teachers to teach from home
Library	e-Information repositories/e-administration	• commenced computerising of library catalogue with Information Storage and Retrieval System (CDS/ISIS), developed, maintained and disseminated by UNESCO in 1991, circulation system in 1993, acquisition with Dbase in 1995 and with bar code entries in 1999 (OUSL library, 2020, pp. 29-30) • introduced integrated library management system (ALIS for windows) in 2003 • expanded and developed its own Content Management System (CMS) using open source software; KOHA and achieved the fully process automation status in 2003. It was the first university library in Sri Lanka to achieve the fully process automation status • provided a dedicated space (“Virtual Library”) in the central campus with internet connection to the OUSL learners to view digital resources in 2006 • expanded the “Virtual Library” to a remotely accessible digital library in 2009 through the library web portal. It is an online resource repository and a very popular service receiving positive feedback from the overseas users as well • developed a national automation system by networking the OUSL library with all public libraries in Sri Lanka (National e-library centre) at the Public Library since 2014 through the funding from provincial and local governments • initiated expansion to access the OUSL learning resources through the public libraries through an e-public information system.
CETMe	e-Information repositories	• initiated OUSL OER repository consisting of OUSL learning resources and made them available through the OUSL web since 2014 • initiated two OUSL repositories to house OUSL video productions; “OpenCast” and “OpenUtube” (with curated OUSL productions) in 2018 • initiated a dedicated audio channel; “Radio OUSL” to enhance communication (Centre for Educational Technology and Media, 2020, pp. 24-28)
	e-Teaching and learning	• took the responsibility of online course design and development since 2007 • initiated in conducting online tests across all regional centres since 2007
	e-Interface	• enhanced OUSL LMS (OUSL ELearn) since 2017 giving more reliable solutions to teachers and learners • enabled easy access for students to MyOUSL and OUSL Elearn with identical user control credentials since 2018

The initial phase of e-publishing at the OUSL was evident at the research dissemination stage when the past volumes of the OUSL Journal were digitized and made available globally through the Sri Lanka Online Journals (SLJOL) portal as an Open Access Journal since 2009 through the International Network for the Availability of Scientific Publications (INASP) under the aegies of SIDA/SAREC library support project, University of Colombo, Sri Lanka in 2005.Currently, initiatives have been taken to provide e-copies instead of printed course material for the undergraduates of Bachelor of Social Studies in 2015, and Bachelors of Medical Laboratory Sciences in 2019.

Reflecting on the technological transformation for 40 years, most of the e-functions of the fifth GDE were initiated and integrated to some extent, thereby enhancing the overall effectiveness of the university functions (Sivalogathasan, 2019). However, e-commerce functionality is used to a limited extent and needs to be developed further, integrating it with other sub-systems.

RQ2 and RQ3: What are the challenges faced during the technological transformations of GDE and what are the mitigation strategies used to overcome these challenges?

The OUSL has faced many challenges when going through these GDE over the past forty years. Some technological innovations were successfully implemented, some could not be materialized in the first place, some were piloted and never institutionalized, and some were achieved to a lesser extent and subsequently expanded after a gap of several years. Even the transition to online teaching and learning presents new challenges owing to change of expectations and roles of both staff and students as rightly highlighted by Ko and Rossen (2010), it takes time to diffuse technology and embrace it into the mainstream, and requires sufficient time to undergo a paradigm shift among all stakeholders.

The commencement of the OUSL itself was a challenge:

> Distance Education was not the only challenge facing the new university; what was daunting was also the nature of its mission. … Thus the very title of the new university and its notion of 'open' entry were considered radical and provocative by a great majority in the university education system. Equally radical was the teaching methodology proposed. The age-old concept of the teacher as a guru and of students as acolytes who had to learn in the presence of the 'master' was now being challenged by a system … (Raheem, 2010, pp. 9-10).

Though the system has evolved through GDE for the past 40 years under eight different leaderships, higher authorities still need convincing as they use the same conventional yardsticks without knowing the complexities of ODL practices.

Having gone through the content analysis, we have identified the main challenges encountered, successful mitigation strategies used, and strategies which have hindered the mitigation when moving across all GDEs (Table 3).

Table 3: Some of the quotations for either successful or hindered strategies for mitigation

Challenge	Successful mitigation strategies	Strategies hindered mitigation
Leadership	… strong skills of persuasion, and the stabilization of the regional centre network in the 1990s was a major step forward (Raheem, 2010, p. 26).	… OUSL did not have the foresight to carry out this experiment that would have been cost-effective and also would have provided some lessons … (Vidanapathirana & Abeysekera 2010, p. 122).

Continued

Table 3: Continued

Challenge	Successful mitigation strategies	Strategies hindered mitigation
Governance	*There were very clear objectives why the OUSL was established … But due to various pressures, desires, comforts, and conveniences, people modified to suit the consensus … Key features of this university must be maintained …* (Interview with Former Vice-Chancellor).	… dissatisfaction at the lack of additional institutional support for those who work beyond their routine duties (Ariadurai & Manohanthan 2008 p. 5)
Staff commitment	… those who were committed to online conversion continuously improve their products with new changes, additions and improvements… (Liyanagama, Kulasekera & Vidanapathirana, 2015, p. 10)	… encourage the young inexperienced programmers to adopt appropriate team working practices … the regular departure of team members to better paid jobs in the private sector … (Johnson & Johnson, 1999, p. 39).
Sustainability of the interventions	Model 2 proved to be a more efficient and sustainable model … since the ET Division's knowledge base continues to grow … (Jayasooriya et al., 2008).	*non-inclusion of the relevant staff during the project and just handing over the tasks at the end of the project to a division with inexperienced staff without any training and technical facilities* (Senior Administrative staff 2)

RQ4: What are the proposed mitigation strategies for future technological interventions?

We pooled the strategies that emerged during the data analysis stage and collectively grouped them as common mitigation strategies that would be useful for future technological interventions (Table 4).

Table 4: Proposed Mitigation Strategies for future technological interventions

	Challenge	Proposed Mitigation Strategies for future interventions
1.	Lack of infrastructure facilities and physical resources	• collaborations and partnerships (local and foreign) through projects and donations
2.	Lack of expertise	• on the job training • off-shore/onsite training through collaborations/partnerships • onsite regular training by the trained master trainers • onsite/off-shore workshops on emerging technologies
3	Visionary Leadership	• strong skills of persuasion to mitigate challenges • take timely and sometime radical decisions to fulfill the vision • identify "enablers" and facilitate the process • prioritize essential tasks • implement decisions quickly enabling interventions • enable support structures/ dedicated units • monitor the progress of implementation • drive all the staff collectively to the goal through participatory approach • institutionalize individual/departmental/faculty level best practices

Continued

Table 4: Continued

	Challenge	Proposed Mitigation Strategies for future interventions
4	Good Governance	• formulate policies • establish organizational structures and streamline mechanisms • prepare guidelines and Standard Operating Procedures (SOPs) • Identify strategies for implementation • formulate monitory mechanism to check the progress and take remedial measures
5	Staff Readiness/ commitment	• exposure/induction • regular staff training • involve them in the project/innovation • provide support mechanisms • regular encouragement, appreciation using motivational strategies

6	Organizational culture	• strengthen infrastructure, physical and human resources
		• establish dedicated units with adequate resources and human resources
		• encourage staff
		  • provide devices – tablet/laptop/desktop computers or financial assistance
		  • provide concessions or free access
		  • provide free telephone number/s for students and staff so that the cost will be borne by the institution
		  • create a stable and conducive learning environment

7	Adoption of Technology	• regular awareness/training to make the staff ready for innovation • provide infrastructure facilities • provide technical experts/support • develop user-friendly e-interfaces • propose alternative support strategies in case the major one fails
8	Sustainability of the interventions/ innovative practices beyond the project period	• formulate a sustainable plan at the beginning of the project • develop strategies for institutionalization of best practices/innovations • draw mechanism for generating funds • encourage collaborations and partnerships • use motivational strategies for staff • implement realistic time schedules • facilitate staff retention through addressing grievances and encouragement

Conclusion

The findings show that the OUSL has demonstrated a glimpse of using e-functionalities of fifth GDE; Intelligent Flexible Learning Model by storing e-information of students and maintaining a student database even at the beginning of its operations. It has gradually progressed towards an e-university concept with greater automation functionality with respect to almost 100% with e-information repositories especially in the functionalities of the OUSL library. However, progress of other foci, such as e-applications and e-interface has not advanced to the same extent. Since this study is mainly based on qualitative data, the exact quantitative figures could not be clearly stated. However, in general, the progression of e-applications, ranged from 2% (limited transactions only for e-commerce) to 60% for e-teaching and learning in which the online assessment has not reached the fully online status as yet. Measures have been taken to improve the e-interface by revamping the university webpage to suit all the stakeholders, however, it needs further enrichment to achieve the full status of the e-university concept. Nevertheless, the concept of a fully autonomous system to

become an e-university is still a dream, and may not be accepted by all the stakeholders of the OUSL as the Sri Lankan culture is social by nature and does have a great propensity to work socially and would not prefer to work entirely online.

Having these automated systems enabled the OUSL to expand its services and decentralize most of its functionalities to the nine regional and nineteen study centres thereby improving its efficiency by providing remote access to both students and staff.

We conclude that the OUSL has faced many challenges when moving from one GDE to another and used mitigation strategies; some were successful and others less so. Having conducted this gap analysis, we collectively identified mitigation strategies that would be useful for researchers and practitioners to consider when moving from one GDE to another smoothly.

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