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Moving with times: The inclusion of Fourth Industrial Revolution Technologies in the curriculum of Library and Information Science Schools in Botswana and South Africa

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Abstract

This paper aims to determine the inclusion of specified Fourth Industrial Revolution (4IR) technologies in the curriculum of library and information schools at the University of Botswana in Botswana (UB) and the University of Fort Hare (UFH) in South Africa. The said 4IR technologies are cloud computing, artificial intelligence and machine learning as well as blockchain technology. This study used content analysis on the website of the two universities, documentary review and literature as data sources in the endeavour to resolve the research problem. The two universities were selected purposively because they were comprehensive universities using the South African context. In addition, the selection was also informed by the LIS curriculum offered by the universities. The study revealed that UB offered a Bachelor of Information and Knowledge Management with specialisation in archives and records management, knowledge management, and library and information studies, and the Bachelor of Information Systems (information management). At postgraduate level, the UB offered a master's degree in archives and records management, a master's degree in library and information studies, and a Master of Philosophy/Doctor of Philosophy in Library and Information Studies. UFH offered a Bachelor of Library and Information Science and a Postgraduate Diploma in Archives and Records Management at undergraduate and the postgraduate levels. Regarding the inclusion of the specified 4IR technologies in their curriculum offerings, the study found that both the UB and the UFH were not included. The study recommends the inclusion of the specified 4IR technologies in the library and information science school to prepare graduates for the disruptive 4IR work environment.

Keywords: Botswana, curriculum, Fourth Industrial Revolution, Library and Information Science, South Africa

Introduction

Information science professions are confronted by various challenges such as the phenomenal growth of digital content in the developing countries (Phiri 2016). The curriculum offerings at higher education institutions (HEIs) should be relevant for the students' needs when they complete their studies amid the ever-changing technologies, such as those synonymous with the Fourth Industrial Revolution (4IR). According to Mabe and Bwalya (2022), skills and competencies are key dimensions in realising the promise of the 4IR. According to Cochin (2023), the inherent skills mismatch between the current educational curriculum and industry demands is a growing concern, as students graduate without the requisite practical skills and experience that employers seek, which hinders their career growth. OECD (2023) adds that an education system that is more responsive to the labour market supports the employability of graduates by minimising skills imbalances and improving the resilience of the workforce to future changes in labour market demand. Tunnel (2022) defines a curriculum as a set of instructional techniques, learning experiences and student performance evaluations that are designed to effectively convey and evaluate the intended learning objectives of a course. For example, in linking the curriculum for archival education to the world of work, the Society of American Archivists (2023) found that most contemporary records are created, stored, maintained, used and preserved in digital form. Thus, learners must be familiarised with networking, hardware and software, and digital systems, in general, is fundamental to performing archival functions in the 21st century. It is therefore of paramount importance for HEIs and beneficial for students to leave the classroom with the relevant skills and competencies required by the job market. For this study, such skills and competencies were those necessary for library and information management professionals to survive and hold their own the office environment in the 4IR.

Background to the study

The 4IR is a period in the knowledge economy that is synonymous with disruptive technologies which are now maturely used in first-world countries like Australia, Canada, China, Germany, the United Kingdom and the United States of America, among others, to manage and preserve records (Modiba, Ngoepe & Ngulube 2019). Such technologies, which are inherently disruptive, include big data analytics, advanced human-machine interfaces, smart sensors and actuators, robotics, artificial intelligence (AI), machine learning (ML), security authentication, cloud computing, location tracking technologies, 3D printing, augmented reality and blockchain technology (World Economic Forum 2017; Bwalya 2021).

The 4IR technologies have an impact on different sectors of the economy, including education (Uleanya 2022). Education is thus crucial in providing students with the necessary skills to survive the disruptive 4IR space. Some HEIs in Africa offer library and information management, such as archival and records management qualifications, with limited disruptive technologies modules (Ngoepe, Jacobs & Mojapelo 2022). This is the case despite an intervention by the International Council on Archives' (ICA) 2015 Strategy for Africa, which incorporates disruptive technologies in curriculum development (Ngoepe & Saurombe 2021). The ICA's inclusion of disruptive technologies modules recommendation was a response influenced by technological transformations occurring all over the world. The curriculum that the ICA suggests has not been

largely adopted by various African HEIs. Maluleka, Nkwe and Ngoepe (2019) and Kandiero (2019) give several reasons for the lack of adoption of disruptive 4IR technologies in HEIs, such as a lack of skills and resources.

Literature review

This section briefly focuses on a review of literature, particularly for the specified 4IR technologies such as cloud computing, blockchain technology and AI, which have been chosen as the focus of this study. These were selected arbitrarily mainly because they are topical and there is research focus on them as they affect the library and information management space. David-West (2021) indicates that there are studies that state that the 4IR has an impact on the workforce to such an extent that LIS graduates may find that they have lower prospects employability due to a skills shortage, as 4IR technologies are being increasingly implemented in the office environment.

The National Institute of Standards and Technology (NIST) (2011:3of the United States' Department of Commerce defines cloud computing as "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or cloud provider interaction." Both public and private libraries have embraced cloud computing technology in the provision of services, as they are perceived as offering benefits such as cost efficiency, scalability, convenience and performance (InterPARES 2016). According to Aviamu, Popoola and Atuase (2019), academic libraries in Ghana, Nigeria and Tanzania have partly adopted cloud computing technology for service delivery but have not yet started to fully use it for storing research data. All the same, librarians need to be able to execute their information provision services where cloud computing is used as a platform for the same in a confident manner.

Blockchain technology is also used for the provision of information management services. For records management, it has the potential to impact all records management processes and extend their capabilities (Gartner 2016). In Estonia, blockchain technology has been used to securely keep medical records and a host of other types of government records while, in Brazil, it has been applied to land transfer registration in the municipality of Pelotas in 2017 (Lemieux, Hofman, Batista & Joo 2019). Mosweu and Chaterera-Zambuko (2021) investigated the adoption of blockchain for records management in Botswana and Zimbabwe. They found that records managers and archivists in the two countries were aware of the existence of the technology and would use it, as they appreciated its potential benefits for records management. Notably, their respective organisations were not yet using the technology.

AI is one of the disruptive 4IR technologies that are increasingly implemented in the provision of information services. AI research has several branches, including ML, natural language, expert systems, speech, vision, planning and robotics (Kulkarni 2016). Thus, the application of AI in information services provision can and may be about the use of one of the several AI branches. The University of Pretoria's Department of Library Services has deployed a robot known as Libby to provide the first client services at the university library, the first in Africa. Libby interacts with library users by providing guidance, answering questions, conducting surveys and displaying marketing videos (University of Pretoria 2019). Furthermore, the robot performs only general and

repetitive tasks that library staff undertake in the library. This frees up their time to perform more advanced and specialised services for the benefit of library users. The library sees the use of robotics as an added benefit that augments and enhances its service portfolio (University of Pretoria 2019).

Library and information science (LIS) schools are expected to include 4IR technologies in their curriculum to serve the needs of modern archivists and records managers. HEIs such as universities need to develop curricula that focus on intentionally developing the needed skills in response to the accelerated skills change demanded in the 4IR (Rojewski & Hill 2017; Bughin et al. 2018). In this regard, HEIs have to offer high-quality education programmes meant to develop graduates with the right knowledge and skills needed for future jobs within the disrupted 4IR office environment (Penprase 2018; Suleman 2018). According to Uleanya and Yu (2019), education remains a key ingredient in preparing people for revolutions, such as the 4IR, which is well achievable, as shown in previous experiences. The next section provides the background to the study and focuses more on archival education in the 4IR with a bias towards the inclusion of 4IR technologies in the curriculum of LIS schools.

The contextual setting of the study

This study was limited to the University of Botswana (UB) in Botswana and the University of Fort Hare (UFH) in South Africa. The UB was initially part of the University of Botswana, Lesotho and Swaziland (UBLS). The UBLS was established in 1964 through the Royal Charter before the independence of the three countries. It was based in Roma, Lesotho. The UBLS remained a joint institution of the three countries as they prepared for self-determination, until 1975 when the Government of Lesotho withdrew from the partnership and established the National University of Lesotho (NUL) (Mokopakgosi 2013). The Government of Botswana then partnered with the Government of Swaziland, now Eswatini, from 1975 to 1982, until Botswana established its sole university in 1982 (Tabulawa & Youngman 2017). The University of Botswana Act (Act No. 11 of 1982) formally established the university (Government of Botswana 1982). The university has eight faculties, namely the faculties of Business, Education, Engineering and Technology, Health Sciences, Humanities, Medicine, and Social Sciences. The Department of Library and Information Studies, which was the focus of this study, was situated within the Faculty of Humanities.

The University of Fort Hare is one of the oldest HEIs in South Africa. It was established in 1916, designed for the black population who were in majority (Monyela 2013). Its establishment served as a point of contestation to the dominant values of the white settler community. It was created specifically for selecting and educating African elites, including the children of chiefs (Cloete, Bunting & Bailey 2018). The university was incorporated under the Higher Education Act of 1923. It was initially called the South Africa Native College and its name changed to the University College of Fort Hare in 1952. The university has two campuses located in East London and Bisho, both in the Eastern Cape province of South Africa. The university has six faculties, namely Law, Education, Health Sciences, Management and Commerce, Agriculture, and Social Sciences and Humanities. The university started to offer library and information science in 1973 under the Faculty of Humanities (Musiker 1986). The Library and Information Science Department resorts under the Faculty of Human Sciences.

Problem statement

The 4IR is associated with disruptive technologies, digitalisation, network and virtualisation in every aspect of life. Automation based on digital technologies is rife (Spotti & Windelband 2020). Both the education system and the work environment are affected by these changes. According to the World Economic Forum (2017), the 4IR is bound to disrupt future jobs and skills while making new opportunities available. This will lead to a demand for information management professionals such as archivists, records managers and librarians who possess the requisite skills and knowledge to work in a 4IR office. However, not much has been done to prepare students through a curriculum tailored to the skills and knowledge required of workers (David-West 2021). LIS programme offerings have partially become irrelevant for the disrupted office environment due the exclusion of modules that cover 4IR technologies. According to Olakunle (2014), HEIs have been striving to include 4IR technologies in their LIS curriculum. For library and information management professionals to remail relevant, they need to reskill and the new ones need to pass through a curriculum that responds to the changes brought by 4IR. It was not known whether the UB and the UFH LIS programmes included 4IR technologies, hence this study which sought to establish this.

The 4IR creates many challenges for LIS in terms of training the right professionals. For example, there is much doubt about the extent to which LIS curricula in Africa prepare library and information professionals for the 21stcentury job market in this field. This gives the impetus to examine the curricula of LIS in Botswana and South Africa with a view to make recommendations about training of library and information management professionals who are fit to work in the 4IR office environment. The enhancement of technology-based work environments has changed the skill set needed by graduates entering the workforce (Landsberg & Van den Berg 2023). The 4IR brings new challenges and opportunities that require human intelligence and skills (Manda & Dhaou 2019). Considering the new skills needed by library and information managements professional and the changes effected by technological advancements by the 4IR, an investigation into the inclusion of 4IR technologies in the curriculum of LIS in the specified universities in Botswana and South Africa was a necessity.

Methodology

This study used content analysis found on the websites of the UFH and the UB, which was supplemented by available literature. The two universities were selected purposively, as they were comprehensive universities in the South African context. The content analysis was done on both the undergraduate and postgraduate LIS curriculum as presented in the prospectus of the two universities. The focus was specifically on the course descriptions to determine the inclusion of 4IR technologies. For the UB, content analysis was done on the Bachelor of Information and Knowledge Management, the master's in archives and records management and the master's in library and information studies programmes. For the UFH, the analysis was limited to the Bachelor of Library and Information Studies and the Postgraduate Diploma in Archives and Records Management A total of nine modules were selected as relevant for the study. The researchers intensively investigated the curricula (course outlines) to understand and obtain information on the content, purpose, method, time/duration, trainers and location or situation of the courses in the archives and records management programme. The qualitative information from the content

analysis was categorised into informative themes derived from the research objectives, and these guided the presentation of the study findings.

Objectives of the study

The main purpose of the study was to determine the inclusion of specified 4IR technologies in the LIS curriculum at the UB and the UFH in Botswana and South Africa. The specific objectives of the study were:

- To identify undergraduate and postgraduate LIS programmes offered by the University of Fort Hare and the University of Botswana.
- To establish the inclusion of specified 4IR technologies such as cloud computing, artificial intelligence, machine learning and blockchain technology in their LIS curriculum at degree and postgraduate levels.

Findings of the study

The findings of the study are presented as guided by the research objectives with findings from the UB presented first, followed by those from the UFH. The first objective of the study was to identify undergraduate and postgraduate LIS programmes offered by the two universities.

Undergraduate and postgraduate LIS programmes are offered by the two universities

The first objective of the study sought to identify undergraduate and postgraduate LIS programmes offered by the UFH and the UB. The findings from this objective are presented first, followed by the findings from the second objective.

University of Botswana

The UB offered undergraduate and postgraduate LIS programmes within the Department of Library and Information Studies. The following undergraduate and postgraduate programmes were offered at the university.

Table 1: Undergraduate programme at degree level

Name of programme	Courses covered
Bachelor of Information and Knowledge Management (Archives and Records Management)	**Year 1 Semester 1 Courses** **ARM 100: Introduction to Records Management** This course introduces students to managing records as tools for good governance, accountability and transparency, and effective decision-making in ensuring legislative and regulatory compliance and preserving the corporate memory of organisations. Topics covered are Definitions of Records, Records Management Theories, Procedures for Managing Current (Developing and Designing Classification and Records Tracking Systems), Managing Semi-current (Records Retirement, Application and Use of Records Retention and Disposition Schedules) and Managing Non-current Records. **IKM 100: Introduction to Knowledge Management** The course discusses the following: Concepts, Definition, Origin, Nature and Types of Knowledge; Major Drivers and Benefits of Knowledge Management; Organisational Impacts of Knowledge Management; Various Knowledge Processes with Specific Emphasis on Knowledge Sharing; Knowledge Management Infrastructure and Different Types of Knowledge Management Strategies; and the Role of Information Technology in Knowledge Management Endeavours **LIM 100: Introduction to Information Science** This course introduces the nature of information science, information architecture and general principles that underlie information processing and information theory. It covers topics such as Definitions of Information Science; Information Architecture; Human-Computer Interaction; Models of Information Retrieval; Information Systems Analysis; Organisational Informatics; IT and Organisations; and Knowledge Management. **LIM 101: Collection Development and Management** This course examines how libraries build and maintain collections. It introduces students to the concept of collection development and management

	in libraries and information centres and exposes them to various reference sources in print and electronic format; general and subject-specific reference sources. The focus is on the Selection of Materials, Producers of Materials, Weeding, Budgeting and Censorship. Content also includes What to Consider When Developing Collections, User Needs, Collection Evaluation and Collection Policies. **COM111: Communication and Study Skills I** This course is designed to assist students to develop balanced proficiency in the four major communicative skills: listening, reading, speaking and writing for academic and general purposes **ICT121: Computing and Information Skills** **Year 1 Semester 2 Courses** **ARM 101: Introduction to Archives** The course introduces students to the practice of managing archives as well as the role and place of archives in society and organisations. Topics covered are Definitions and Terms used in Archives Administration, the Nature of Archives, (Public, versus Private Archives, Manuscripts Collections), the Role of Archives in Society, Acquisition of Archives, Records Appraisal, Macro and Micro appraisal, Accessioning, Introduction to Arrangement and Description of Archives **ARM 102: Organisational Cultures and Archives and Records Management** This course introduces students to organisational cultures and how they impact processes in archives and records management. The topics include Introduction to Organisational Cultures, Factors that Influence Organisational Cultures, Types and Characteristics of Organisational Cultures, Assessing Organisational Cultures, and Promoting Information Management in the Various Organisational Cultures **IKM 101: Knowledge Management Theory and Practice** The course discusses the following: Knowledge Creation Model, Knowledge Artefacts, Knowledge Agents, Content Management, Theoretical Framework for Knowledge Management Process to Improve Knowledge Performance,

	Diffusion of Knowledge, Communication and Leadership Subject Knowledge. **LIM 102: Introduction to Organising Information** The course aims to introduce students to the principles underlying the organisation of data and information sources. Students are taken through the theory and practice of cataloguing and classification. It is expected that students would be able to catalogue different types of information carriers at the end of the course. **COM112: Communication and Study Skills II** This course is designed to provide the development of writing proficiency through intensive instruction in academic writing skills and teaches students the rhetorical principles and writing practices necessary for producing effective business letters, memos, reports and collaborative projects in professional contexts. **ICT122: Computing and Information Skills** **Year 2 Semester 1 Courses (Core)** **IKM 200: Knowledge Management Systems** The course discusses the following: Origin, Evolution and Role of Knowledge Management Systems; Components of a Knowledge Management System; Environmental Scanning; Developing Knowledge Management System Blue Print; Prototyping and Deployment; Major Knowledge Management Systems, including Document Management Systems, Decision Support Systems, Group Support Systems, Executive Information Systems, Workflow Management Systems; Conceptual and Theoretical Frameworks on Integration of Systems in Organisations' Business Processes. **LIM 200: Digital Libraries** The course is designed to give the students an overview of digital libraries and their role in the information or digital era. Content covers Conceptual, Practical and Technical Issues; Problems and Approaches to Digital Libraries; Overview of Differing Efforts; Evolving Concepts and Thinking in several Fields and Enterprises; Types of Digital Library Collections, Organisation, Access and Use of Digital Libraries; Technical Infrastructure and Processes for Building Digital Libraries and Research Projects, such as Digital Libraries

	Initiatives; Social and Economic Issues; Integration of Digital and Traditional Resources in Libraries. **ISS221: Data and Information Management 1** The course discusses fundamental principles and concepts of databases; DBMS architecture; components of DBMS; data models; database design: conceptual and logical; ER and Relational model; ER to Relational; Schema refinement, functional dependencies, normalization; SQL: DDL and DML; database application development. **Optional Courses** **LIM 201: Publishing and the Book Trade** The publishing industry underpins the work of librarians and how its operations have implications on the way in which librarians work and what items they stock in their libraries. The course considers the relationship between libraries and the book trade, together with three areas of the law (Copyright, Public Lending Rights and Censorship) that affect both libraries and the trade. It studies each step of the publishing process, the role of marketing and how books are promoted, and the different types of publishers, including issues related to electronic publishing. Additionally, the course examines the publishing industry in the SADC countries as well as the role of women publishers today. **ARM 201: Preservation of Information Materials** The purpose of this course is to introduce students to the measures required to prolong the useful life of records, archives and other documentary materials and to ensure that they remain accessible over time. The topics covered are History of Paper and Paper Making, Preservation and Conservation Nature and Quality of Materials; Agents of Deterioration – Physical, Mechanical, Biological, Chemical, Damage, Collection Care, Disaster Management and Disaster Preparedness; Preservation Planning Programmes, Policies and Procedures; and National and International Preservation Organisations. **Year 2 Semester 2 Courses** **ARM 200: Archival Arrangement and Description** This course explores the principles and practices that underpin the arrangement and description of archival collections. The topics covered are Arrangement and Description of Archives using the Principles of Provenance and Original Order; Levels of Arrangement; Arranging Records into Series; Preparation of Administrative Notes; and Other Types of Archival

	Arrangement such as Chronological Arrangement, Topographical Arrangement, and Arrangement by Records Type; Alphabetical Arrangement; The Role of Descriptive Standards in Facilitating Access to Archival Materials; and Preparation of Archival and Finding Aids. **ARM 201: Preservation of Information Materials** The purpose of this course is to introduce students to the measures required to prolong the useful life of records, archives and other documentary materials and to ensure that they remain accessible over time. The topics covered are History of Paper and Paper Making; Preservation and Conservation; Nature and Quality of Materials; Agents of Deterioration – Physical, Mechanical, Biological, Chemical, Damage and Collection Care; Disaster Management and Disaster Preparedness; Preservation Planning Programmes, Policies and Procedures; National and International Preservation Organisations. **LIM 202: Management of Library and Information Systems** The course covers the structure and components of management systems for library and information service providers and creators. Topics covered are Management Information Systems and Packages for Transaction Processing and Decision Support; Expert Systems, Artificial Intelligence and Strategies for Providing Successful Management Information. **Optional Courses (select one)** **LIM203: Social Networking Issues for Information Professionals (3 credits)** **LIM204: Information Literacy (3 credits)** **Year 3 Semester 1 Courses** ISS 321: Data and Information Management (3 credits) **LIM 300: User Needs and Services** The general purpose of this course is to enable students to understand the theory, principles and techniques underlying information use and -seeking behaviour with special emphasis on applying user-centred approaches. The content covers Definition, Basic Concepts and History of User Study; Types of Users; User Studies and Human Information Behaviour; Models of Information Seeking Behaviour; Different Information Seeking Behaviours; User-centred Design; Information and Poverty and Everyday Life Information Seeking Behaviour; Community Information Needs and Services; and Evaluation of Reference and Information Services.

	ARM 300: Vital Records and Disaster Planning The course aims to equip students with skills for the management of vital records and the development and implementation of records disaster plans. Topics covered are types of disasters – natural and man-made; Identification of Potential Disasters and Risks Assessment in Organisations; Selection and Identification of Vital Records; Copying and Duplication of Vital Records; Onsite and Offsite Storage Facilities; Disaster Planning; Response and Recovery; Formulation of Disaster Preparedness Policies and Procedures; and National Disaster Management Strategies. **Optional Courses** IKM 300: Customer Knowledge Management (3 credits) IKM 301: The Knowledge Economy **Year 3 Semester 2 Courses** **ARM 301: Electronic Records Management** This course introduces students to the management of electronic records. It provides the skills and knowledge needed to manage electronic records throughout the records lifecycle and to take the steps required to transition from a paper to an electronic records environment. Topics covered are: The Nature of Electronic Records; Understanding the Concepts of Electronic Records Management; Preserving Electronic Records in a Trusted Digital Environment; Planning and Managing an Electronic Records Management Programme; Managing the Creation, Use, and Disposal of Electronic Records; Opportunities and Challenges of ERM Planning; Technological and Organisation Context of ERM and Managing an ERM Programme **ARM 302: Orality and Indigenous Knowledge Systems** The course introduces students to oral traditions and indigenous knowledge systems, their role in society and their capture and management. Topics covered are: Role of Oral Traditions in African Societies; Colonial Interpretations of the African Past; Role of Archivist and Archival Institutions in the Collection and Preservation of Oral Tradition; Forms of Oral Traditions (including story-telling, song and performance), Oral Traditions and Written Records; Oral Traditions and the Media; New Approaches to Collecting and Documenting

	Oral Traditions (including transcription, video and video representation); Oral Traditions in the Electronic Age; Training (skills) in Conducting Fieldwork; Ethical Considerations in Fieldwork and Problems Associated with Oral Traditions **IKM 302: Research Methods in Information and Knowledge Management:** The purpose of the course is to introduce learners to research methodologies in knowledge management. Topics covered are Cognitive Maps; Literature Search; Statistics; Writing; Qualitative Methods; Mixed Methods Research; and Good Examples of Information and Knowledge Management Research. **IKM 303: Industrial Attachment** Placements are an integral part of the BIKM programme. They are incorporated into the courses and earn credits. During the third year of their study, students are expected to undertake a six-week up to a year placement in industry to gain practical experience, assist their academic learning and boost their employability after graduating. Through the placements, students not only acquire skills as they put their knowledge into practice, but also develop their career plans. The placements are offered each year. All students are supervised by a tutor from the school. All placements are assessed based on a written report, an oral presentation during visitations and an assessment report from the company. **Optional Courses** LIM301: Business Information Systems (3 credits) LIM302: Content Management (3 credits) LIM303: Health Information Systems (3 credits) LIM304: Information and Society (3 credits) **Year 4 Semester 1 Courses** **ARM 400: Access and Reference Services** This course covers archival concepts and principles and their impact on archival access. The topics covered are Principles Governing Access to Archives; Search Room Layout; Design and Equipment; Retrieval Processes and Procedures; Administering Archival Reference Programmes. Types and Uses of Archival Finding Aids; Archival Ethics, Protecting and Preserving Archives while Administering Access; Legal Issues and Related Concerns in Access to Archival Records; Marketing and Promotion of Archival Services. **LIM 400: Project Management for Information Professionals**

	This course provides students with an overview of project management as it relates to projects undertaken in today's libraries, archives and information/IT sectors. It also introduces project management theory and practice, with an emphasis on the practical skills required to work successfully within a team-based environment. The course sensitises students to concepts of project management, project management techniques and software. The following are some of the topics that are covered under this course; Introduction to Project Management; the Project Life Cycle; Working with Project Teams; Tools and Processes for Project Management; Communication; Decision-making and Risk and Evaluation. **LIM 401: Marketing of Information Products and Services** The course teaches students the skills needed in the design, packaging and customisation of information products and services. It also aims to equip students with strategies and techniques for marketing information products and services. **Optional Courses** IKM400: Entrepreneurship and Innovation (3 Credits) IKM401: Competitive Intelligence (3 credits) One elective course One elective course **Year 4 Semester 2 Courses** **ARM 401: Managing Audio-Visual Archives** The course introduces students to the management of various types of audio-visual archives, including but not limited to still pictures, motion pictures and sound recordings. Topics covered are: Types and Nature of Audio-visual Records; the Importance of Audio-visual Materials to Society; History, Handling and Storage of Films; Photography, Video, CDs, DVDs, Maps and Plans; Works of Art; Appraisal and Selection of Sound Records; Handling and Storage Requirement for Sound Recordings and Evaluating Audio-visual and Television Archives. **LIM 402: Legal, Ethical and Policy Issues in Information Management** This course exposes students to some of the legal, ethical and policy issues in information management. It covers the Definition of Concepts, Ethics, Legislation and Policy; and Overview of Ethical Theories and How They Inform Agency Policies and Practices. It examines selected policy issues relating to information and communications: Copyright, Intellectual Property,

	Privacy, Censorship, Equity of Access, Freedom of Access, Professional Liability and other issues; Legal Implications and Safeguards; and Issues and Challenges Faced in Developing and Implementing Policies within Organisations and Companies. **LIM 403: Project Work in Information and Knowledge Management** This is an independent study to be carried out by each student under an assigned supervisor. It aims to make students apply the knowledge gained in the Bachelor of Information and Knowledge Management (LIS option) to solving a particular problem in selected libraries or information centres. **Optional Courses** ARM402: Management of Records in Specialised Environments (3 credits) IKM402: Knowledge Management Strategies for Information Agencies (3 credits) LIM 404: Information Security (3 credits)

The inclusion of specified 4IR technologies in the LIS curriculum

The second objective of the study sought to establish the inclusion of specified 4IR technologies such as cloud computing, AI, ML and blockchain technology in the LIS curriculum at degree and postgraduate levels for both UFH and UB. The findings of the study from content analysis undertaken to show that despite the 4IR being so influential and impacting on the work environment across the globe, BKIM (Archives and Records Management) does not include 4IR technologies such as cloud computing, AI and ML and Blockchain Technology in its curriculum. The findings are contrary to those of Ngoepe et al. (2022) who opine that the knowledge economy is dominated by 4IR technologies, including blockchain technology and artificial intelligence. These have an impact on the way digital records are managed in organisations.

- **Master's level**

The second objective of this study was to establish the inclusion of specified 4IR technologies such as cloud computing, AI, ML and blockchain technology in their LIS curriculum at degree and postgraduate levels. The findings indicated that the Department of Library and Information Studies offered a an MLIS and a master's degree in archives and records management (MARM) for the training of library professionals and archivists and records managers.

The MARM programme extends over four semesters (six semesters for part-time students), leading to the awarding of a MARM. The programme includes coursework and dissertations. The first year consists mainly of course work, developing research proposal and a practical attachment. The essence of a practicum in LIS education is captured by Južnič and Pymm (2016:92) who said that:

> In Library and Information Science (LIS) courses, practicums serve as a specific bond between theory on the one hand and practical work and the profession on the other. In seeking to prepare graduates for the profession and for professional work, LIS programmes use practicums as a model to enhance the library school curriculum.

The coursework consists of core courses (common to library and information work, coded LIS) and courses specifically devoted to the theory and practice of ARM, coded REC. Optional courses can be selected from other departments and faculties at master's level. A practical attachment is undertaken after the first year, during the long vacation, for a period of two months leading to the development of a professional report under the auspices of REC 611. In their second year, students carry out their research and write a dissertation. The curriculum for MARM is as follows:

Table 2: Postgraduate programmes at the UB

Name of Programme	Course description
Master in Archives and Records Management	**Year 1 Semester 1** REC 601 Theory and Practice of Records Management REC 603 Advanced Course in Conservation and Preservation REC 606 Computer Applications for Archives and Records Management **Optional courses (one course is selected)** REC 605 Legal Aspects of Information LIS 620 Foundation of the Information Profession LIS 621 Theory & Practice of Cataloguing and Classification LIS 630 Technical Writing, Editing and Newsletter/Magazine Production LIS 634 Knowledge Management for the Information Professional LIS 635 Business Information Systems LIS 602 Database Systems LIS 607 Web Design and Multimedia LIS 628 Information Entrepreneurship Skills
	Year 1 Semester 2 REC 602 Theory & Practice of Archives Management REC 604 Electronic Records Management LIS 627 Research Methods and Proposals **Optional courses** REC 607 Managing Audio-visual Archives REC 608 Business Records Management REC 609 Archival Public Services, Systems and the Profession REC 610 Management of Specialised Records LIS 624 General Management in Information Services LIS 626 Information networks and networking (Pre: LIS 600) LIS 632 Special topics in information science & archives and records management
Master's in library and information studies	**Semester I: Core Courses** LIS 600 Computers and Data Communications LIS620 Foundations of the Information Profession LIS 621 Theory and Practice of Cataloguing and Classification REC 601 Theory and Practice of Records Management **Optional Courses**

	LIS 630 Technical Writing, Editing and Newsletter/Magazine Production LIS 634 Knowledge Management for the Information Professional LIS 635 Business Information Systems LIS 602 Database Systems LIS 607 Web Design and Multimedia LIS 628 Information Entrepreneurship Skills REC 603 Advanced Course in Preservation and Conservation REC 605 Legal Aspects of Information **Semester 2 – Core course** LIS 622 Information Storage and Retrieval LIS 623 Information Needs, Sources and Services LIS 624 General Management in Information Services LIS 627 Research Methods and Proposals REC 602 Theory and Practice of Archives Management LIS 636 Cataloguing Electronic Resources (Pr LIS621) **Winter vacation (core)** REC 611 Practical Placement **Semester 3** REC 700 Dissertation (Pr LIS627) **Semester 4** REC 700 Dissertation (Pr LIS627)

Similar to its undergraduate programme (BIKM – Archives and Records Management), the postgraduate programme (MARM) for the education of archives and records management professionals does not include 4IR technologies in its subject offerings.

Meanwhile, the MLIS programme extends over four semesters of full-time study and six semesters of part-time study in the single subject library and information studies, leading to the awarding of a master's degree in library and information studies. The MLIS programme consists of coursework and a dissertation. During the first year, it is mainly of coursework and developing a research proposal. The coursework consists of core courses in LIS, information science and courses specifically devoted to the theory and practice of ARM, including optional courses. Furthermore, a two-month practical attachment is undertaken after the first year, during the long vacation,

leading to the development of a professional report under the auspices of LIS729. In the second year, students carry out their research and write a dissertation.

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Content analysis revealed that the UFH's Department of Library and Information Science offers the undergraduate bachelor's degree: Bachelor of Library and Information Science. The Postgraduate Diploma in Archives and Records Management is only offered at postgraduate level. Graduates of this programme may progress to a master's degree in information studies and then to the PhD programme. The Postgraduate Diploma in Archives and Records Management programme introduces students to the management of archives and records in both the public and private sectors. The requirement to register for this qualification is any undergraduate qualification.

Table 3: Postgraduate programmes at the UFH

Name of Programme	Course Description
Postgraduate Diploma in Archives and Records Management	1. **Computer Literacy**: This module covers basic computers and computing course content. This module is offered by the university's Department of Computer Science. Interdepartmental training and development are promoted within the department 2. **History and theory of archives**: The module covers history and archives theory. Major archives theories such as Principles of the Original Orders, Records Life Cycle and *Respect des fonds* Concepts on archives management are covered in this course. Legislation aspects are also covered in this module. **3. Archives Administration:** The modules cover archives administration systems such as archives appraisal, accessioning, description and classification of records. Acquisition, access and legislative framework are covered in this course. The promotion of archives administration was also covered in this module. 4. **Records Management**. This module covers records management theories and the life cycle of records management systems. The registry management system, records management survey and, integration of the management system are covered in this module. The course also highlights signification of electronic records management systems.

	5. **Conservation and Preservation:** The module covers aspects of conservation and preservation of archives materials. Emphasis is on the preservation of archives materials and physical security of records. 6. **Internship:** Students are required to do some practical work in archives and records management environments to gain skills in and knowledge of archives management.
Elective models	**Advanced Information Technology:** This module covers aspects such as database concepts: overview, models and application of database systems; history and motivation for database systems conceptional modelling, functions supported by a typical database, recent development and applications. Databases in information resource centres. **Systems Analysis and Design:** This module covers an introduction to the concept of systems theory: input, output and process. Systems analysis: people, organisation, data, technology and type of decision. System environment, competition, people, technology, capital, raw materials, data, regulation and opportunities, and system design tools. **Archives and Development:** This module covers aspects of governance, legislative framework, disaster preparedness and legislation. **Information Technology and Archives:** Students learns various information technologies for the creation, maintenance and retrieval of records and archives. The module covers developing.
Master's in Archives and Records Management	The content analysis found that there was no master programme focusing on archives and records management programme. The master's degree offered by the university includes information science, archives and records management programme.

The content analysis showed that UFH has not yet included cloud computing, AI, ML, blockchain technology and other 4IR technologies in its archival education educational programme offered at postgraduate levels, although they were slowly being embedded in the workplace. Furthermore, a Postgraduate Diploma in Archives and Records Management is offered to postgraduate students. The master's programme is offered as general information science inclusive of information science. According to Tsabedze (2019), the archives and records management profession in Africa, including South Africa, is still underdeveloped. This is worrisome since LIS with 4IR skills could innovate new business processes and services. This provides an opportunity for LIS to close this gap by exposing graduates to new skills required in the 4IR office environment.

Conclusion and recommendations

This study sought to investigate whether LIS in the selected universities of Botswana and Fort Hare in South Africa have included 4IR technologies such as cloud computing, AI and ML, and blockchain technology in their curricula. In view of the findings of the study, the following are recommended:

- The two universities should consider including 4IR technologies in their LIS course offerings as a response to the 4IR office environment. The 4IR office environment demands an application of new skills and knowledge. Mosweu and Ngoepe (2019) opine that knowledge and skills for archives and records management professionals are crucial in ensuring that archives and records remain accessible to promote accountability and governance, despite disruptions brought by 4IR technologies. According to Ngoepe et al. (2022), 4IR technologies such as blockchain technology and AI influence the manner and context in which digital records are managed in organisations. It is thus imperative that curricula are revised to include technology-based subjects and practical topics to help graduates learn and understand the technology as applied in their work environment (Al-Htaybat, Von Alberti-Alhtaybat & Alhatabat 2018).

- The LIS department should undertake stakeholder engagement, collaboration and partnerships, as these will result in a comprehensive curriculum that meets the needs of the industry. Collaborative efforts should be established with industry for practical demonstrations. The same industry offers an opportunity for experiential learning to graduates to put what they have learnt as theory at university into practice in the work environment. Mosweu (2019) notes that formalised agreements between academic institutions and industry can be beneficial to both, as industry would to support experiential learning needs while the host organisation benefits from student contributions in the work environment. This collaboration may include LIS considering offering joint degrees with related schools, departments and colleges (Markey 2004).

- Instructors at the universities need to be reskilled to offer a curriculum that includes 4IR technologies. This can be done on a continuous basis while the curriculum is being revised. Lubingaa, Maramura and Masiya (2023) acknowledge the demands and changes brought by the 4IR and suggest that educational institutions must create comprehensive skill plans to document and address the technological needs of their staff members. In addition, change management must form an integral part of introducing the 4IR to help staff members realise the increase in productivity that comes with adopting the 4IR, including its ability to reduce time spent on tedious tasks.

- The study recommends that in the revamping of the LIS curriculum to include 4IR technologies, benchmarking should be undertaken with other universities locally and internationally. For example, the University of South Africa has revised its curriculum to make it relevant to digital transformation brough by 4IR technologies.

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