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Framework to Infuse Data Science in the Archives and Records Management Curriculum in South Africa

Makutla Mojapelo and Ngoako Marutha
Department of Library and Information Science
University of South Africa
Pretoria, South Africa
mojapmg@unisa.ac.za
emarutns@unisa.ac.za

Abstract

Current trends in technology dictate how archives and records management fraternity should take action to remain relevant in the industry. The mode of operation illustrates that current business strategies intend to go fully online without any physical records to be managed. Records practitioners are thus systematically becoming irrelevant and unemployable. This study sought to investigate a framework to infuse data science into archives and records management curriculum in South Africa. This qualitative study relied on literature review to explore a framework to infuse data science into the archives and records management curriculum in South Africa. The study discovered that archives and records management education is still lagging technology; this may result in candidates with impressive qualifications but dated knowledge and expertise. The study recommended an infusion of data science into the archives and records management curriculum, using the proposed framework to guide the process. It is hoped that this will enable institutions of higher learning to upskill students in line with the growth in technology and modus operandi.

Keywords: Data Science, Archives and Records Management, Records Practitioners, Curriculum, South Africa

Introduction and background

The archival profession, just like any other profession, is believed to be threatened by the way technology is growing, not just in South Africa but across the entire Eastern and Southern Africa Branch of the International Council on Archives (ESARBICA) (Garaba, 2015) and throughout the world. Several scholars such as Usman (2021), Mosweu and Cheterera-Zambuko (2021), Modiba, Ngoepe and Ngulube (2019) and Ngoepe (2016), broadly explained how disruptive technology had left archives and records professionals with no choice but to embrace technological development in order to improve the quality of service. This advancement in technology requires archives and records management (ARM) training institutions to ensure they offer an ARM curriculum designed to respond meaningfully to industry needs. Surprisingly, Katuu (2022) reports that insufficient effort is made by ARM institutions in Africa since they have not featured technology in their curriculum. In designing the ARM curriculum, attention should focus on transformation and decolonisation in education, in general, which has captured the recent interest of many scholars, including Motala, Sayed and de Kock (2021), as well as Cherington, Botha and Kleet (2018). Saurombe (2018) claims the inability to decolonise education is part of the structural problems hindering curricula designs that address societal needs. According to Saurombe (2018), the higher education curriculum's transformation is a matter that needs buy-in from all stakeholders rather than being left to academics only.

The poor state of records management in South Africa's public sector has been under scrutiny for quite some time, with several scholars (Marutha, 2019; Masuku and Ngulube, 2019; Mosweu, 2019; Netshakhuma, 2019; Ngoepe, 2016; Katuu, 2015; Saurombe and Ngulube, 2016) stating that the situation is compounded by a lack of skills and the appointment of officials without relevant qualifications and experience. One would argue that the root cause of this unfortunate trend might be centralised on the quality of education that professionals receive, which needs to be thoroughly interrogated with a common view to find solutions. Ngoepe and Katuu (2017) concur that research and training in ARM has not received the required attention in many sub-Saharan African countries. This view is confirmed in a study by Onyancha, Ngoepe and Maluleka (2015), who found only a small portion of institutions offer ARM qualifications in sub-Saharan Africa. Of the 26 universities in South Africa, only 10 offer Library and Information Service education and training, and of these, only four offer ARM education and training. The higher education institutions (HEIs) in South Africa that offer education and training in ARM are the University of South Africa (Unisa), University of Fort Hare (UFH), University of Zululand (Unizulu), and the University of Johannesburg (UJ) (Onyancha, Ngoepe and Maluleka, 2015; Khayundi, 2011).

Experts in the area of ARM further lament that graduate-level education is characterised by several challenges such as "poor quality of education materials and outdated programmes and education approach based on the mode of learning which encourages memorization as opposed to critical thinking, problem solving and creativity" (Katuu, 2009). Education and training is the only available tool to empower archivists and records professionals to cope with the challenges associated with governance and trust in dealing with digital records (Ngoepe and Katuu, 2017). Eastwood (2017) is thus correct to suggest that archival education goes a long way in what he best categorises as a "cultivation of archivist's mode of thinking", which influences everything the archivists do in pursuance of their business activities.

The greatest challenge that the archival profession is confronted with is the appointment of records management officials without relevant qualifications. For example, in a survey to investigate medical records' role in the provision of public healthcare services in the Limpopo province of South Africa, it was found that 70% of the respondents had never attended a single formal records management training session (Marutha and Ngoepe, 2017). Given all the obvious challenges that the archival profession in southern Africa is facing, it is thus critical to investigate the role and responsibilities expected to be fulfilled by educational institutions. Wamukoya (2015) asserts that higher education institutions can play a significant role in attracting young people by revamping academic challenges and entrenching technology-oriented courses, as this will go a long way in fostering new skills and competencies.

Challenges in Archival Education and Training in Southern Africa

Several scholars, including Mosweu (2019), Katuu (2015), and Katuu and Ngoepe (2015), emphasise various challenges in ARM education and training in southern Africa. There seems to be a consensus amongst researchers that the problems archival professionals face are similar in all southern African countries, where the archival curriculum surprisingly appears unstandardised despite efforts to collectively deal with similar problems in the profession. For example, Khumalo and Baloyi (2019) mention the appointment of unqualified personnel to records management positions in the public sector in the ESARBICA as one of the reasons for consistent poor record management. In support, Mosweu (2019) is of the view that records and archives professionals in the ESARBICA region have not received the required education and training due to inadequate funds. Most public entities in the ESARBICA do not prioritise education and training when making decisions on budget allocations. The lack of standardised archival curricula offered by African countries also necessitated the International Council on Archives' (ICA) strategy to prioritise education and training in Africa, as already indicated earlier.

It is evident that challenges in the records and archives profession are common in the ESARBICA regions, justifying the ICA's call to standardise archival education in South Africa. Garaba (2015) calls for a transformation of archival education and training in ESARBICA on the basis that there is

obvious evidence the region is unable to produce "fully grounded" information professionals. According to Garaba (2015), the digital technology component is not adequately featured in the curriculum, which presents numerous challenges for graduates confronting 21st-century realities. This stance is also confirmed by Ngoepe and Katuu (2017), who concur that the curricula of South African universities offering ARM education and training do not embrace digital records in the same comprehensive manner as universities in countries such as Canada and Australia. Duranti (2007) postulates that archivists need continuing education to acquire new skills and keep abreast of developments in the field.

Therefore, it cannot be business as usual for ARM professionals who continue to learn archival theories meant for the traditional management of records. Marciano, Lemieux, Hedges, Esteva, Underwood, Kurtz and Conrad (2018) state that traditional archival science should be reviewed with the intention to merge computer science or data science with archival science in order to respond positively to the needs of the large data environment. Indeed, Mosweu and Ngoepe (2019) are correct to suggest that the digital age requires a skilled and knowledgeable workforce with the capabilities to ensure the proper management of digital records. A study by the InterPARES Trust highlights some of the archives and education programmes offered by various universities in Africa (Katuu and Ngoepe, 2015).

Inclusion of data science

One of the key elements that is not covered or included in information and records management is data science. Simplilearn (2021) underscores that data science is one of the most-needed subjects in the industry today, considering the high production of data, which comes in large volumes and at high speed. Data science has started frequenting the industry's daily agenda in their regular meetings with the intention to implement it for growing their business and production (Simplilearn, 2021). Oracle (2021) claims there has been a shortage of data science professionals since the concept was discovered in early 2008, as presented in several journal publications, including "The data science" by the International Council for Science. Sharma (2020) views data science as "the future of Artificial Intelligence", while Oracle (2021) sees it as "a subset of artificial intelligence" together with machine learning.

Data science is related to a multidisciplinary field, as it is "a blend of various tools, algorithms, and machine-learning principles with the goal to discover hidden patterns from the raw data" (Sharma, 2020). This implies that any information related to research is covered in the data science functions or subject matters. These include records management, archives management, information management or information science, computer science, big data management, the Internet of things, information and knowledge governance, and digital curatorship, to list a few. For instance, Oracle (2021) emphasises that "data science combines multiple fields including statistics, scientific methods, and data analysis to extract value from data". According to Simplilearn (2021), data science is "the domain of study that deals with vast volumes of data using modern tools and techniques to find unseen patterns, derive meaningful information, and make business decisions". The Sol Plaatjie University (2021) explains that data science is a solution to the problems attached to big data with the integration of fields from multi-disciplines, using "scientific methods, processes, algorithms and systems to extract knowledge and insights from structured and unstructured data". It further states that it is meant to address the challenges pertaining to skills shortages in the industry (Sol Plaatjie University, 2021). The Sol Plaatjie University offers a Bachelor of Science in Data Science degree with a strong mathematics, statistics and computers science core. According to Sol Plaatjie (2021), the degree is designed to produce graduates who are highly qualified and skilled to confront challenges faced by the industry.

Sharma (2020) and Simplilearn (2021) further mention that data science involves looking at different angles of data history processing, data exploratory analysis, and the application of machines that are advanced enough to learn algorithms and zoom into future incidents. Data scientists are thereby able to make decisions and predictions from "predictive causal analytics, prescriptive analytics (predictive plus decision science) and machine learning" (Sharma, 2020). Simplilearn (2021) states that data science illuminates the key causes of problems, promotes an exploration of data, ensures

data modelling with algorithms, and visually communicates and shares data graphically using dashboards, tables and many more. Advanced technology is required for data processing and analyses because, unlike in the past, most current data are not structured or are partially structured and difficult to process and analyse using our ancient traditional modes (Sharma, 2020). There are several matters that may result in data science not being functional, such as data scientists not working efficiently due to difficulties in accessing data, usable machine learning not being accessible to application developers, IT administrators spending too much time on support, and business managers not being focused on data science (Oracle, 2021).

Moreover, Oracle (2021) emphasises that data science is still a very young speciality emanating from fields such as "statistical analysis and data mining". In support, Simplilearn (2021) claims it is a prerequisite to understanding concepts such as machine learning, modelling, statistics, programming and databases when learning data science. Candidates will need to familiarise themselves with data analysis, data warehousing, data visualisation, and machine learning. Oracle (2021) further shows that 'data scientist' is the title for people practicing data science in the organisation or information industry, and these individuals are typically multi-skilled in analysing data from different sources, such as smartphones, customers, websites, and sensors, amongst others. Business managers, IT managers and data science managers are the overseers of data science processes (Oracle, 2021). Some of their duties include data analysis, data preparation for analysis, data exploration, and visualisation with language of programming (Oracle, 2021). Sharma (2020) further explains the role of data scientists as follows: Data scientists are those who crack complex data problems with their strong expertise in certain scientific disciplines. They work with several elements related to mathematics, statistics, computer science, and many more (though they may not be experts in all these fields). They make significant use of the latest technologies in finding solutions and reaching conclusions that are crucial for an organisation's growth and development. Data scientists present data in a more useful form than the raw data available to them in structured as well as unstructured forms.

Contribution of Professional Associations

Professional associations in many countries around the world have been instrumental in influencing several aspects and people's perceptions of the profession. While Mojapelo and Ngoepe (2022) listed several professional associations that contribute to the archival profession, the current study was only interested in archival education and training. Mojapelo and Ngoepe (2022) are of the view that professional associations can make a meaningful contribution toward curriculum development at institutions of higher learning, particularly because some of these institutions are members of such associations. Ultimately, professional associations' involvement will ensure that the curriculum is aligned with the actual societal needs. In the case of South Africa, the Higher Education Act (No. 101 of 1997) stipulates that all HEIs must provide education and training that promote the development of appropriate skills and innovations to meet the country's economic and development needs. In South Africa, currently, there is one professional association by the name of the South African Society of Archivists (SASA) advocating for ARM, including education (SASA, 2021). SASA is using conferences, workshops, and academic articles to promote ARM education (Mojapelo and Ngoepe, 2022). At the regional level, ESARBICA is one of the regional branches of ICA in Africa, like the Caribbean Regional Branch (CARBICA), the Central Africa Regional Branch (CENARBICA), and the West African Regional Branch (WARBICA) (ICA, 2016).

Research Problem

The National Development Plan lists quality education as one of the country's non-negotiable goals (National Planning Commission, 2014). With the rate at which technology is significantly impacting the work of ARM professionals, there is a need for institutions of higher learning to produce graduates with the necessary skills to confront industry needs. Indeed Ngoepe, Jacobs and Mojapelo (2022) are correct to say African countries require higher education institutions that are responsive to real problems facing professionals and consistently review their programmes to accommodate new developments. After seeing a similar need to develop new skills, Europe initiated the European Data Science

Academy (EDSA) project, which aimed to bridge the data science gap (Mikroyannidis, Domingue, Bachler and Quick, 2018). The EDSA project ran between 2015 and 2018 and developed learning materials necessary to close skills gaps in data science in the European Union. Currently, academic institutions in South Africa are entrusted with the responsibility of producing graduates who are capacitated to render proper and efficient records management. The question of whether academic institutions are able to fulfil this requirement is answered in this study.

According to Katuu (2022), institutions offering formal ARM qualifications in South Africa include University of South Africa, University of Fort Hare, University of Johannesburg, University of KwaZulu-Natal, and University of Zululand. Data science does not feature as a module in the ARM programmes offered by the aforementioned universities, but the researchers acknowledge Unisa's introduction of a digital records curation qualification. It offers graduates the opportunity to take advantage of technology to introduce innovation in their workspaces (Ngoepe, Jacobs and Mojapelo, 2022). The government is also looking for data-driven methodologies and relevant tools to render efficient public services (Marivate and Moorosi, 2018).

Research purpose and objectives

The purpose of the study was to investigate a framework to infuse data science in the ARM curriculum in South Africa. The study's specific objectives were to:

- explore how data science may be infused into ARM qualifications in South Africa, and
- propose a framework to guide the infusion of data science as a standing module for ARM qualifications in South Africa.

Methodology

This qualitative study relied on a literature review to explore a framework to infuse data science in the ARM curriculum in South Africa. Universities used as the population of the study are the universities listed by Onyancha, Ngoepe and Maluleka (2015) and Khayundi (2011) as institution offering ARM programmes namely: University of South Africa (Unisa), University of Fort Hare (UFH), University of Zululand (Unizulu) and the University of Johannesburg (UJ).

In identifying appropriate literature, the researchers used key concepts from the title of the study to search for literature through the Google search engine. The search engine provided substantial results with summaries of the content and links to appropriate web addresses. Some links in the results led the researchers to websites and journal databases with relevant articles. These were opened and reviewed for discussion in the study. This process allowed the researchers to review the results until saturation was achieved, when the researchers determined they reviewed sufficient sources or there were no additional relevant sources in the list of results. The researchers were satisfied with the amount of information uncovered, and this led to a discussion on the findings from the reviewed literature. The researchers were able to discuss the findings, make recommendations and offer concluding remarks for the study.

Research Findings

The following presents research findings obtained from the literature.

Infusion of Data Science in ARM Curriculum

Based on the literature, the following institutions in South Africa offer education and training in ARM: University of South Africa, University of Fort Hare, University of Zululand, and the University of Johannesburg (Onyancha, Ngoepe and Maluleka, 2015; Khayundi, 2011). Each institution will be discussed separately.

University of South Africa

Apart from being the first public institution to teach exclusively by means of distance learning in South Africa (Unisa, 2023), Unisa is also a leading institution in the provision of education and training for records professionals in South Africa. According to Ngoepe, Maluleka and Onyancha (2014), Unisa was the leading institution in ARM research in 2014, and the reason for this was discovered to be because the institution offers ARM qualifications. In terms of qualification listing on the university website, Unisa offers ARM qualifications from undergraduate to postgraduate level. Formal ARM qualifications offered by Unisa are as follows: Bachelor of Arts

(Major in ARM); Bachelor of Arts Honours in ARM; Master of Information Science and Doctor of Philosophy in Information Science. In terms of the curriculum for each qualification level, there is no infusion of data science. Although Ngoepe, Jacobs and Mojapelo (2022) share that the honours in ARM at Unisa cover aspects such as diplomacy, digital forensics, knowledge governance and data curatorship which is in line with the content recommended by InterPARES Trust. Unisa's ARM honours programme was informed by the research by the InterPARES Trust through Team Africa, which recommended that the International Council on Archives (ICA), through its Africa Programme, must develop standard study material to be used by African countries with a view to standardise records management curriculum across Africa (Katuu, 2018).

University of Fort Hare

Just like Unisa, UFH offers ARM as a postgraduate diploma. Much as the module entails Information and Communication technologies – it is mainly focused on traditional records management. Most of the information technology modules are electives (UFH, 2023) as opposed to being compulsory which means students can use their intuition to decide which one they would like to take. Some of the modules offered entails preservation and curation; archival theories and principles; and archives administration. Based on details provided above, UFH does not offer programme of modules in data science.

University of Zululand

According to Ocholla (Ocholla and Botha, 2007), the following are some of the qualifications offered by Unizulu: Bachelor of Arts in Library and Information; Honours Bachelor of Library and Information Science; Masters in Library and Information Science and PhD in Library and Information Science. Unizulu offers a records management as a module within a broad undergraduate qualification in Information Science (Shongwe and Ocholla, 2011). The Bachelor of Arts in Information Science, which is the entry level for information science programmes, offers the students with knowledge, skills and attitude for information and knowledge management. Students who are enrolling for the programme are also equipped with records management and archival knowledge skills (Unizulu, 2023). As per the course outline, students will also be exposed to electronic records management (Unizulu 2023).

University of Johannesburg

University of Johannesburg offers a qualification in information management which is under College of Business and Economics, Department of Information and Knowledge Management. According to University of Johannesburg (2023), this qualification provides students with intellectual competencies and practical skills in the acquisition, analysis, interpretation and application of information management principles in different settings. For one to be admitted into the qualification, you need to have obtained 50% in English, 50% in Mathematics or 70% in Mathematics literacy. Although the undergraduate qualification doesn't offer anything related to data science, it is acknowledged that honours programme does offer content on data science. The honours programmne prepares students to be Business Analysts and Web Content Managers. Some of the modules offered at honours level are: Business Intelligence; Competitive Intelligence; Knowledge Management and Web and Intranet Management. At the undergraduate, some of the modules include: information management, social media management and business management.

Discussion and Recommendations

Based on the results obtained from various university websites, it is clear that data science has not been infused in various ARM curriculum. It is vital to have necessary skills to infuse data science into ARM curriculum and practices. Gone are the days when records practitioners' and archivists' responsibilities were limited to maintaining information materials and controlling access. It is high time that information professionals like records managers, archivists, and librarians get involved in organisational planning, improvement, management, and growth. As information professionals, records managers and archivists must acquire skills that will contribute to management planning and the development of the institution to which they belong. Infusing data science into the curriculum will enable them to acquire skills and expertise that will make them competent in interpreting the current data contained in the records

within their custody. They must be able to predict or foresee the future of their organisations in terms of different functions, whether positive or negative. With this information and expertise, records practitioners will also be able to serve in the role of management advisors. This kind of specialisation may lead to the profession and practitioners gaining recognition within the organisation, especially from management. The appointment professional records practitioners and having this kind of function in organisation's organogram may be a priority for many organisations. These individuals may substantially assist leaders without extensive information analysis skills to make information based-decisions.

More importantly, data science's infusion into the curriculum may lead to archives, records and information professionals remaining relevant within their field of expertise. Current trends in technology mean skills in filing and retrieving paper-based information will no longer be relevant and will become a thing of the past. Therefore, it is important that the ARM curriculum also reshape professionals' responsibilities in the forms of technology that dictate the new ways of doing things. It is very important to understand that with the current technology, depending on the nature of systems, data will be born into the system as administrative activities are being discharged automatically, and systems may automatically do many other records management administration such as capturing, classification and arrangements, protection with safety and security measures built into the system, metadata creation, access control and distribution, as well as disposition according to the value in different records as programmed.

Figure 1 provides a framework to illustrate how data science may be infused into the ARM curriculum or qualification in South Africa. Nevertheless, it takes considerable effort for the institutions of higher learning to successfully establish data science-infused ARM qualifications. The findings revealed that institutions offering ARM have not infused data science in their curriculum which eventually limits records and information professionals in terms of skills and knowledge. Students needs to gain insights into vast amount of data their prospective companies would be generating. Data science is regarded as a scarce skill in South Africa.

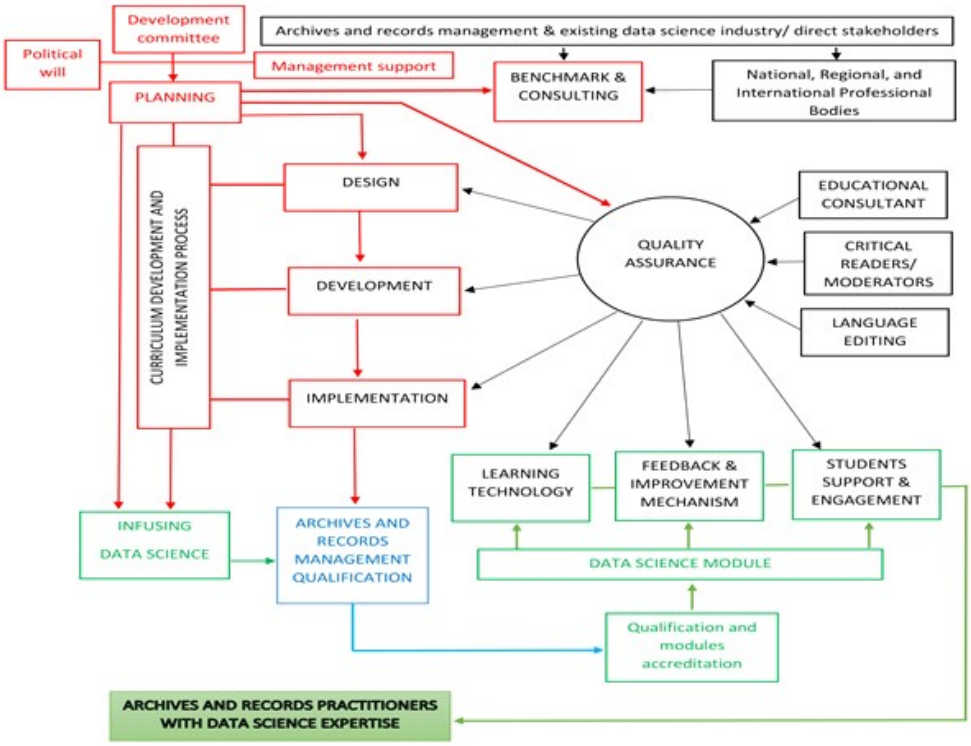

Figure 1: Framework to infuse data science in the archives and records management curriculum in South Africa

Looking at the framework demonstrated in Figure 1, the process may commence with planning, as illustrated in the red interconnections. The institution will start by establishing a working committee comprising diverse specialists to commence with the development or review of the curriculum with the intention to incorporate data science. The working committee should be headed by a senior academic staff member appointed by the head of the ARM department within the institution. This group of experts may include archives, records and information professionals, curriculum development experts and many others so that they close any existing gaps during the development process. In order for this team to succeed in their task from planning to implementation, they will need management support from within the institution, as well as political will from within and external from the department of higher education and training. The committee will start by planning their benchmark and consulting with groups of experts from professional bodies, industry, and direct stakeholders. These groups have expertise and background in ARM as well as science and technology. Their role is advisory regarding the content and implementation of the curriculum. The team will also need to plan quality assurance measures in terms of module design, development and implementation to be discharged during the development and implementation process. This will entail educational consultants, critical readers or moderators and language editors being involved during the design, development and implementation processes.

The second next step will be curriculum development and implementation. The team will start the hands-on activities of designing, developing and implementing the module using assigned academic professionals involved in teaching and learning. During this process, the team will consider strategies to infuse data science into the ARM qualification either as a standalone module or in different related modules already in the curriculum. Prior to implementing the module and/or qualification, the institution should obtain accreditation from appropriate government bodies within the country, such as the South African Qualification Authority (SAQA) in terms of the South African government. Upon obtaining accreditation, the institution may start rolling out the new qualification to students, preferably using current modes of teaching and learning based on technological trends. Institutions may need to acquire appropriate technologies to render teaching and learning to students. Appropriate technology should enable student-lecturer interaction, with the lecturer being able to guide students with feedback and mechanisms to improve their performance. Generally, the system must enable both the learner and lecturer to engage with each other as a form of student support. This process will promote archives and records practitioners who are equipped with data science expertise in line with the current trends in technology.

Conclusion

In conclusion, data science appears to be a very serious and urgent requirement to address the skills and expertise gaps amongst archives and records practitioners. In the current situation, institutions of higher learning offering ARM seem ignorant about their shortcomings. Challenges also result from the gap in interactions between education providers and industry professionals who attain employees or candidates with skills gaps that require further development by the employer or industry. It is also crucial that institutions of higher learning plan their curriculum wisely to avoid gaps in their end-product, since this will not help their students. If institutions of higher learning do not take this seriously, the industry will eventually race ahead of them and their products as students become unemployable. For instance, ARM practitioners will still be equipped with ancient modus operandi that includes physically filing and disposing of records while the industry is now fully electronic. Instead, now that technology is able to perform all physical responsibilities, practitioners should be able to assign themselves to data analysis and interpretation roles to guide management in future decision-making, problem-solving, and during business planning. Moreover, it is hoped that the generic framework provided in Figure 1 will help institutions of higher learning in infusing data science into the ARM curriculum in South Africa and across the globe.

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Ngoako Marutha is Full Professor in the Department of Information Science at the University of South Africa (UNISA). He also serves as a representative of the Unisa Department of Information Science on the International Council on Archives (ICA). He is a National Research Foundation (NRF) of South Africa C2 rated Researcher. He holds a Bachelor of Information Studies and Bachelor of Information Studies Honours from the University of the North (UNIN), now known as University of Limpopo (UL), Master of Information Science and Doctor of Literature and Philosophy from University of South Africa (UNISA).

Makutla Mojapelo is currently working as a Lecturer in the Department of Information Science at the University of South Africa (Unisa). He holds Ph.D Information Science.