The Fourth Industrial Revolution and Academic Library Practices

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Abstract

As we begin to fundamentally redefine our world, informed through the Fourth Industrial Revolution (4IR) lens, entire industries are gearing up for this disruptive event. Library practices have been no exception. With the advent of advanced digital technology, knowledge is becoming more readily accessible. This chapter focuses on how libraries need to respond, adapt, and transform to become meaningful spaces in our rapidly changing 21st century, within the 4IR and coupled with the restrictions of the pandemic. Tracing the evolution of technology over the centuries, the changing role of the library as a response to disruptions is discussed.

Keywords: South Africa; new trends; academic library; library practices; Fourth Industrial Revolution; 4IR; disruption; pandemic

Introduction

In 2003, Matthew Battles referred to the unquiet history of libraries, tracing the various ages of information, and the library's role. Despite its tumultuous history characterised by a recurring theme of fear and destruction, the library stands out as a tale of triumph in the pursuit of knowledge. As Battles (2004:11) eloquently explains,

> *In the stacks of the library, I have the distinct impression that its millions of volumes may indeed contain the entirety of human experience; that they make not a model for but a model of the universe. Fluttering down the foot-worn marble stairs that drop into the building's bowels, descending through layer after layer of pungent books, I am often struck by the sense that everything happening outside must have its printed counterpart somewhere in the stacks.*

According to Lyman (1994), a library is 'a place which defines the shared knowledge of a community and conserves its historical memory.' This is perhaps the most traditional concept of a library. The Covid-19 pandemic in tandem with the 4IR, encapsulated by rapid technological advances, has transformed

and overhauled entire industries, including libraries, which has necessitated a reimagining of operations. Klaus Schwab (2015) signalled the advent of the 4IR, arguing that it would fuse digital, biological, and physical technologies and blur the divide between the physical, digital, and biological spheres. As the pandemic raged at the beginning of 2020, it became apparent that higher education, and by default the academic library, would fundamentally need to undergo an overhaul. In 2017, a discussion at the International Federation of Library Associations and Institutions (IFLA) (Church, Butz, Cassell, Kamar, Swindells, Tallman, & Snellenberg 2017) observed that libraries increase literacy in society, produce informed and participative citizens, and are reliable information brokers. The focus of this chapter is to argue that the wide-sweeping changes prompted by the 4IR and pandemic lockdowns offer a rare window of opportunity for academic libraries to transform their services and, more importantly, create new vistas required by the users. The pervasive impact of the 4IR is visible across a multitude of spheres like banking, logistics, finance, and education. Our traditional experiences are now being subverted and the pace at which the required changes are needed, vary across sectors.

The library is undergoing an evolution 'to become less about brick and mortar and more about the access to knowledge in a digital sphere' (Marwala 2019). This is a pivotal transformation in a country such as South Africa, where the legacies of Bantu education, which represented a segregated education system based on race, still pervade. The Bantu education system was formulated to keep African education separate and inferior (South African History Online 2011). Access to knowledge has thus been shaped and honed by apartheid histories and exacerbated by deep inequalities in our society. Access to libraries is an essential vehicle in support of the goal of access to higher education. The creation of digital spaces can widen access that was previously relegated to a narrow audience.

The shift to online modes of learning has been a powerful tool in increasing access to education in South Africa, particularly when one considers the spatial limitations of institutions. It allows higher education institutions to target students beyond the capacity of classrooms, which has been important in beginning to provide solutions to the digital divide. Yet, it is crucial to outline that this still does not address the vexed issue of leaving people behind because of a lack of access apparent through the digital divide (Marwala 2019).

One manifestation of this is the access or lack thereof to the internet. As a Statistics SA Report (Statistics South Africa 2017:120) states, "the proportion of households with access to the internet connection in South Africa grew significantly from 23.9% in 2009 to 62.2% by 2017.' The statistics indicate that although there was an increased access to internet connections in households in rural areas, there was a significant lag when compared to urban

areas indicative of South Africa's stark and prevailing digital divide. While solutions in the form of public Wi-Fi and national data interventions begin in part to address this and merit the discussions, it is apparent that there is a role for academic libraries to play in providing further access to knowledge. As the internet has demonstrated, the evolution of libraries also completely encompasses digital spaces. Mandal (2015) narrates: "The future library is bigger than all the world's historical libraries combined and smaller than a book on one of those libraries' shelves. Such a thing has only previously been conceived of in fiction.' Libraries have shifted towards information networking since the advent of the smartphone (Marwala 2019).

The Impact of the Pandemic on the Role of the Academic Library

As the Covid-19 pandemic spread globally in 2020, it became apparent that entire systems and processes would have to transform. Faced with the need for social and physical distance and due to national lockdowns, remote study, and work, there was a distinct shift towards online offerings, new networking, and co-working platforms, and the rise in popularity of e-learning modalities and sites such as Google Classroom. This represented the proverbial future library in practice.

Lozada (2020) asserts that the pandemic accelerated changes that were already underway, particularly the increasing reliance on digital technologies and a deepened digital divide. South Africa's digital divide, which is characterised by various factors such as internet access, skills, levels of education, and the pace of technological innovation, is representative of the country's deep inequality and inequity. It is apparent that our digital divide, just like many of the other inequalities, corresponds to race, gender, and class. In a country blighted by a growing chasm between the wealthy and the poor, the digital divide leaves vast swathes of our population behind (Marwala 2019).

University libraries with resources and a clear vision were already adapting and evolving to the digital environment before the pandemic. The library had to undertake significant business reengineering to contend with technological advances. This included a reconceptualisation of services and functions, reskilling staff to acknowledge that traditional jobs within a library environment would change significantly, and creating new systems prompted by the digital environment.

The library of the present has to look ahead and imagine the future library. The terror induced by the vision of 'the robots are coming' is completely false regarding libraries and the innovative ways in which the 4IR has been embraced. It resembles an explosion of knowledge spaces and a widening of access in multiple ways. The leveraging of new services and functions of the 21st-century library has the inherent possibility of pushing the

frontiers of research to new levels. For example, digital cataloguing enables the discovery of all written works related to a search within minutes. Whilst there was undoubtedly a pleasure derived from dwelling in the archives, it was conceivable to miss scores of relevant information. In the case of the fire that engulfed the Jagger Reading Room at the University of Cape Town (UCT) in April 2021, thousands of valuable items from the African Studies Collection were lost. Digitalisation could have mitigated much of the losses that occurred there (Satgoor 2021). Among the resources which were destroyed, were the majority of the African Studies Published Print Collection, the entire African Studies Film Collection on DVD and various government publications. A valuable lesson inherent here is that the university had already commenced digitising special collections and archives. If they had not, the losses would have been dire. Although there is value in having physical copies, it is apparent that we must invest in creating lasting digital copies if we are to preserve our resources, especially since the technology is available. Valuable lessons from the past have also taught us that our choice of digital resourcing is essential to ensure that it is lasting and not rendered obsolete with the advent of new technologies.

Leadership at the helm in higher education must invest wisely in creating the future library. It is unthinkable for higher education to leapfrog into the 21st century, leaving behind the critical cornerstone of a university – the library. While individual institutions may adopt different strategic pathways for overhauling libraries, there is also a need for national collaboration and international partners. Viewing the library as an edifice located in a physical space and geographically bound, is decidedly archaic. The library is no longer a gatekeeper for knowledge. The proverbial doors remain wide open on a 24/7 basis, cutting across all geographical boundaries. Embedded in this fact is the mega potential for widening access to knowledge, especially in a country with a deep legacy of inequalities and inequities.

The Impact of the 4IR on Academic Libraries

Managing the flow of information, knowledge, and resources has been a critical function of academic libraries. In a dynamic world where information rapidly changes, expands, and evolves almost at the same speed as technological changes, libraries can position itself as knowledge hubs. Historic libraries, whether in the seminaries of Africa or the early institutions of Europe, have served as spaces for sharing, organising, and widening access to knowledge, and documenting the intellectual histories and archives of states, regions, and cultural groups (Nampala, Kityo, Makuma-Massa, & Adipala 2017). Scholars, students, and public members have found refuge in the physical spaces of libraries.

The shifts and rapid transitions to technology are not new phenomena as, over the last three decades, knowledge mediated by evolving technologies have overtaken knowledge on paper. 'Ink on paper,' exemplified by the printed journals that lined the shelves of libraries along with hardcopy books, is now a rarity. With its vast computing power currently providing wider access, the internet provides its readers with a myriad of choices from around the world. The power of the devices used to access information, renders physical spaces, making paper-based resources irrelevant, unless these are repurposed and reconfigured to keep abreast with the changing digital revolution. While libraries have historically been a critical resource in organising, sharing, and curating knowledge, they are also at risk of becoming antiquated as information is increasingly digitised and available through ubiquitous technologies and platforms such as Google (Lewis 2007).

As higher education institutions transform, driven by artificial intelligence (AI) and cyber-physical systems, libraries need to be reimagined to embrace both the physical and virtual spaces (Xing & Marwala 2017:15). We need a combination of physical and virtual environments that can facilitate access to knowledge. With every user's potential to access a global library on their devices, the library has to lead the charge in creating these common spaces. What we need are smart libraries keeping abreast with smart new technologies. These are the rules of survival in the 4IR. The skills required in the 4IR are agility, resilience, responsiveness, and adaptability (Deloitte 2018). A library has to shed the cobwebs of the past, display its skills, and move into the future.

The rapid globalisation of the world economy in the latter half of the last century, and the accompanying expansion of higher education as a global industry, have both cemented and problematised the historical role of academic libraries, as the world continues to undergo an intense change (Lewis 2007; Jain 2013). The notion of a 'knowledge economy' has characterised these changes, given that knowledge and information flows have become an essential 'productive factor' in developing, innovating, and shaping global markets, social worlds, and cultural experiences (Shanhong 2000:3). It is not argued that the academic library will lose its value, but that its function will continue to be interrogated to re-evaluate the role of libraries in the 21st century and for the already present '4IR.' No university can exist without a library. Logically, if higher education institutions are transitioning into spaces where technology is not feared but embraced, it is rational that the library has to innovatively advance as well. Just like other spheres of society being impacted by the 4IR, even job functions within a library have to change. For example, at the University of Johannesburg (UJ), staff who were shelvers, have had to be reskilled to perform other tasks such as running audio-visual equipment. During the lockdown periods, the library asserted its role in new

and exciting ways to continue providing access to resources to both staff and students. Using multiple technologies, events, training sessions, and repurposing digital spaces in creative ways, the library bolstered the academic programme as the university shifted to emergency remote teaching, learning, working, and researching.

The Opportunities Presented by the 4IR for Academic Libraries

It is a misnomer to claim that the industrial revolutions have followed each other consecutively. The reality is that the transitions overlap and co-exist with shifts not being heralded with warning signs. The Third Industrial Revolution (3IR), characterised by the enhanced use of digitisation, electronics, and information technology in productive and generative processes, is argued to transition into the 4IR through increased specialisation, hybridisation, and the use of inter-disciplinarity to solve complex social/economic/ecological challenges. In this sense, many of the concerns surrounding the role and function of libraries in the 4IR, have already emerged in the course of the 3IR, given the major impact of information technologies on the disruption of long-held processes, practices, and skills (Ocholla & Ocholla 2020:356). Given that the warning signs heralding change have been around for some time, the reimagining of a library is not a once-off event, but should have been a sustained change over the years with due attention paid to technological advances.

In the financial sector, an increased reliance on technology, big data, AI, and cloud computing has drastically changed the traditional roles of the accountant, for instance. By implication, the library also has to keep pace and be ahead of the race. What is not questioned is that libraries are much needed. To stay ahead and assure itself of relevance, libraries must be acutely aware of how knowledge is being created, stored, accessed, and retrieved. An additional layer understands the changing profile of users who have access to the internet, which opens the proverbial doors to information in many forms. It can be debated that it is not merely the adoption of technology required. The library has to be reimagined in terms of its functions, the form it presents, systems, and processes.

Regardless of how we grapple with the previous three revolutions, technological advances require us to adapt without discounting our challenges. Ultimately, however, many companies are afraid of adopting 4IR related technologies because of the perceived steep costs of new technology. This, it is argued, is far outweighed by the economic benefits of turning to AI or nanotechnology, for example. There is scope to incrementally add 16% or around $13 trillion by 2030 to the global GDP. When disaggregated, labour automation could add up to 11% or approximately $9 trillion, while product and service innovations could add about 7% or around $6 trillion (Bughin,

Seong, Manyika, Chui, & Joshi 2018). Libraries have a vital role in providing the kind of knowledge resources that can propel core industries towards innovation, practices, and avenues for growth.

Lewis (2007) offers a multi-pronged strategy for preparing libraries for the 21st century, suggesting that libraries are a means, not an end, and could maybe be displaced by more appropriate means (e.g., online repositories and databases) as the available technology develops. However, he argues that libraries still serve essential social and intellectual functions that should be emphasised and strengthened even as some of its other functions fall away (Lewis 2007). In his view, while some functions may become the operational concern of larger regional, national, and global bodies – such as the digitisation of print and legacy collections and the curation and management of new, large-scale databases – other functions are essential to the everyday knowledge projects of the universities with libraries, with the teaching, learning, and research enterprises that form its core work (Lewis 2007). For this reason, greater focus needs to be given to developing the resources, tools, and expertise that enable libraries and those who work in it to support students and staff in navigating and drawing maximal benefit from the new knowledge ecologies available to them. Libraries need to adapt to receiving digital resources, which require different forms of organisation to be accessible. Once again, changes occurring in other spheres have to be considered when a library adopts a trajectory of change.

Ocholla and Ocholla (2020:359), as well as Abubakar (2011:446) support this view when they suggest that academic libraries are increasingly required to provide services to its users, rather than be sole or primary sources of knowledge. Instead, people use libraries to identify multiple pathways to the knowledge they seek and draw on library services to support their (mostly) independent search for information and resources. In their review of library services at 26 South African universities, Ocholla and Ocholla (2020:360) found that several key avenues for future development exist that could strengthen the role that academic libraries can play in supporting students – including disabled students and those from marginalised backgrounds – as well as providing the kind of services that facilitate learning and successful teaching and research (Ocholla & Ocholla 2020:360). This is particularly significant, given the impact of the Covid-19 pandemic on the pivot to online learning and the fault lines of inequality that the pandemic has highlighted in the South African higher education sector and society more broadly. For university libraries to fully embrace the 4IR, it first needs to make full use of the possibilities enabled by the 3IR, including providing a positive and exciting user experience through its digital and online support services and library websites (Abubakar 2011:446; Ocholla & Ocholla 2020:360).

The Impact of the Pandemic and 4IR on Services Offered

Given that physical access to libraries has now been proven unpredictable due to the pandemic, it is essential that libraries' online presence provides a comparable, if not superior, experience to contact encounters. Equivalence of services should be a primary objective and bridge the gap for users who now need to be tech-savvy to utilise the library. This does not signal the end to browsing the aisles in libraries, but forms a segue into new forms of browsing.

The pandemic propelled higher education institutions to pivot around remote teaching and learning. This required all other services offered by universities to undertake a rapid turn to the online world. The UJ library reconceptualised services with agility, having already embraced technologies cognisant of the need to keep abreast and ahead of the disruptions of the 4IR. From mobile apps to chatbots, the library asserted and navigated the vagaries of the pandemic, proving that despite restrictions, a wide array of services could be provided. For example, the Makerspace in the library, bringing technology and creativity together, printed 7,000 face shields to support frontline staff during Covid-19. This is a far cry from consensual understandings of a library and its functions. The library has ramped up its online presence with outreach programmes for staff and students, an array of seminars and talks, robust library guides, and making its presence felt in the lives of the UJ community. These are some examples of the changing role of the library.

Jain (2013) maps out the major changes that exemplify the 21st-century library, a number of which bears repeating here. Academic libraries of the 21st century are now able to offer knowledge on-demand, rather than during operating hours; direct users to massive online databases where multiple users can access resources simultaneously, rather than relying on limited print versions; direct funds towards providing electronic resources such as computers and printers that facilitate independent work, rather than printed books and volumes; and support the digital curation and archiving of printed documents, grey literature, and out-of-print texts (Jain 2013). These changes are essential because it both disrupts existing library operations and carves out new avenues for growth and innovation for library managers and staff. Gorman (cited in Jain 2013:137) further expands on the five library science laws: Libraries should work for humanity; respect all knowledge communication media; intelligently use technology to improve service; safeguard open access to knowledge; and respect the past and build the future.

These 'laws' exemplify the role that libraries have to play in the transition to the 4IR, mainly that it can effectively act as leaders in a growing information revolution that critics argue would render these facilities obsolete. Instead, libraries can act as gateways or portals to the vast expanse of knowledge that is now readily available. Library services are geared towards

supporting the critical discernment and use of this knowledge (Jain 2013:143; Ocholla & Ocholla 2020:364). As the nature of the knowledge economy shifts and transforms, library services will be increasingly integral to ensuring that users develop the requisite skills to engage critically with much broader yet more uneven knowledge ecologies. As new forms of universities emerge (Xing & Marwala 2017), libraries, through the lenses of creativity and innovation have to evolve. Changes in higher education such as open and distance learning, online education ventures, virtual campus, flipped classrooms, m-learning, and learning management systems have brought about diverse patterns which require different types of information (Chutia 2015:258).

Libraries have evolved from their elite beginnings and are now widely and readily accessible to the public, providing access to knowledge as well as a space for communities. For a country like South Africa, where education has been unequally accessible, impacting access to knowledge, libraries can provide a dynamic space to address this by not limiting itself to a geographical area. This could mean providing access for all to the library, or libraries for all. This argument may be significant, given that the internet is such a rich resource.

The 4IR era is a time of disruption for libraries. Writing from an engineering background and being a Vice-Chancellor of a university, embracing technology is what we do naturally. No sector is impervious to the impact of the 4IR. For example, in the manufacturing industry, line operators can adjust the behaviour and operation of robotic arms in real-time on the user interface, which has increased their capability to support human operation and safety standards. Even a library can use robots to do menial tasks (Marwala 2020).

Despite misconceptions that the library has long been static, it is apparent that libraries have undergone a continuous evolution, albeit at a slow and steady pace. The library has certainly adapted to the technological revolution through automated systems, digitised collections, the introduction of computers, free Wi-Fi, and the provision of access to e-books and e-readers. It provides undoubtedly scope to adopt more technology such as *Ivy Guide*, a device attached to a pen to translate words (Marwala 2019). This is particularly attractive in a country such as South Africa, which has 11 official languages, often acting as barriers to access knowledge. Elsewhere, tools for translation can be used to ensure that indigenous knowledge is stored and collected from primary sources.

The NMC Horizon Report (2017:34) suggests that the shift in focus to digital resources will directly impact the role of library professionals who will need to learn evolving skills to develop the capability to employ the latest technologies for teaching, learning, research, and innovation. Within the 4IR, librarians need to extend their professional development.

The Horizon Report also observes a shift in how students use libraries and notes that students rely less on libraries as the primary source of information, and regard it more as a place of socialisation (NMC Horizon Report 2017:9). Students now expect to learn and work everywhere, with continuous access to learning materials and one another for collaborative learning. This offers new opportunities for staff and students to develop the kind of critical skills that enable them to transition into a rapidly changing global economy, the dimensions of which have yet to be fully revealed.

Conclusion

The role of libraries has not diminished. Its scope has expanded and as libraries expand, so too does knowledge. Like every sphere of society, the library is not impervious to disruptions and cannot be slow in transforming and innovating. The shift towards online modes of living, learning, and working in the context of the pandemic has redefined the role of the academic library, which has contributed significantly to the widening of access and the leveraging of new digital services. The library of the future is one that embraces both physical and virtual environments. Technology, big data, and AI are incredible tools that can open magical worlds of knowledge if the library is bold enough to look into the future to create brave new worlds.

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