Examining the Impact of Industry 4.0 on Academic Libraries

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INVESTOR IN PEOPLE

Dedication

I dedicate this book to my beloved husband Isaya Chigwada who is also dealing with the effects of the industry 4.0 at his work place, my son Nathaniel Takudzwa Chigwada whose wish is to be an engineer, and my daughter Joanna Thandaza Chigwada who wants to be a doctor. These people have been my pillar of strength and give me the zeal to write academic articles for publication.

Josiline Phiri Chigwada
Bindura University of Science Education, Zimbabwe

I dedicate this book to Udodiri, my loving husband and our children Chijindu, Ucheomachi and Jachimma Nwaohiri with heartfelt thanks for their loving support and constant inspiration.

Ngozi Maria Nwaohiri
Federal University of Technology, Owerri, Nigeria

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List of Abbreviations

4IR	Fourth Industrial Revolution
AFLIA	Africa Library and Information Associations and Institutions
AI	Artificial Intelligence
ALA	American Library Association
AR	Augmented Reality
AT	Assistive Technology
CAS	Current Awareness Service
CDP	Collection Development Policy
CD-ROM	Compact Disk-Read Only Memory
CPD	Continuous Professional Development
CPS	Cyber Physical System
DaMaHub	Data Management Hub
FOSS	Free Open Source Software
HEI	Higher Education Institutions
HIB	Human Information Behaviour
ICT	Information and Communication Technologies
IFLA	International Federation of Library Associations and Institutions
IM	Instant Messaging
IoT	Internet of Things
ISO	International Standards Organisation
JAWS	Job Access With Speech
LCoNZ	Library Consortium of New Zealand
LIASA	Library and Information Association of South Africa
LIAZ	Library and Information Association of Zambia
LIS	Library and Information Science
MARC	Machine Readable Catalogue
MAS	Minimum Academic Standards
MOOC	Massive Open Online Course
ODDS	Online Document Delivery Service
OPAC	Online Public Access Catalogue
RCZ	Research Council of Zimbabwe
RDA	Resource Description and Access
RDM	Research Data Management
RFID	Radio Frequency Identification

SCARLET	Special Collections Using Augmented Reality to Enhance Learning and Teaching
SCECSAL	Standing Conference of the Eastern, Central, and Southern Africa Library Information and Associations
SDG	Sustainable Development Goals
SDI	Selective Dissemination of Information
UN	United Nations
UNESCO	United Nations Educational Scientific and Cultural Organisation
VIAF	Virtual International Authority Files
VRS	Virtual Reference Service
ZIMCHE	Zimbabwe Council for Higher Education
ZIMLA	Zimbabwe Library Association
ZULC	Zimbabwe University Libraries Consortium

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Foreword

History has it that industrial revolutions have had tolls or impact on organisations and most of the time very catastrophic. Libraries whether big or small have also experienced the impact of industrial revolution at one time or the other. This book entitled *Examining the Impact of Industry 4.0 on Libraries* is a well-articulated attempt to capture the impact of the Industrial Revolution on libraries generally. There is no doubt that industrial revolutions have in one way or the other affected library functions, services or even the activities.

The publication of this book is very auspicious and timely considering the paucity of books in librarianship particularly the one that delved into this ugly experience on librarianship. The efforts expanded on the production of this book by these seasoned library scholars assembled around the globe is highly commended.

The book is divided into six sections each with corresponding chapter. Section one deals with "The Fourth Industrial Revolution and Libraries." This section has three chapters, namely:

1. Introduction to the Fourth Industrial Revolution and Libraries
2. The Fourth Industrial Revolution and Libraries
3. Library 4.0 and Sustainable Development: Challenges and Opportunities.

Section two which is entitled "Redesigning Library Space" has five chapters, namely:

1. Understanding the Information User in the Electronic Age
2. Application of Industry 4.0 in Delivering Library Services to Special Need Library Users
3. Compatibility Analysis of Virtual Reference Services in ABCD Software-based Website
4. Packaging and Repackaging of Information Products and Services for Effective Service Delivery
5. The Role of Librarian in the Twenty-first Century.

Section three entitled "Research Support Services in the Fourth Industrial Revolution" covers two chapters, namely:

1. Academic Library Research Support Services in the Maker Culture Era
2. Research Support Services in Academic Libraries in the Digital Environment in Zimbabwe.

Section four is broadly entitled "Quality Assurance of Library and Information Services" has two chapters, namely:

1. Quality Assurance of Library and Information Services in the Fourth Industrial Revolution to Achieve the Sustainable Development Goals
2. Quality Assurance and Marketing of Library Services and Products: The Case of Midlands State University.

Section five is entitled "Marketing of Library and Information Services" has two chapters, namely:

1. Marketing of Library Collections and Services in the Twenty-first Century Environment: The Use of Social Media Technologies
2. Do Libraries Need to Market Their Services and Resources?

Section six which is the last section is entitled "Capacity Building of Librarians in the Fourth Industrial Revolution" and it has two chapters, namely:

1. Capacity Building for Library and Information Science Professionals in University Libraries
2. Reskilling the Library Workforce for the Fourth Industrial Revolution.

The writers assembled different countries of the world here in their respective chapter presentations rolled out well researched papers for the benefit of librarians, educators, students of library and information science and the general public. I have no reservation in recommending this enviable text for all seekers of knowledge in librarianship and other related disciplines around the globe.

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Library and Information Science
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April, 2020

Preface

The Fourth Industrial Revolution (4IR) also known as the industry 4.0 is defined as the bringing together of economies, scale and economies of scope to produce new technologies, which will in turn adopt the use of computers, Internet of Things (IoTs) and cloud computing to monitor production processes (Postelnicu, & Calea 2019). It is changing how people live, work and communicate and many trades have been highly affected by the 4IR, libraries included.

This technological revolution called the 4IR is changing industries and the jobs within them and is described as a journey that industrial companies are taking towards a complete value chain transformation. Introducing connectivity, artificial intelligence, robotics and machine learning into the workplace has meant that employers no longer rely on their teams having a static set of skills, but instead, requires adaptable, digitally-minded workers that are committed to lifelong learning. This book therefore X-rays the ways and to what extent computers, IoTs, social media, artificial intelligence, data mining, robotics and machine learning has affected information acquisition, packaging, storage, and delivery. It would be sufficient to say that the above-mentioned technologies are just emerging and as such require up-to-date knowledge and skills fit for their use, as this will without doubt bring about enhanced information service delivery even to remote areas regardless of time and geographical location.

An informed society is healthy, knowledgeable and a literate society. Information and research findings are the hubs around which institutions, organizations and industries revolve for their existence and competitive advantage. Twenty-first century libraries must employ the main areas of Industry 4.0 such as IoT, artificial intelligence, big data and computers in information products, services and marketing which are in turn given out to institutions, organizations and industries for health services and economic growth. Hence, Hang, Thuy, & Tam (2018) report that

> the industry 4.0 is breaking the structure of almost every industry, foreshadowing the transformation of the entire production, management system and training. The industry 4.0 will be the foundation for a dramatic transition from a resource-based, low-cost to knowledgebase economy.

So long as universities and academic institutions are striving to boost their research and academic productivity through the development and implementation

of digital technologies in research, teaching and learning, the issue of reskilling and upskilling of these library staff cannot be over emphasized. Thus, Ntlotlang (2019) and Cardwell (2009) advised that libraries should conduct library staff skills audit exercise in order to identify each individual's strength, ability and skills gap so as to have in-depth understanding of library staff competencies in regarding of their role of the demands brought about by technological revolution.

The book comprises 16 chapters which serve as guide and information resource to library and information professionals. Library managers, heads of institutions and government policy makers can also benefit from the contents of the book to make available adequate funds and resources that will bring about technological revolution in libraries and the reskilling and upskilling of these information service providers who will make use of these technologies.

Organization of the Book

The book is organized into 16 chapters. Chapter 1 introduces the Fourth Industrial Revolution and libraries and how it is affecting the operations and services of all types of libraries. It also states that librarians should have the needed competencies and skills in the Fourth Industrial Revolution in order to remain relevant.

Chapter 2 showcases the changes that have been brought about by the Fourth Industrial Revolution and point out that librarians should not overlook those changes. It states that libraries should adapt and embrace the changes brought about by industry 4.0 to meet the needs of the different types of patrons that they serve.

Chapter 3 points out the challenges and opportunities of library 4.0 on sustainable development due to the Fourth Industrial Revolution. It highlights how libraries can take advantage of the disruptive technologies to meet the sustainable development goals. The challenges that are affecting libraries in embracing industry 4.0 are also explained.

Chapter 4 discusses the information users of all categories and the challenges they encounter in their search for information in this electronic age. The study went further to bring to light the concept of digital literacy, classification of understanding the information user in electronic age, studies dealing with Information need and challenges of the information user in the electronic age. Suggestions on how to reach out efficiently and effectively to users was made.

Chapter 5 addresses the problem of how industry 4.0 can support the special need library users in accessing and utilizing information services effortlessly, by combining theories, proposing strategic models, and articulating its opportunities for the special need users. The chapter concludes by providing an overview for librarians, library educators, students and researchers of how special need library users can be supported to access and utilize information services effortlessly using industry 4.0 components

Chapter 6 documents how reference services can be enhanced in the Fourth Industrial Revolution using ABCD library management software to create an online live chat called Zoho chat. This is a virtual reference service which is used to provide feedback to patrons in real time. The chapter is a step by step guide of

the customization process of Zoho chat via the library website using the ABCD site module.

Chapter 7 deals with how information can be repackaged in the Fourth Industrial Revolution so as to meet the needs of various users who use the library. These users have different needs and various backgrounds and some are techno savvy while others are advanced in the use of technology. This chapter unpacks the concept of information packaging and repackaging and the strategies that are used in providing library services and products to patrons.

Chapter 8 discusses the changing roles of librarians in the Fourth Industrial Revolution due to the rapid technological changes that are taking place. The challenges that are faced by librarians as a result of these technological changes are stated in the chapter as well as the need to build capacity among librarians to ensure that they are able to deliver their new roles.

Chapter 9 explains the maker culture where there are changes in space, infrastructure and service organization. This also affects research support and academic libraries should create research support services which suit the maker culture. It points out the importance of research in higher education institutions and how the researcher can relate to librarians in the maker culture era.

Chapter 10 documents the research support services in academic libraries in the Fourth Industrial Revolution. Libraries are obliged to be innovative in delivering research support services due to the changes that are brought about by the industry 4.0 era. The issues that are discussed in the chapter involve the relationship between librarians and researchers, challenges experienced by librarians when offering research support services, role played by the librarians, and a framework that can be used to render the research support services. The importance of a national policy and the need to train librarians in emerging issues was highlighted in the chapter to ensure effective services are rendered to the research community.

Chapter 11 deals with quality assurance in libraries so as to achieve the sustainable development goals. Libraries are regarded as the information hub of any institutions and patrons access such information as a way of understanding how they can contribute to the attainment of the sustainable development goals. In order to achieve that, there are standards which should be adhered to in order to offer efficient and effective services. All facets of the library including the library building, collection, human resources, service provision, qualification, library schools among others should meet these minimum standards that are laid down in various policy and procedures documents.

Chapter 12 is related to the previous chapter and this documents the quality assurance and marketing of library services at Midlands State University in Zimbabwe. This is a case study of what is being done at the institution in all service areas to offer efficient services to the clientele. An element of continuous professional development came out to ensure that librarians are able to move along with the changes that are brought about by the Fourth Industrial Revolution.

Chapters 13 and 14 document the marketing of library services and products in the Fourth Industrial Revolution. Marketing is regarded as an essential

component in the industry 4.0 era and libraries should seriously consider this in delivering services and products. Chapter 13 points out the importance of using social media technologies in marketing library services and products in the twenty-first century. This is another way of meeting the users where they are since most library patrons are now utilizing social media platforms to meet their academic needs. As a result, libraries now have official social media platforms that they use to communicate with patrons. The next chapter showcases the 7Ps of marketing library services which should be applied by librarians in the Fourth Industrial Revolution.

Chapter 15 discusses the need for capacity building among university librarians to meet the needs of the Fourth Industrial Revolution. This is caused by the changes in higher education and information technology as well as the learning landscape which is demanding new skills and competencies from library and information professionals.

Chapter 16 reviews the industrial revolution phases down to the 4th industrial era or the Fourth Industrial Revolution (4IR) with the resultant effects of upskilling and re-skilling the workforce for future fits of the industry 4.0 era. The chapter also provided answers to what skills today's workforce need to develop as their roles evolve, what reskilling, cross-skilling, upskilling is all about and the various strategies through which library managers can adopt to encourage their workforce to re-skill, cross-skill and upskill.

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Introduction

Examining the impact of industry 4.0 on academic libraries is a book that showcases the emerging issues in the Fourth Industrial Revolution. The industry 4.0 era has affected all types of organisations and libraries were not spared in the process. This book provides answers to questions on how academic libraries can adapt to the emerging technologies so as to remain relevant in the institutions of higher learning where they are regarded as the hub of learning, teaching and research. Academic librarians should understand the new services and products that were brought about by the Fourth Industrial Revolution which is also regarded as 4IR or industry 4.0. Therefore, this book documents original research on the issues, opportunities, challenges and the effects of industry 4.0 on academic libraries.
The target audience of this book are professionals, librarians, students, lecturers and researchers working in the field of library and information science, archives and records management, communication sciences, education, and information technology. The publication documents the changes that are taking place in the 4IR and what librarians should do to move along with those changes. The book summarizes the emerging trends and contemporary issues in academic librarianship. The impact of the book would be in providing reference information to students in the library and information science (LIS) schools in institutions of higher learning with the information sources required to gain knowledge and skills of twenty-first century librarianship. Lecturers would also benefit since they would have a reference source in contemporary issues in LIS. Academic librarians would gain the skills and knowledge that are required in offering services in the 4IR.

The areas that are covered in the book include the 4IR and libraries, redesigning library spaces such maker space, learning commons, research commons, etc., reference services in the 4IR, electronic information services in the 4IR, research support services, information seeking behaviour in the 4IR, marketing of library services in the 4IR, and capacity building in the 4IR.

The editors of the book wish you well and hope that you will enjoy the book as you come to terms with the impact of the 4IR on academic libraries and how you can enhance your competencies and skills to continue offering relevant services.

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Second, the editors wish to acknowledge the valuable contributions of the reviewers regarding the improvement of quality, coherence, and content presentation of chapters. Most of the authors also served as referees; we highly appreciate their double task.

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Section I

The Fourth Industrial Revolution and Libraries

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Chapter 1

Introduction to the Fourth Industrial Revolution and Libraries

Josiline Phiri Chigwada and Collence Takaingenhamo Chisita

Introduction

The Fourth Industrial Revolution (4IR) also known as Industry 4.0 (Hussain, 2019; Frederick, 2016) is the current and developing environment where disruptive technologies such as the Internet of Things (IoT), robotics, artificial intelligence (AI), and virtual reality are changing how libraries operate (Donna, 2016). The oddments of information reported by the media give the impression that robots, AI, cloud-based computing, big data and a combination of other technologies are gradually converging and merging to create a new reality which has the potential for revolutionising all aspects of life (Frederick, 2016). The 4IR is considered to be the outcome of the convergence of a number of technologies in industrial operations for example, the proliferation of robotics, AI, cloud computing, big data, linked data, 3D printing, biotechnology, and the integration of technology with the human body through wearable technologies (Frederick, 2016). These technologies are underpinned by access to datasets.

Globally, the 4IR era has greatly affected the way library and information centres conduct their daily activities in ensuring that the dynamic and diverse needs of users are met. More focus has been placed on innovation forcing the libraries to re-examine the way they conduct their business leading to transformation of production, management, and governance in libraries. The Industry 4.0 era is calling for a librarian who has an in-depth knowledge of a specific field with sufficient knowledge of other fields including the ability to use the panoply of digital technologies in various areas. Chisita and Chibanda (2019) highlighted that digital technologies were stimulating revolutionary changes among libraries by changing how work is done or accomplished.

Therefore, there is need to develop a library workforce that is not threatened by these new technologies through continuous professional development. Ahmat and Hanipah (2018) pointed out four strategic actions that should be taken by libraries to control the disruptive changes brought about by the 4IR. These are reshaping organisational behaviour, redesigning business model, restructuring

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business process workflow, and remaking job descriptions and roles. There are various types of libraries which include academic, school, public, and special, and all these libraries should move along with these changes.

Hirschi (2018) noted how the gig or sharing economy would create new opportunities through crowd work and work on demand via apps (De Stefano, 2016). In crowd work, individuals complete a series of tasks online (e.g. reviewing documents, annotating photos, entering data) for an infinite number of organisations worldwide, facilitated by a platform. This economy will facilitate the growth of independent information practice in the form of information consultants, brokers, vendors, and mediators. De Mauro, Greco, and Grimaldi (2016) highlighted how the 4IR would enhance the value of librarians and their role in big data by creating value with regard to bibliometric, data sharing, and data curation. Thelwall (2008) argued that the emergence of the networked milieu has resulted in bibliometric evolving into closely related virgin subfields such as webometrics, infometrics and altmetrics, analysing statistical patterns between digital documents and sets of data. 'Big Data is the Information asset characterized by such High Volume, Velocity and Variety to require specific Technology and Analytical Methods for its transformation into Value' (De Mauro et al., 2016, p. 131). It is against this background that the chapter seeks to meet the following objectives:

1. To analyse the changing roles of librarians in the Industry 4.0 era.
2. To document the new skills required by librarians in the 4IR.
3. To examine various ways of continuous professional development in the Industry 4.0 era.
4. To recommend strategies to enhance continuous professional development for librarians in the Industry 4.0 era.

History of the 4IR

The Industrial Revolution started during the eighteenth–nineteenth centuries in Europe and America in the iron and textile industries when the steam engine was invented. The Second Industrial Revolution took place from 1870 to 1940 prior to World War II (1939–1945) when steel, oil, electricity, and electric power were used for mass production, telephone, light bulbs, phonograph, and internal combustion engine were developed. Frederick (2016) noted that the phrase 'industrial revolution' is a buzzword that many readers undoubtedly encountered in their school history lessons and likely associated with a time-period lasting from the late eighteenth century to the mid-nineteenth century where small home-based industries gradually succumbed to larger scale production in industrial shops. The industrial revolution was set into motion by technological changes in the form of invention of machines which could manufacture products faster and more efficiently than the home-based craftsperson (Frederick, 2016). The Third Industrial Revolution is regarded as the digital revolution where there was advancement of technology from analogue electronic and mechanical devices to the digital technology from 1980. There was the advent of personal computers, internet, and information communication technology (ICT). The 4IR was

coined by Klaus Schwab a German Engineer and economist who is best known as the founder and executive chairman of the World Economic Forum (World Economic Forum, 2016). He pointed out that the 4IR will affect the essence of human experience (World Economic Forum, 2016a; Schwab, 2019, Smith, 2019).

Libraries have encountered three phases of development within these industrial revolutions and these include the emergence of automation systems leading to the use of Machine Readable Cataloguing (MARC) and Online Public Access Catalogue (OPAC), audio visual media systems and web-based indexing; the development of CD-ROMs, full-text databases, the Internet, and the Web; and the advancement of new technology that was used to accomplish complex tasks (Ahmat & Hanipah, 2018). This led to the development of maker spaces in libraries where there are collaborative work spaces for making, learning, exploring and sharing using high-technology tools and applications (Smith, 2019). Some librarians are now responsible for teaching robotics, coding, and programming skills to library patrons.

Industry 4.0 Tools and Applications in Libraries

The 4IR is driven by specific types of technology which are big data, AI, robotics, virtual and augmented reality, advanced security systems, and the IoT (Hawthorne, 2018). Romanovs, Pichkalov, Sabanovic, and Skirelis (2019) added that there are growing technologies in the 4IR which include drones, 3D printing, AI, nanotechnology, robotics, among others. This has led to the increasing digitisation of products and services which is termed internet of everything. These tools and applications have the potential to boost productivity in libraries and can reduce costs as well as improve the quality of products and services.

Drivers of Industry 4.0

There are some drivers of the 4IR which has been noted as information communication infrastructure and emerging technologies, education and training, innovation, policy innovation, and responsive and context-specific strategies.

Information Communication Infrastructure

Information communication infrastructure and emerging technologies such as cloud computing, IoT, that is the development of smart products, the internet of services and internet of energy topped the list in the 4IR (Lom, Pribyl, & Svitek, 2016). Digital connectivity in the Industry 4.0 era is provided by telecommunication technologies such as broadband to ensure that there is digital connectivity to enhance communication and collaboration as stated by the European Commission (2015). Libraries can take advantage of the use of 5G technologies, big data, the IoT and AI to increase efficiency and to make evidence-based decisions since data analytics can be used to gain more insights in understanding customer preferences, changing market conditions and to enhance efficiency in library services (World Economic Forum, 2016a; Golub & Hansson, 2017).

High Processing Computer (HPC) is turning out to be a major source of hope for future applications development that require greater amounts of computing resources in various modern science domains such as bioengineering, nanotechnology, the 4IR and energy where HPC capabilities are mandatory in order to run simulations and perform visualisation tasks (Smari et al., 2016).

Education and Training

There is an increased demand for skilled labour in the 4IR . Librarians should be skilled, innovative, and technological savvy as pointed out by Manda and Backhouse (2017). Xing and Marwala (2017) noted that the 4IR revolution will result in new forms of universities that will conduct teaching, research, and service in a dissimilar manner. Furthermore, Xing and Marwala (2017) foresaw the novel university characterised by interdisciplinarity, have virtualised classrooms, laboratories, libraries, and teachers. This implies that librarians should develop their skills to fit well in the changing work environment. These skills include the use of information communication technologies, communication skills, marketing skills, public relations skills, research skills among others. Libraries should also prepare and anticipate these future skills requirements so as to develop proper training programmes for the librarians and review job descriptions in line with these changes.

Innovation

Due to the advent of technology, innovation is a key in the 4IR leading to the need for investment in research and development (Mckinsey Global Institute, 2015). These innovations would assist in addressing developmental challenges as stated by Buhr (2016). This calls for innovative policy and legislative reforms by libraries, institutions, and the government to support the digital transformations. Zhou, Liu, and Zhou (2015) reiterated the challenges that are brought about by the 4IR which include trade restrictions, data security, liability issues, and personal data privacy and these can be dealt with by strict regulations in the form of standards, legislation, and policies. The policies would address the issues of skills, infrastructure, funding and regulation among others.

Responsive and Context-specific Strategies

In dealing with the Industry 4.0, there is need to have strategies that can be utilised by libraries to be efficient and effective. There is need for clear strategies with guidelines on how libraries should respond to the demands and challenges of the digital environment. However, in the developing world, libraries mostly fail to have strategies that respond to the local context. This has been stated by Majdalawi, Almarabeh, Mohammad, and Quteshate (2015) who pointed out that the major challenge in developing countries is not the absence of strategies but the available strategies do not suit the local settings. Manda and Backhouse (2016b)

added that developing countries fail to adapt to the best practices leading to the implementation of poor strategies.

Changes Brought by the 4IR

The 4IR brought about a number of changes in the library and the major change agents are automation and AI. This led to the emergence of other issues such as diverse users, library automation, embedded librarianship, open science, the use of social media platforms, and the changing roles of librarians. Some librarians feel threatened by the revolution and they believe that some certain groups of employees are getting redundant and will be replaced with new workers with the required skills or with machines. The librarians should be able to answer the information needs of diverse users such as the millennial generation, generation X, Y, and Z, and patrons with special needs. Libraries are now promoting digital literacy to ensure that the patrons are able to access and use the information using various technologies. All librarians' jobs require digital skills and the use of technology is now a basic requirement. During the digital literacy training sessions, librarians would be unpacking issues such as how to deal with the information overload and imparting skills on how to conduct sound research as well as dealing with fake news on the internet.

There are some libraries that have adopted Industry 4.0 tools and applications in their day-to-day activities. There is an advanced robotic conveyer system that transports books from Bryant Park off-site storage area to New York Public Library underground (Smith, 2019). At Connecticut West Port Library, two librarians, Vincent and Nancy are responsible for teaching AI to library users. Some libraries are collecting data using social media tools, drones, cameras, and other Industry 4.0 devices to analyse and use it intelligently. The University of Pretoria employed Libby, a client service robot in May 2019 as a way of evolving in line with the 4IR. According to the University of Pretoria (2019), the robot is responsible for providing guidance, conduct surveys, display marketing videos, and answering questions.

Why Continuous Professional Development?

The 4IR brought about many changes which affect the way library services and products are offered. This calls for the need to continuously develop the knowledge and skills of librarians so that they stay abreast of the changes and know how they can positively impact the communities that they serve. There are new services in the research, teaching, and learning and these include big data, research data management, and open science such as open data, open access, open educational resources, and open methodology among other things. This shows that librarians are now taking new roles and responsibilities and they are now regarded as researchers and teachers. Librarians now teach information literacy to impart skills on how to access and evaluate information resources. Therefore, it is important that librarians should develop their skills to remain relevant in the Industry 4.0 era.

Opportunities and Challenges of the 4IR

Manda and Dhaou (2019) pointed out that the Industry 4.0 brought economic and social opportunities and challenges which should be handled and dealt with appropriately in order to respond to it. This was supported by Manda and Backhouse (2017) and Schwab (2016) who stated that the tools and applications of Industry 4.0 can disrupt society, business and government through its innovations. The European Parliament (2016) identified the challenges experienced in Europe as changing business models, skills mismatch, intellectual property issues, and the need for investment, data issues, standards, and legal questions of liability. Dregger, Niehaus, Ittermann, Hirsch-Kreinsen, and ten Hompel (2016) pointed out that in Germany, the challenges in the Industry 4.0 era are increased social insecurity, job loss, new kinds of stress, and disqualification. Libraries can also take advantage of the opportunities that are offered by the 4IR and those in the developing countries can align themselves with the developed countries by embracing the use of AI, big data analytics and blockchain.

Opportunities in the Industry 4.0 Era

Library users are now able to afford and access the digital world due to the advances in technology regardless of time and location. Libraries are now offering both on and off campus access to information resources and patrons only need an internet connection to enjoy the facilities where they can access the services 24/7. This has greatly increased the use of electronic resources since convenience of accessing library services had been improved. New products and services that increase the efficiency of library services are also being introduced in libraries due to the Industry 4.0. These include the use of social media platforms to communicate with clients, online reference services, online renewal of print materials, and self-services at circulation points. Libraries and librarians will have to reinvent and restrategise on how they can benefit from the numerous opportunities arising from the 4IR era as highlighted below:

> Libraries enable literate, informed and participative societies. When we look at the future, according to the debates in our teleconference, libraries will be trustworthy information brokers; will do more with new technology; provide universal access to information and scholarly works, whether it be media or information we already know or new media; preserving and providing access to information in all formats and providing trusted and effective support for political and social engagement. Libraries will be advocates for and facilitators of the Fourth Industrial Revolution, where people create their own devices and objects. (Church, Butz, Cassell, Kamar, Swindells, Tallman, & Snellenberg, 2017, p. 2)

The introduction of these new services have assisted library patrons since there is a drop in transportation and communication costs as they can transact from