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# The Position of Information Professionals in an Era of Rapid Technological Change in a Data Driven Economy

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**ABSTRACT:** Technology continues to evolve and become an integral part of society by making people's lives easier. As technology changes, the way peoples' lives are managed also changes and this affects information professionals too. The 4<sup>th</sup> Industrial Revolution (4IR) is set to reshape the role played by human beings in organizations and prove their relevance. Information professionals such as librarians, records/archival managers and information managers need to show their importance at their places of work including the benefits they bring to these places. Despite the numerous benefits brought about by technological changes, there are costs associated with it and some measures have been suggested to re-position the information professionals in this phase of globalization. Adopting new innovative technologies will allow information professionals to: globally collaborate, provide improved access to reading materials/resources, effective preservation of online collections, improved data mining, redefining access for researchers, digital data management, improved ways patrons discover content, etc. This growing focus on accessibility and use of digital resources will impact greatly on the position of information professionals world over. Obviously, the need to learn new skills to be able to implement the new technologies for the patrons or an extension of professional development is a necessity. Such a state demands for a complete overhaul of the information professional's work by adapting to fit with a world that work within the existing space which is increasingly becoming digital (paperless reading areas, touchscreen information portals, robotic assistant guides, etc.) ; the focus for this paper.

**KEYWORDS:** 4<sup>th</sup> Industrial revolution, data economy, digital technologies, information professionals, information era

## I. INTRODUCTION

The 4<sup>th</sup> Industrial Revolution (4IR) is a way of describing the blurring of boundaries between the physical, digital and biological worlds. It is a fusion of advances in artificial intelligence, robotics, the Internet of Things, 3D/4D printing, genetic engineering, quantum computing and other technologies. The insurrection is paving way for transformative changes in the way people live and radically disrupting almost every business sector including the information management field. This has not spared the information professionals too. Consequently, if information professionals are to remain relevant to society in the fast-paced information technology era, there is a need to harness emerging technologies (artificial intelligence, robotics, 3D/4D printing, etc.) to the benefit of the clientele and organization as a whole hence the 4<sup>th</sup> Industrial Revolution (4IR).

The Fourth Industrial Revolution (4IR) has been referred to a combination of Industry 4.0 and Smart services [1]. Other scholars like Hussain [2], De Mauro, et al. [3] and McKinsey [4] denote the concept to mean "the new level of organization and control over the entire value chain of products". It includes use of technologies like artificial intelligence, autonomous vehicles and the Internet of Things as merging with humans' physical lives. For example use of voice-activated assistants, facial ID recognition or digital health-care sensors. This revolution has change agents such as artificial intelligence and automation which make employees redundant and information professionals are not exceptional. They can only remain relevant if and only if they acquire new skills in information services, marketing values and fulfill the growing demands of their patrons [5].

It has been reported by the World Economic Forum [6] that today, 65 percent of students enroll in schools with the hope of getting jobs which are not yet created. This is the reverse of the "good old days" when students would join colleges and universities to acquire qualifications that would set them up for the jobs in the market. However, with the

onset of the 4IR, the situation seems to have changed with the world of uncertainties forthcoming. Information professionals globally are frightened with effects of the new revolution. It is the fear of uncertainty (alarming levels of unemployment) caused by unmatched skills that form the major focal point for this paper.

## II. LITERATURE REVIEW

According to the founder of the World Economic Forum [6], [7] by entering the 4IR era means megatrend drivers within the physical, digital and biological environment that would disrupt the common ways of human lifestyle, industrial production and government policies. This is likely to impact on the economic growth and development of certain countries leading to income inequalities and social disparities. Research shows that technological developments came in multiphase fashion stemming from the 1<sup>st</sup> industrial revolution to the 4IR as demonstrated in the table 1 below.

**Table 1: Phases of industrial revolution**

Phase	Period	Information Profession Related Technology
First Industrial Revolution	1720-1840	-Massive production of reading materials (print media) -Growth of libraries -Lack of proper cataloging methods
Second industrial revolution	1850-1914	-Public libraries established in England and Wales -Book stock increased and opened up to readers
Third industrial revolution	1915-2012	-Internet and renewable energies -Computer became faster and could store huge data libraries data) -Machine Readable Catalog introduced in 1966 -Automation became easier, interlibrary loan, networking standardization and online database searching -Online Public Access Catalogue -Resource sharing and sophisticated reference services were adopted
Fourth industrial revolution	2013-2019	-Data and Internet connected devices for collection and processing of huge data -Social media, smart phones, digital cameras etc -People and Machines are connecting to each other at enormous speed. -Artificial intelligence, mobile computing, machine learning and automation of everything -Retrieval of bibliographic data and digital books using internet. -Similar processes have affected academic libraries eg. Use of robots in combination with RFID technology -This application is considered the cutting edge technology in library industry. -Artificial intelligence helps information professionals to detect critical errors and present this data on web (AI and Internet of Things are great examples for library data in 4IR

### Technologies driving the 4IR related to information work

The 4IR has affected almost all spheres of life including information management. From the observations made, this revolution has transformed society for better. For this to be achieved, there are a number of drivers associated with the technological innovations and adaptation as shown in table 2.

Table 2: Implication of technologies driving the 4IR related to information work

Driver	Information work before 4IR	Implications in the 4IR
High-speed mobile internet	Gather data, populate data banks with e-resources or establish digital centers.	-Social media, smart phones, digital cameras, sensors are creating more information than ever before via internet.
Artificial intelligence (AI) and Automation processes	Information workers use tools to organize and process knowledge in physical facilities.	-Make information workers redundant and replace them with new workers possessing the needed skills [2].
Big data analytics	Generation of data at an alarming rate and in big amounts.	-Data analysis needs AI, mobile computing, machine learning and automation. -AI can help information workers to detect critical errors while presenting data on web [2].
Cloud computing technology	Large amounts of data retrieved in form of MARC and digital resources for cataloguing purposes.	-Information workers need new lenses about their collection, patron and usage.
Internet of Things (IoT)	Development of internet technology and mobile technology, information exchange as well internet service usage [8].	-World fueled by data and internet connected devices capable of collecting and processing huge amounts of data. -Resource sharing by many users at the same time is possible.

### The 4IR and the information profession

Advancements in technologies have greatly impacted on the labour markets, agriculture, manufacturing and service sectors [1]. These trends have influenced the information professionals too. The information professionals should embrace the 4IR and implement them to fulfill the growing demands of their patrons [8]. The 4IR has disrupted the way information professionals used to conduct business – knowing the “*connection*” (internet of things) from knowing the “*collection*”. Thus the 4<sup>th</sup> industrial revolution has changed the role played by information workers from “*knowledge organisers*” to “*knowledge users*”. However, the question remains: will information workers remain relevant to society given the changes associated with the 4IR? The answer is obvious – there is need to continue professional development in order to acquire corresponding work-related skills.

### Impact of 4IR on information profession

As information workers strive to catch up with the realities of the 4IR, it has been observed that the revolution has changed the traditional role played by them in society specifically from knowledge collectors to knowledge users. This has created a challenge on the side of information workers in terms of connecting resources to patrons in a better way [9]. The solution lies in continued professional development with the aim of acquiring corresponding skills to fit in the 4th industrial age. The revolution has redefined what it means to be human and how we engage with one another and the planet [10]. Therefore, whether information workers or other employees, the following are some of the likely effects of this revolution to society (see table 3):

Table 3: Impact of 4 <sup>th</sup> Industrial Revolution technologies on information profession		
4IR technology	Positive	Negative
AI/Machine learning	<ul style="list-style-type: none"> <li>-Intelligent robots developed with sophisticated machine learning algorithms for interpretation of data.</li> <li>-New tools to show virtual reality e.g. some academics libraries use robots in combination with RFID technology to serve users</li> <li>-Machines to “think” like human beings</li> </ul>	<ul style="list-style-type: none"> <li>-Advanced robots kill cheap labour advantage.</li> <li>-Kills traditional methods of knowledge organisation and processing.</li> </ul>
Internet of Things (IoT)	<ul style="list-style-type: none"> <li>-Knowledge sharing &amp; skills transfer</li> <li>-Collaboration with peers by engaging technology &amp; internet</li> <li>-Multi-task &amp; job rotation</li> <li>-Integration of all systems to make it easy for decision makers to use analyzed data.</li> </ul>	<ul style="list-style-type: none"> <li>-Security of information. The IoT is associated with risks of unsecured systems.</li> <li>-IoT devices, networks &amp; cloud servers can be compromised in case of cyber-attack. The above lead to:               <ul style="list-style-type: none"> <li>-Breach of privacy (who controls the IoT?)</li> <li>-Over-reliance on technology (What if the internet &amp; technology is not available?)</li> <li>-Loss of jobs (Automation will have a devastating impact on the employment prospects of less-educated workers [11].</li> </ul> </li> </ul>
Big data analysis	<ul style="list-style-type: none"> <li>-Shared E-resources with internet enabled services.</li> <li>-Create opportunities for data mining.</li> <li>-Reduced demand for physical space/facilities.</li> <li>-Potential to more job creation in the field of information management.</li> <li>-Harness big data &amp; analyse it for development purposes.</li> </ul>	<ul style="list-style-type: none"> <li>-Security issues (misuse of persona data, loss of trust)</li> <li>-Data breaches that may lead to identity theft, blackmail, reputation damage and distress.</li> <li>-Political manipulation and social harm (fake news, bots &amp; filter bubbles)</li> <li>-Data and system errors (wrongful identification that can lead to loss of jobs, detention, deportation, etc).</li> </ul>
3D Printing	<ul style="list-style-type: none"> <li>-Ability to convert designs into finished products.</li> <li>-Presents great opportunity for leapfrogging into manufacturing sector.</li> </ul>	<ul style="list-style-type: none"> <li>-Kills the factory manufacturing model.</li> <li>-Particles of 3D printers emitted cause potential harm to human respiratory system.</li> </ul>
Cloud Computing technology	<ul style="list-style-type: none"> <li>-Enable people work remotely</li> <li>-Primary &amp; secondary data backups</li> <li>-Provision of platforms for credits to purchase goods &amp; services</li> <li>-The above ensure business stability</li> </ul>	<ul style="list-style-type: none"> <li>-Challenges of data stored on cloud servers. How will staff access sensitive files, data and information from the company servers without compromising its security?</li> </ul>
Blockchain technologies	<ul style="list-style-type: none"> <li>-Numerous trust-based applications capturing vital documents (land registries, contracts, etc)</li> <li>-Crypto currency-based transactions.</li> <li>-Trustless system (blockchain system negates the risks of trusting a single organization &amp; reduce the costs/transactions of third parties)</li> </ul>	<ul style="list-style-type: none"> <li>-Trust issues. It is prone to attacks especially if an entity manages to control a big percentage of the network hashing power which eventually allows intentional disruptions or modifying the ordering transactions.</li> <li>-Data modification – once data has been added to the blockchain, it’s</li> </ul>

		<p>difficult to modify.</p> <ul style="list-style-type: none"> <li>- Blockchain technology can be slow and cumbersome (due to their complexity, encryption &amp; distributed nature, transactions normally take longer compared to the traditional payment system.</li> <li>-Lack of regulation creates a risky environment (due to lack of regulatory oversight, scams &amp; manipulation).</li> </ul>
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### III. METHODOLOGY

Desk research methodology was used to collect secondary data which was relied on. Published reports, statistics and journal articles were major sources of data used. In the context of this paper, all possible sources of information including libraries, internet, on-line databases and consultations with information professions was done. The authors adopted this methodology because secondary data (main data) was easily accessible, time saving and less costly. Since this paper serves as a stage-gate study, its adoption justified the cost implications of this primary research, understand the problem, generate hypotheses, and then determine the most effective methodology suitable for future research.

### IV. RESULTS

The major focus of this paper was to establish the position of information professionals in an era of rapid technological change in a data driven economy, Uganda being the targeted country. A survey carried out by the authors' shows that while awareness of the 4IR technologies and their likely impact on the labour market is high, many respondents perceived it to create job disposition to the information professionals than offering more as indicated in table 4 below.

**Table 4: Showing results of 4IR as a threat to the information profession**

4IR as a threat to existing jobs in the information profession				
Opportunity	Perception	Percentage response (professionals) likely to lose jobs	Percentage response (professionals) likely to create new jobs	Observation
Leadership directing /	Neutral	50%	50%	Job loss/creation (likelihood)
Knowledge organization	Negative	61%	39%	Job loss/creation (majority)
Knowledge processing	Negative	62%	38%	Job loss/creation (majority)
Skills based on education level/training	Negative	54%	46%	Job creation/loss (majority)
Mind-set attitude /	Neutral	52%	48%	Job creation/loss (probable)
Automated processes	Positive	71%	29%	Job creation/loss (majority)
Marketing services	Positive	57%	43%	Job creation/loss (majority)

**Source: Researcher (2020)**

*Note: The respondents were drawn from an array of stakeholders including policy makers, private sector, employers, employees and academicians from selected information management sector in Uganda*

### Explanation

Findings show that the 4IR revolution presented an opportunity for people (information professionals) engaged in leadership positions to either create new jobs or loss them. Evidence is shown by the 50% perception response as given by the respondents on either side. This perception is also assumed by the information professionals whose mind-set attitude postulate that the Fourth Industrial Revolution will make them loss jobs, retain or create them. These respondents infer that unless people get new skills or are retooled to acquire the needed competence; their relevance will be superseded by the new events.

The study found out that information professionals engaged in knowledge organization stood high chances of losing their job positions given the advancements in technology. This is evidenced by the perception given by the respondents. Majority of the professionals (61%) believe they will lose jobs given the impact of 4IR, while only 39 percent believe in job creation. Almost the same perception is held by information professionals involved in knowledge processing i.e.62% (job loss) compared to 38% (job creation). Similar views are held by respondents on the inquest of skills possessed/education level or training. Majority (54%) harbor feelings that jobs will be lost due to the impact of 4IR, while a sizable number (46%) are confident that new jobs will be created. In fact majority in this category hoped to become infopreneurs. According to [12], infopreneurs are people engaged in selling of information irrespective of format or delivery methods. These may include information professionals, librarians, journalists or reporters. Basically, infopreneurs sell information, knowledge or experience whose value is attractive and useful to other people. This category of information professionals believe that the 4IR wave will create new forms of jobs that will absorb them. Their belief is justified owing to the fact that information is regarded as basic ingredient knowledge based economies [13]. Thus, based on the trend of events, training should be an on-going activity if information professionals (workers) are to stay focused with the realities of the 21<sup>st</sup> century.

Furthermore, following the common sense clairvoyance and the natural laws, automated processes and marketing services have positive response towards job creation in the field of information profession (work). This observed mutual response was supported by respondents whose perception was neutral or positive. For example, information professionals who had a neutral mind-set were likely to create jobs or even if they lose jobs, the probability of reskilling is high (52% vs 48%). This is attainable because such people (workers) have the right attitude and can be easily trained to get the skills needed in the job market.

Evidently, majority of workers engaged in automated processes and marketing services are likely to lose jobs with the advent of the 4IR. While 71% of those involved in the automated processes believe will create new jobs, 29% are not certain of retaining their jobs. This same analysis applies persons engaged in marketing services. Majority (57%) are certain that new jobs will be created while 43% contemplate their jobs will disappear. Information professionals in the categories, whose perception is either neutral or positive, are likely to survive in the 4IR era considering their mind-set, attitude towards work and ability to gain new skills. This is the new crop of innovative information professionals that will survive the wave of 4IR and remain productive.

### Challenges of information workers' job market

Based on the findings, the following are some of the challenges faced by information professionals in the job market:

- a) Deteriorating accessibility to job opportunities
- b) Increasing income inequality due to job opportunities
- c) Dwindling information-related firms in the private sector
- d) Limited demand for waged workers in the private sector
- e) Slow transformation of waged jobs to self-employment
- f) Unmatched labor force growth pace compared to job creation potential
- g) Decreased "job satisfaction" and "job security". Job satisfaction depends on pay, promotion opportunities, fringe benefits, job security, relations with co-workers, etc. which are not synonymous with 4IR wave of technologies.

## V. CONCLUSION

Today, information is a major driving force in data driven world economies. Businesses seeking to thrive in the 4IR will have to invest heavily in quality information at different levels (gathering, processing, analyzing, selling or accessing) if they are to remain competitive [14]. For this reason, some information professionals will be forced seize the opportunity by creating information related jobs while others will lose jobs. This calls for reskilling and adopting new strategies to survive in an era of disruptive technologies. Despite the hype of 4IR technologies taking over jobs, some work tasks will remain given their nature e.g. communicating, interacting, coordinating, developing, managing,

advertising, reasoning and decision making. According to the 2016 World Economic Forum report [14] on Sub-Saharan Africa, new job roles will emerge though require new skills. Some of the emerging skills include analytical thinking and innovation, creativity, originality and initiative, active learning and learning strategies, technology design and programming, complex problem solving, critical thinking and analysis, leadership and social influence, reasoning, emotional intelligence, resilience, stress tolerance and flexibility. It should be noted that all jobs are at risk except for industries that power essential services like food, agriculture, transport, medical care and education. Even then, these will be disrupted by the speed of innovation for increased efficiency and effectiveness. Information professionals are not spared by this new technology either. The only key is in agility and adaptability to change in order to stay ahead of the disruptive curve.

## VI. RECOMMENDATIONS

The different phases of industrial revolution have had an impact on human life. These phases have shaped the information needs of human beings. However, this has come with challenges as shown above. For the organizations and individuals to overcome the fear of uncertainty associated with the 4IR, the following are some of the recommendations proposed:

- a) Creation of enterprises that create businesses which businesses create jobs opportunities that strengthen market competition and increase productivity.
- b) Competencies still override leadership required in any workplace. Therefore, qualities of team work, negotiations, integrity and customer care have an avenue in the 4IR era.
- c) Need for the employees to adapt to the metrics of emotional intelligence and the capacity to innovate than reliance on traditional qualifications (degree or diploma).
- d) Adaptability – graduates should consider having the right attitude towards work than “mere qualification” obtained. In fact some companies like Ernst and Young have removed the degree classification from the entry criteria for its hiring programs [6], [14]. People with the right attitude can easily be trained to get the expertise one needs.
- e) Soft skills (ability to relate to people) required in numeracy, communication, people management and leadership, mentorship, sales and business acumen, character, expertise fit. This is related to the above. The mind should be ready to learn without being rigid, respect to authority and protocol in work-related environment.
- f) According to some experts, no country in the world has developed without vocational training. This is not exceptional to the information profession. It is only the skilled that can produce [15]. The effects of vocational skills equates to employment [16]. Employment should be for a product relevant for the market. This will help produce people with employable skills relevant to the needs of the employers. It is not an era for white-color jobs; sudden adaptation into vocational skills has not yielded any impact.

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