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Utilization of Artificial Intelligence in Journalism in Nigeria

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Abstract. Artificial intelligence (AI) is changing present day journalism. Automated news writing and distribution, without human supervision, is already a reality. Infact, AI has changed the way journalists interact with the world outside the newsroom. It enables journalists to analyze data from multiple sources. In sum, we can say that artificial intelligence will help journalists to survive and overcome the core problems faced by contemporary journalism. This article explored how artificial intelligence is impacting newsrooms and how it can be better adapted to the field of journalism. The study reveals that AI is already automating the newsroom, AI is augmenting journalists, AI is creating new forms of investigative reporting, AI is helping to verify and fact-check, AI is creating a personalized user experience, AI is creating ethical implications. However, the study reveals journalists in Nigeria are yet to embrace AI. Many challenges affacting the adoption of AI in Nwesrooms in Nigeria include lack of electricity to effectively power the AI applications; lack of adequate infrastructure; lack of finance to purchase and maintain these equipments. cost of Internet connection and the training of AI handlers among others. Although there are challenges facing journalists in the use of AI, these include that it undermines creativity, there is the absence of monitoring, there could be bias, and there could be lack of transparency, fact-checking and fairness among others. However, it is imparative journalists especially in the developing contries like Nigeria, adjust and enbrace these changes occasioned by Artificial intelligence. The study reveals artificial intelligence does not pose a serious threat to professional journalism. In other words, artificial intelligence technologies have added and still adding value to journalism in the digital age.

Keywords: Artificial intelligence**,** journalism, **newsroom,** challenges,

1. Introduction

Something fundamental is changing in the news industry. New technological challenges and opportunities are encouraging a reflection about the deeper meaning and mission of journalism, as well as the shape and ethics of the news industry in the era of Artificial Intelligence (AI). As a result, many realize the urgency to explore innovative solutions to sustain the business of news. Many journalists in Nigeria have little or no knowledge of what AI actually means, let alone what it can do for a newsroom. AI in its most basic form is a system that makes autonomous decisions, performing tasks that mimic acts of human intelligence like solving problems, understanding language or recognizing sounds and objects. To help computers perform their specific tasks, they need a set of step-by-step instructions that tell them what to do: an algorithm. To feed the algorithm, data is the basic ingredient for every AI. Algorithms and machines can augment the power of journalists, opening up new possibilities and unexplored territories. "AI just does not work on its own, and we can not expect it to fix all our problems, the best impact can be achieved as a partnership between humans and technology." (Mattia 2019) According to the father of Artificial Intelligence John McCarthy, AI is "The science and engineering of making intelligent machines, especially intelligent computer programs". Artificial Intelligence (AI) is a way of making a computer, a computer-controlled robot, or a software think intelligently in the similar manner the intelligent humans think. AI is accomplished by studying how human brain thinks and how humans learn, decide, and work while trying to solve a problem, and then using the outcomes of this study as a basis of developing intelligent software and systems.

We can say that an artificial intelligent system is a system that thinks like human, act like human, thinks rationally and acts rationally.

1.1 Artificial Intelligence (AI) and Journalism

Technology has played and is still playing vital role in the way journalism is practiced. According to Vaglis and Bratsas (2017), dramatic change in the field of journalism is connected directly to advanced technology tools. Therefore, the use of Artificial Intelligence (AI) technologies has become an indispensible part of the field of journalism that has led to radical transformations (Galily 2018). Omebring (2016) see the technology as an objective alliance to change the professional practices of journalism, along with changing journalist skills. Technology has become an essential requirement of contemporary media production. How does technology fit in the news production? According to Mark *et al* (2017), AI increasingly assists in reporting, content creation, distribution, and audience interaction, to name a few examples. Recently, crowdsourcing, brainstorming, and fact-checking tools are being developed to aid data information gathering and, particularly, to structure relevant data. Among contemporary newsrooms, automation is a key tool in competing favourably in the news industry.

Today, according to Waleed and Mohamed (2019, p.43) readers can read articles written entirely by a journalist who does not have a human form. In this context, the Washington Post has developed its own technology, an artificial intelligence called" Heliograph ", to support its editorial team during the 2016 Summer Olympics in Rio. Since then, the Washington Post has been using "Heliograph "to spit out 850 articles, which focused mainly on political and sports news. In a recent Reuters report "*Media, Trends and Technology Expectations in 2018*", which included a survey of quite a few media outlets, Newman (2018), notes that nearly three-quarters of respondents said they use artificial intelligence in their production. On the other hand, they also develop projects to boost their use both in terms of content improvement, increased marketing efficiency and economic feasibility, automation of information validation within the information material, or to speed up the classification of information contained within a massive stream of data. In 2017, Jung *et al* (2017) in the study entitled: Intrusion of software robots into journalism: The public's and journalists' perceptions of news written by algorithms and human journalists – pointed out that the audience tended to trust the journalistic materials written by software more than those written by journalists. In sum, Zangana (2017) points that the relationship between technology and content creation in modern newsrooms is synthesized in the following basic idea: "This tendency in journalism proves the changing character of the newsroom staff, where programmers are working steadily more closely with journalists, and where journalists become programmers and vice versa".

2. Technology Aided Transformation of Journalism

Loosen (2018) highlight of new four forms of journalism, which can be considered as transformation process journalism faces today not only at the level of the basic stages of news production and consumption but also affects journalism at its core.

Data journalism: Data journalism refers to the process of extracting useful information from data, writing articles based on the information and embedding visualizations in the articles that help readers to understand the significance of the story. As Lindén (2017, P.24) notes, "digital revolution has expanded the supply and availability of data that can be used for computational journalistic processes, along with the expectation of events to a larger extent than before". However, data journalism represents the convergence of a number of fields which are significant in their own right - from investigative research and statistics to design and programming (Bradshaw 2010).

Algorithm Journalism: This type of journalism happen when there is the intersection between journalism and data technology" (Gynnild 2041). Besides, it can be "the combination of algorithms, data, and knowledge from the social sciences to supplement the accountability function of journalism" (Harmilton and Turner 2009).

Automated Journalism: The focus with this term is, according to Graefe (2016) to emphasize the increasing amount of content that is being produced automatically and by means of technologies being developed by providers of automated content solutions. In other words, it is "algorithmic processes that convert data into narrative news texts with limited to no human intervention beyond the initial programming" Carlson (2015).

Metrics-Driven Journalism: Refers to the varied attempts to make sense of an ever-growing amount of audiences' digital traces with the potential to influence decision making processes at all stages of

the news production process. Tandoc and Thomas (2015).

3. Ways Artificial Intelligence can help Journalism

Chase Davis, editor of interactive news at The New York Times, highlighted the ongoing promises around the melding of technology and journalism: **To help reporters find and tell stories that were previously out of reach or impractical**. Mark *et al* (2017), suggested that many activities where AI can be particularly helpful in the newsroom fall into three categories:

(i) **Finding needles in haystacks**: In those outlying or special cases that might elude human identification because of the scale or complexity of the data, AI can be a breakthrough tool. This role fits neatly into standard newsroom processes, because even if it discovers cases the human eye could not, the findings can be fact-checked via standard human investigative techniques.

(ii) **Identifying trends (or departures from trends):** The massive computing power of AI can help provide characterizations of aggregates of data, perhaps grouped in time or by geography or demographics. Alternatively, it can quickly identify outlier data.

(iii) **Examining an application of AI or computation as the subject of the story itself**: Because they are built by humans, algorithms harbor human bias—and by examining them, we can discover previously unseen bias. How are these complex truths being found through these tools? What happens when these tools are applied to the operation of our neighborhoods or cities or nation?

Tom (2018) out lined 10 ways AI is having impact on journalism to include that:

- **AI is already automating the newsroom**,
- **AI is augmenting journalists**,
- **AI is creating new forms of investigative reporting**,
- **AI is helping to verify and fact-check**,
- **AI is creating a personalized user experience**,
- **AI should be transparent to build trust**,
- **AI is creating ethical implications,**
- **AI is redefining copyright rules**,
- **AI is forcing journalists to refocus and retrain**,
- **AI is not the way to cut costs and jobs**

AI is already automating the newsroom

By using machine intelligence in the newsroom, we can increase efficiency in our creation processes. Since journalists have to serve different audiences on different platforms, it is not unusual to hear them complain about repetitive, monotonous tasks they have to perform. These tasks can be reduced by AI. Some news organizations like Bloomberg and the Associated Press are using Wordsmith by Automated Insights, a tool that mines data and is capable of producing reports about sports results and company earnings. AI-generated smart templates help them to produce this "commodity news" on a much larger scale than before, up to 12 times in the case of AP.

AI is augmenting journalists

There is a big concern that using machine intelligence will demote the role of journalists to database managers. Experiments and implementation of AI in large news organizations like the AP show the opposite is true, freeing up to 20 percent of the journalists time. This way, they can focus on content and spend more time on their core expertise: reporting. Many examples of augmentation are already available. Speech-to-text-powered transcription tools like Trint or recordly can make our lives so much easier, instead of spending hours transcribing interview recordings. Companies like Clarifai or Vidrovr are using computer vision to automatically recognize content in photos, tag it and find similar concepts, speeding up the workflow of image editors.

The production of video news packaging can also be automated by AI. The Israeli company Wibbitz created a text-to-video platform using image recognition to create videos that can match with a text automatically, speeding up rough-cuts that can later be refined by human editors. Again, this tool is augmenting, not replacing traditional video production. Tools like Newswhip or Graphext can help us find news topics, by applying machine learning to social media data. Reuters' News Tracer is analyzing tweets in real time and has already uncovered several stories before other media reported them.

AI is creating new forms of investigative reporting

AI can be leveraged to power new forms of reporting, by analyzing data and identifying patterns at a much larger scale than ever before. For example, it can take investigative journalists days, months, or years to sift through millions of documents in a corruption investigation. With Natural Language Processing (NLP), they can go through these documents, discover entities from the data and the relationships among them. It is effectively playing the role of a magnifying glass that can see things that are not visible to the naked human eye. This way, AI can surface stories that have not been told before.

AI is helping to verify and fact-check

As trust in news has been eroded by disinformation and misinformation distributed on social media, AI can offer a solution to detect and diminish it. Journalists can leverage AI for fact checking and analysis of text, pictures and video.
Think of Chequeabot, a tool made in Argentina, which automatically finds fact-checkable claims in news text and sends them to the newsroom. Similar automated fact-checking applications are Claimbuster and Factmata.

AI is creating a personalized user experience

AI can help to serve content tailored to each user, depending on who you are, where you are, or what mood you are in. By creating unlimited versions of an article, it can help newsrooms develop a more engaged audience. It can also improve the quality of dialogue with our audiences. Chatbots, like those created by Quartz Bot Studio, allow users to text questions about news events, people or places. They immediately receive an answer back.

AI should be transparent to build trust

It is essential that journalists and news consumers always be informed when a story is authored by a machine or a human. Newsrooms must be open and honest about this. To work properly, AI systems rely on our trust. And to build trust in AI, it's crucial that it is transparent and can explain how it made its decisions. Just as verifying the reliability of a news source has become obvious, there is need to verify the reliability of any smart machine system. No doubt there will be hiccups when introducing AI, but constant monitoring can diminish mistakes. To achieve more trust in AI, journalists and users should be allowed to experiment with the technology, by adjusting the parameters of an algorithm to see how the results change, for example. The Wall Street Journal is already testing this, as a way to audit AI.

AI is creating ethical implications

AI will not change the fundamentals of journalism; AI cannot succeed in a newsroom environment if the same journalistic and editorial standards that have been around for decades are not applied. Algorithms are prone to bias and can make mistakes, just like the humans who created them. But unlike humans, algorithms cannot be held legally accountable. Therefore, it is important that human accountability is embedded in all stages of the content value chain.
As newsrooms implement AI, they should install an ethics board that can develop an ethical checklist for using AI in a newsroom environment.

AI is redefining copyright rules

Copyright laws are challenged by the rise of AI in the newsroom. AI is learning from human-created expressive works like articles or videos, each with specific rights owners, to create its own output. This can pose a new conflict, as it can violate the copyright of traditional media outlets. Legality of contents will become an important issue.

AI is forcing journalists to refocus and retrain

Because of the rise of AI in newsrooms, the role of journalists will change. Journalists will become more like gatekeepers. Therefore, the newsroom management will need to invest more in training its journalists. This is the only way journalist can become more at ease operating in a technology environment. The more journalists know about AI, the more effectively they can use it.
There will also be a need to foster closer collaboration between news organizations and the technology industry. Collaboration is crucial in an AI-assisted newsroom. Journalists should be encouraged to experiment and share best practices with colleagues. AI will also create new jobs like automation editors, necessary for maintenance and supervision, watching for errors and correcting them. Academic training of new journalists will involve teaching more coding skills.

AI is not the way to cut costs and jobs

Living in an era of turbulent news markets, there is fear that some senior newsroom managers might look at AI as a way to cut operating costs and work with fewer journalists. It may be tempting, but that will be making a big mistake.
Journalists should play an even bigger role in putting the pieces together, verify and add a human touch to

stories. Without journalists as gatekeepers with strong news judgment, AI will be doomed to fail.

4. Challenges of Artificial Intelligence Utilization in Journalism

As with any complex system, errors happen and with AI those errors can have serious consequences. This highlights the importance of keeping humans close and rigorously checking the work of AI systems. Robots cannot be held accountable for any mistake. Some scholars have identified two kinds of challenges to include **Professional** and **Ethical Challenges.**

4.1 Professional Challenges

It Undermine Creativity: Creativity is the core concept in journalism that reflects the human way of thinking including creative writing and interpreting, etc. In this respect, Latar (2018,p24) notes, "AI algorithms cannot "think" out of the conceptual framework created for them by their human algorithm designers, they are unable of attaining the highest level of creativity that requires the ability to mentally cross into new unexpected conceptual frameworks". For instance, AI algorithms cannot manufacture the requisite atmosphere to inspire readers' emotional reactions, such as laughter (Aljazairi 2016), respond to an accident scene, interviewing people on the street, or conducting any investigative work. Therefore, analytical skills and creativity still the major advantages of journalists against the algorithms (Van Dalan 2012).

The absence of Monitoring: Journalism is an essential force to maintain the survival of the social system, due to its great impact on society. Therefore, it is essential to preserve journalism as a public good in the digital age. As Latar (2018) notes, "AI algorithms cannot be expected to understand and monitor unexpected alarming developments: They lack the human capacity to make connections not previously experienced".

Bias: The most significant challenge in the field of automated journalism is that biases can be created within AI systems, such as gender bias (larson, 2017) and race bias (koolen and Van 2017) From this perspective, AI algorithms are not free of human influence, implying that they are inherently influenced by the values of their designers. Osoba and Welser (2017,p.25) state that"The error and bias risk in algorithms and AI will continue as long as artificial agents play increasingly prominent roles in our lives and remain unregulated". In 2015, Google had to apologize after the algorithms powering its Photos app tagged two black people as gorillas—perhaps because its training dataset did not have enough pictures of black people. In 2016, an investigation by ProPublica found that COMPAS "AI-driven software" that assesses the risk of criminals in the US was biased against people of color, in particular, black criminals, despite the fact that the white criminals had more serious criminal records (Angwin *et al* 2016).

4.2 Ethical Challenges

Transparency: This term essentially refers to being open about the way data is collected and used, as well as eschewing unnecessary data collection. However, transparency is very important to ensure reader trust, which would involve making the underlying data available—allowing people to interact with it. Leppänen, et al (2017) defined transparency as the "trust in the system that transforms the data into an article". Thus, the publisher should first make the distinction between the subjects which items were written by a human journalist and which were written by a smart algorithm (Ombelet et al 2016).

Fact-Checking: In this aspect, the readers should have information on how the raw data is chosen, which reasoning was employed while choosing the data, how the data was checked, whether personal data of the readers are being processed, how credibility and objectivity of the used sources are ensured (Clerwall 2014).

Fairness: Fairness means to avoid harmful biases and stereotypes on people's lives. Thus, AI considered being the core challenge for journalism, in particular with the use of data as a tool for invading privacy, social manipulation and oppression. In October 2018, the International Conference of Data Protection and Privacy Commissioners (ICDPPC) released the Declaration on Ethics and Protection in Artificial Intelligence. The declaration states that "unlawful biases or discriminations that may result from the use of data in artificial intelligence should be reduced and mitigated".

Data Utilization: Currently, data utilization is one of the ethical problems related to AI in the field of automated journalism due to the lack of ad hoc laws and rules. Wang and Siau (2018) argue that the security and privacy of data pose significant risks not only for users but also for developers and governments. Regarding this issue, Monti (2019) in his study entitled: Automated Journalism and Freedom of Information: Ethical and Juridical Problems Related to AI in the Press Field, point out

that ethical duty should be the necessity to use correct, objective, and accurate data.

Data Quality: One of the main bigger concerns of the current use of AI in newsrooms is the quality of the data used that can lead to misleading results, including the source and the accuracy of data. In this regard, the European Parliament (EP) has approved a report on Robotics which establishes an Ethical Code of Conduct, which includes several fundamental principles, notably; protect privacy and data use.

5. Prospects of Artificial Intelligence Utilization in Journalism in Nigeria

Journalists in Nigeria are not using AI in their newsrooms. Exparts say it will take Nigeria a minimum of Eleven years to level up on AI globally (Olanrewaju. 2018; Ndiomewese, 2017)
Reasons for this assertion are not far fetched. Among the challenges bedevilling the introduction and adoption of AI in newsrooms are that of electricity to effectively power the AI applications; lack of adequate infrastructure; finance to purchase and maintain these equipments. Cultural and socio-economic barriers to adoption, cost of Internet connection and the training of AI handlers also pose a problem. Infact, Nigerians are still struggling with the basic needs. Furthermore, Nigeria is slow in adopting technological innovations as evident in her inability to successfully have a digital switch over system introduced for many years now.

The fact is that AI has come to stay thus investment in the introduction, training and retraining of editors and reporters are very crucial. As AI tools enter newsrooms, journalists need to understand how to use these new resources for storytelling—not only ethically, but also efficiently.

Developing and promoting the use of shared guidelines among journalists and technologists around ethical use of data and public disclosure of methodology is a must. Existing AI tools should be used as opportunities for thinking about how to apply editorial values and standards to the early stages of new journalistic technology.

Since tools are programmed by humans, there is a need for a concerted and continued effort to fight hidden bias in AI, often unacknowledged but always present. Journalists must strive to insert transparency into their stories, noting in familiar and non-technical terms how AI was used to help their reporting or production.

6. Conclusion

Journalism earthwide is undergoing a historic transition, thanks to rapid advancements in digital technology. Importantly, this development is another aspect of technological progress that had lead to major transformations in organizational structures and functions of media companies. In this respect, artificial intelligence is considered the most important revolution of journalism in the digital age, which has reorganized the newsroom as never before. On the other hand, these technologies offer much great potential for enhancing journalism today – especially in allowing journalists to process a high volume of data in a limited period of time, create news stories from structured data and automatically deliver them, as well as more diverse coverage. It is therefore imparative that journalists especially in the developing contries like Nigeria, adjust and enbrace these changes.
Nigerian journalists should embrace and adopt Artificial intelligence in their newsrooms. Though there are challenges to the adoption, but then they need to start from some where and then improve with time. AI at least for now does not pose a threat to professional journalism. In other words, artificial intelligence technologies has added value of journalism in the digital age, which cannot completely replace journalists, implying that these technologies will enhance, rather than replace journalists' work.

References

Aljazairi, S. (2016). *Robot Journalism: Threat or an Opportunity*. MA thesis. Örebro University, School of Humanities, Education and Social Sciences. Accessed: 2nd March 2020 from http://oru.diva-portal.org/smash/record.jsf?pid=diva2%3A938024&dswid=5523

Angwin, J, Larson, J., Mattu, S. & Kirchner, L. (2016). *Machine Bias. There's software used across the country to predict future criminals. And it's biased against blacks*. ProPublica. Accessed: 2nd March 2020 from https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing.

Bradshaw, P. (2010). How to Be a Data Journalist. *The Guardian*, Retrived 2nd March 2020 from https://www. The guardian.com/news/datablog/2010/oct/01/datajournalism-how-to-guide.

Carlson, M. (2015). The Robotic Reporter: Automated journalism and the redefinition of labor, compositional forms, and

journalistic authority. *Digital Journalism*, 3(3), 416-431.

Charlie C. (2018). Journalism and Artificial Intelligence: Some Notes. Retrived 14th March 2020. Available at https://blogs.lse.ac.uk/medialse/2018/03/02/journalism-and-artificial-intelligence-some-notes/

Clerwall, C. (2014). Enter the Robot Journalist: Users' perceptions of automated content. *Journalism Practice*, 8(5), 519-531.

European Parliament (2017). *Report with Recommendations to the Commission on Civil Law Rules on Robotics.* Retrieved from http://www.europarl.europa.eu/doceo/document/A-8-2017-0005_EN.html.Accessed: 14th March 2020.

Galily, Y. (2018). Artificial intelligence and sports journalism: Is it a sweeping change? *Technology in Society*, 54, 47-51.

Graefe, A. (2016). Guide to Automated Journalism. *Tow Center for Digital Journalism*. Retrieved from http://towcenter.org/research/guide-to-automated-journalism/ Accessed: 19th March 2020.

Gynnild, A. (2014). Journalism Innovation leads to Innovation Journalism: The impact of computational exploration on changing mindsets. *Journalism*, 15 (6), 713-730.

Hamilton, JT. & Turner, F. (2009). Accountability through Algorithm: Developing the Field of Computational Journalism. *Behavioral Sciences Summer Workshop, Stanford*. Retrieved fromhttp://web.stanford.edu/~fturner/Hamilton%20Turner%20Acc%20by%20Alg%20Final.pdf/ Accessed: 11th April 2020.

Jung, J., Song, H., Kim, Y., Im, H. & Oh, S. (2017). Intrusion of software robots into journalism: The public's and journalists' perceptions of news written by algorithms and human journalists. *Computers in Human Behavior*, 71, 291-298.

Koolen, C. & van Cranenburgh, A. (2017). These are not the Stereotypes You are Looking For: Bias and Fairness in Authorial Gender Attribution. *Proceedings of the First ACL Workshop on Ethics in Natural Language Processing*. pp. 12-22, Valencia, Spain.

Larson, B. N. (2017). Gender as a variable in natural-language processing: Ethical considerations. *Proceedings of the First Workshop on Ethics in Natural Language Processing*, pp. 1–11, Valencia, Spain.

Latar, NL. (2018). *Robot Journalism: Can Human Journalism Survive?* World Scientific Publishing Company.

Leppänen L., Munezero, M., Granroth-Wilding M., & Toivonen, H. (2017). Data-Driven News Generation for Automated Journalism. *Proceedings of the 10th International Conference on Natural Language Generation*, 188–197. Retrieved from https://aclanthology.info/papers/W17-3528/w17-3528. Accessed: 18th March 2020.

Lindén, C-G. (2017). Algorithms for Journalism: The future of news work. *The Journal of Media Innovations*,4(1),60-76. Retrieved 14th March 2020 from https://journals.uio.no/index.php/TJMI/article/view/2420.

Loosen, W. (2018). Four Forms of Datafeed Journalism: Journalism's Response to the Datafication of Society. Bremen: "Communicative Figurations" *Research Network, Centre for Media, Communication, and Information Research* (ZeMKI) (Working Paper Series "Communicative Figurations Working Papers" No.18).

Malmelin, M. & Nivari-Lindström, L. (2015). Rethinking creativity in journalism: Implicit theories of creativity in the Finnish magazine industry. *Journalism*, 18(3), 334-349. Retrieved 14th March 2020 from https://doi.org/10. 1177/1464884915620272

Mark, H., Meritxell, R., Jon, K. and George, K. (2017). Artificial Intelligence: Practice and Implications for Journalism. *Tow Center for Digital Journalism and the Brown Institute for Media Innovation*

Mattia P (2019). *How AI could shape the future of journalism.* Retrived 14th March 2020. Available at https://www.blog.google/outreach-initiatives/google-news-initiative/how-ai-could-shape-future-journalism/

Monti, M. (2019). *Automated Journalism and Freedom of Information: Ethical and Juridical Problems Related to AI in the Press Field*. Retrieved 19th March 2020 from https://papers.ssrn.com/sol3/papers.cfm?abstract_id = 3318460

Ndiomewese, I. (2017). *Experts answer 9 questions on the state of Artificial Intelligence in Nigeria*. Retrieved from https://techpoint.africa/2017/09/26/artificial-intelligence-nigeria/.

Newman N. (2018). *Journalism, Media, and Technology Trends and Predictions. Digital news project*. Retrieved 14th March 2020 from

https://reutersinstitute.politics.ox.ac.uk/our-research/journalism-media-and-technologytrends-and-predictions-2019

Newman, N., Fletcher, R., Kalogeropoulos, A., Levy, DA. & Nielsen, R.K. (2018). Reuters Institute *Digital News Report* 2018. Oxford: Reuters Institute for the Study of Journalism.

Olanrewaju. B. (2018). *Artificial intelligence and Nigeria dearth system*. Retrieved from http://ni geriannewsdirect.com/96246-2/.

Ombelet, PJ., Kuczerawy, A. & Valcke P. (2016). *Employing Robot Journalists: Legal Implications, Considerations, and Recommendations.* WWW 2016 Companion, April 11-15, Montréal, Québec, Canada.

Osoba, OA. & Welser, W. (2017).*An Intelligence in Our Image: The Risks of Bias and Errors in Artificial Intelligence* – RAND Corporation. Retrieved 14th March 2020 from https://www.rand.org/pubs/research_reports/ RR1744. html

Tandoc, EC. & Thomas, RJ. (2015).The ethics of web analytics. Implications of using audience metrics in news construction. *Digital Journalism*, 3(2), 243–258.

Tom, V.(2018). *10 things about AI every newsroom should know. Preparing your newsroom for the artificial intelligence revolution.* https://medium.com/jsk-class-of-2019/10-things-about-ai-every-newsroom-should-know-19745dac8ad7,

Van Dalen, A. (2012). The Algorithms Behind the Headlines: How Machine-written News Redefines the Core Skills of Human Journalists. *Journalism Practice*, 6, 648–658. Retrieved 14th March 2020 from http://dx.doi.org/10. 1080/17512786.2012.667268

Veglis, A. & Bratsas, C. (2017). Towards a Taxonomy of Data Journalism. *Journal of Media Critiques*, 3(11), 109-121.

Waleed A. and Mohamed, H.(2019). Artificial Intelligence and Automated Journalism: Contemporary Challenges and New Opportunities. *International Journal of Media, Journalism and Mass Communications (IJMJMC)* Vol. 5, Issue 1, 2019, PP 40-49.

Wang, W., & Siau, K. (2018).*Ethical and Moral Issues with AI: A Case Study on Healthcare Robots. Twenty-fourth Americas Conference on Information Systems*. Retrieved 14th March 2020 from https://www.researchgate. net/publication/325934375

Zangana, A. (2017). *The Impact of New Technology on the News Production Process in the Newsroom.* Ph.D. Thesis, University of Liverpool. Retrieved 14th March 2020 from https://livrepository.liverpool.ac.uk/3008664/.