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THE IMPACT OF 5TH INDUSTRIAL REVOLUTION TECHNOLOGIES ON ACADEMIC LIBRARIES: IMPROVING DIVERSITY AND INCLUSIVE SERVICES IN OPEN AND DISTANCE LEARNING

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Abstract
This study investigates the impact of Fifth Industrial Revolution (5th IR) technologies on enhancing diversity and inclusive services in Open and Distance Learning libraries. Using a descriptive design, the research focused on librarians at the National Open University of Nigeria, with data collected through a Google Form questionnaire. Analysis was conducted using SPSS and linear regression to test hypotheses. Findings revealed that librarians believe 5th IR technology improves data extraction, processing, and service efficiency (mean score 3.44, SD = 0.586). The study identifies key implementation strategies, including awareness-raising, curriculum updates, training, collaboration, and skill enhancement. It emphasizes the importance of funding, reliable power supply, and collaboration for effective 5th IR adoption. The study underscores the potential for human-machine partnerships to automate tasks and foster connectivity, suggesting an optimistic outlook for the 5th IR's role in promoting inclusive, customized library services in academic and distance learning environments.
Keywords: *Inclusive Library Services, 5th Industrial Revolution, Open and Distance Learning*

Abstrak
Studi ini menyelidiki dampak teknologi Revolusi Industri Kelima (IR ke-5) dalam meningkatkan keberagaman dan layanan inklusif di perpustakaan Pembelajaran Terbuka dan Jarak Jauh. Menggunakan desain deskriptif, penelitian difokuskan pada pustakawan di National Open University of Nigeria, dengan pengumpulan data melalui kuesioner Google Form. Analisis dilakukan dengan menggunakan SPSS dan regresi linier untuk menguji hipotesis. Temuan mengungkapkan bahwa pustakawan percaya bahwa teknologi IR ke-5 meningkatkan ekstraksi data, pemrosesan, dan efisiensi layanan (skor rata-rata 3,44, SD = 0,586). Studi ini mengidentifikasi strategi implementasi utama, termasuk peningkatan kesadaran, pembaruan kurikulum, pelatihan, kolaborasi, dan peningkatan keterampilan. Hal ini menekankan pentingnya pendanaan, pasokan listrik yang andal, dan kolaborasi untuk adopsi IR ke-5 yang efektif. Studi ini menggarisbawahi potensi kemitraan manusia-mesin untuk mengotomatisasi tugas-tugas dan mendorong konektivitas, menunjukkan pandangan optimis terhadap

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peran IR ke-5 dalam mempromosikan layanan perpustakaan yang inklusif dan disesuaikan dalam lingkungan akademik dan pembelajaran jarak jauh.

***Kata Kunci**: Layanan Perpustakaan Inklusif, Revolusi Industri 5, Pembelajaran Terbuka dan Jarak Jauh*

INTRODUCTION

The Industrial Revolutions have been instrumental in driving technological and societal transformations. According to Petcu et al. (2020), The Industrial Revolution, spanning from Industry 1.0 to Industry 5.0, has revolutionized the way we work and live. It introduced mechanization, mass production, and the rise of e-commerce. The 4th Industrial Revolution integrated advanced technologies like IoT and AI, transforming production into a decentralized model. The 5th Industrial Revolution, Industry 5.0, aims to optimize resource efficiency and production output by reshaping human-machine interactions. (Golić, 2019). Industry 5.0 aims to redefine industrial processes and human-machine interactions, highlighting the collaboration between humans and intelligent systems. It also emphasizes the bioeconomy, utilizing renewable biological resources for industrial purposes, and circular economy principles to enhance resource utilization and minimize waste. The 5th industrial revolution has applications across various industries, including libraries. (Rame, Purwanto & Sudarno, 2024)

Diversity and inclusive library services involve creating an environment where individuals from diverse backgrounds (regardless of gender, race, ability, religion, etc.) have access to a variety of information resources to meet their needs (Zaid & Nduka, 2023). Diversity in the library context pertains to heterogeneous differences, encompassing the workforce, collections, and community. Inclusivity, on the other hand, focuses on establishing and maintaining an organization and community where every member is treated fairly and respectfully (Kauffman & Anderson, 2020). In the context of the 5th Industrial Revolution (IR), diversity and inclusion entail recognizing differences and perspectives in development, deployment, addressing potential biases, and promoting equitable outcomes for all Integrating diversity and inclusion principles into artificial intelligence (AI) can enhance technology's responsiveness to diverse user needs, thereby improving our understanding and implementation of diversity and inclusion in library services (Noble, et. al 2022). The mission of the National Open University of Nigeria is to provide equitable access to education for all individuals seeking knowledge. The university aims to achieve this objective by granting access to students regardless of their remote locations through the use of electronic and digital information resources.

1.1 Research Objectives

1. Investigate the expected impact of the 5th Industrial Revolution technology in enhancing Diversity and Inclusive library services in Open and Distance Learning.
2. Identify challenges librarians will encounter implementation the 5th Industrial Revolution for enhancing diversity and inclusion in Open and Distance Learning
3. Suggest strategies and best practices for enhancing diversity and inclusion aligned with the principles of the 5th Industrial Revolution among librarians in Open and distance learning.

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1.2 Research Questions

1. What are the expected impacts of the 5th Industrial Revolution technologies in enhancing diversity and inclusive library services in open and distance learning?
2. What challenges are librarians likely to encounter when implementing the 5th Industrial Revolution to enhance diversity and inclusion in open and distance learning?
3. What strategies and best practices can be recommended for librarians in open and distance learning institutions to enhance diversity and inclusion in alignment with the principles of the 5th Industrial Revolution?

LITERATURE REVIEW

This section presents some selected literature industrial revolution technologies, challenges and Strategies for Implementing the 5th Industrial Revolution among Librarians

2.1 The Impact of 5th Industrial Revolution Technologies on Diversity and Inclusive Library Services.

The Fifth Industrial Revolution (5th IR) transitions from traditional automation to advanced technologies, enhancing connectivity, speed, and innovative solutions, boosting productivity and creating new business opportunities. (Santhi & Muthuswamy, 2023). For libraries, particularly in Open and Distance Learning environments, the adoption of 5th IR technologies is crucial for delivering inclusive, user-centered services (Akparobore, Omosekejimi, and Nweke, 2020). Librarians are encouraged to integrate tools like artificial intelligence, robotics, the Internet of Things (IoT), cloud computing, and 3D printing to enhance access to information and improve user experiences (Ibinaiye and Jiyane, 2021). These technologies support libraries in providing flexible, remote access to digital resources, thereby extending their service offerings and facilitating internet access for communities, including students (Frank et al., 2021). Additionally, incorporating data science into library services and updating librarian training programs are essential for navigating 5th IR advancements, particularly during crises like epidemics (Ibinaiye and Jiyane, 2021). The collaboration between humans and technology (Noble et al., 2022) allows for automation and process efficiency, fostering personalized services, higher productivity, and increased job satisfaction (George & George, 2020)).

2.2 Challenges of Implementing The 5th Industrial Revolution

The 5th industrial revolution could significantly alter human life, causing job loss, skill shortages, digital inequality, privacy breaches, cybersecurity issues, and ethical concerns, necessitating ongoing education and regulation of AI, automation, and libraries. To adapt to present and future library services, Apriliyanti and M, (2022) advises updating curriculum regularly. Life skills, critical thinking, and creativity must also adapt to the situation. Sajidan, Atmojo, Febriansari and Suranto, (2021), stressed that librarians must have 5th IR abilities and competences to be trusted by institutions. This requirement complicates curriculum, competency, training, and skill acquisition.

The 5th Industrial Revolution, characterized by advanced technology and human-machine collaboration, presents a significant challenge in libraries, as people adapt to the new work environment. Noah, et al (2020) suggested that university libraries struggle

to support modern technology. Financial constraints could prevent the development and transformation of smart services and the purchasing of all the equipment needed for the 5th IR, according to Apriliyanti, (2022). They also listed networking, inconsistent power supply, lack of skilled workers, outdated technologies, economic issues, and high tool costs as challenges to adopting AI and other modern technologies in library operations.

2.3 Strategies for Implementing the 5th Industrial Revolution Among Librarians

According to Rushan, Madhu and Rifkat, (2024). Library activities have improved due to information and communication technologies, especially the Industrial Revolution, and the demand for more customisation and flexibility in information dissemination and services. Libraries must educate people about the 5th IR, collect feedback, and train librarians to improve AI-driven services that meet user needs (Rushan, Madhu and Rifkat, 2024). The 5th Industrial Revolution (IR) could revolutionize library operations by automating tasks, improving efficiency, and providing real-time usage data, thus enhancing cost-effectiveness (Adewojo, Dunmade & Akanbiemu, 2023).

METHODOLOGY

The study surveyed 60 librarians at the National Open University of Nigeria using a Google Form questionnaire. Out of the 60 respondents, 44 filled the form correctly. Data was analyzed using SPSS, with simple percentage, mean scores, and standard deviation as the analysis values. The mean response was interpreted using a 4-point scale, with a criterion mean of 2.50 was used to interpret the data, with values equal to or above this threshold indicating agreement. The data was arranged into tables based on the questionnaire and evaluated using mean (x) scores and standard deviation (SD). Linear regression was used to test hypotheses, with a P-value of 0.05 indicating no significant relationship between variables.

1. THE FINDINGS OF THE STUDY

Table 1: Demographics of the Respondents

Items	Frequency	Percentage (%)
Gender		
Male	17	38.6%
Female	27	61.4%
Total	44	100%

Table 1 shows that 61.4% of respondents were female, showing that the NOUN library has more female librarians than male librarians.

Table 2: Adoption of 5th Industrial Revolution technologies

Statement	Mean	SD
The 5th Industrial Revolution will enhance data extraction and boost efficiency in service delivery.	3.44	.586
5th IR will make librarians to be proactive with different users' needs.	3.33	.477
The 5th IR will result in employees being more productive	3.40	.495

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The industry has infiltrated the virtual world in the 5th IR age by linking people, machines, and data.	3.31	.596
The 5th IR technology collaborate to automate tasks and enhance connectivity for diverse and inclusive library services.	3.44	.503
The 5th IR will presents opportunities for significant enhancements in library services.	3.42	.543
5th IR utilization will enhance the profession's image.	3.56	.546
Libraries enhance service delivery with 5th IR for inclusive community access to the internet and digital resources.	3.40	.539
The 5th Industrial Revolution is expected to enhance data extraction	3.42	.543
AI algorithms will enhance search, recommend resources, and automate library tasks	3.36	.609
Aggregate Mean	**3.41**	

Most librarians believe 5th Industrial Revolution technology will increase data extraction and cognitive processing to boost service delivery efficiency and productivity (mean score 3.44, SD = 0.586). With a mean score of 3.33 (SD=0.477), The 5th Industrial Revolution (IR) is expected to enhance library diversity and inclusivity by implementing new technologies, enhancing service delivery, staff productivity, and community access, with a mean score of 3.41.

Table 3: Challenges librarians are likely to encounter when implementing the 5th Industrial Revolution in open and distance learning

Statement	Mean	SD
Implementation of the 5th IR in libraries will bring frequent changes in curriculum development.	3.24	.529
constant change in technology will lead to economic waste.	2.31	.821
I lack adequate training for the 4th IR and this will affect the implementation of the 5th IR in library services.	2.96	.737
Learning new technologies too frequently will lead to inefficiency.	2.02	.753
Training and retraining will increase the overhead cost of library management.	3.00	.953
I need to be creative, cooperative, and tech-savvy to implement the 5th IR Technology.	3.33	.603
I have the right skills and competencies for the implementation of the 5th IR	2.87	.661
It will be impossible for human-machine to collaborate.	2.18	.747
Advanced technologies used in the 5th IR are complex and not easy to maintain.	2.49	.787
My job is threatened by the introduction of the 5th IR.	2.38	.806
Aggregate Mean	**2.68**	

Most librarians believe the 5th IR will change curriculum frequently, with a mean score of 3.24 (SD = 0.529). Their mean score of 3.33 (SD = 0.603) indicates that applying the 5th IR Technology demands innovation, cooperation, and tech-savvy. Most respondents disagreed that learning new technologies too often leads to inefficiency (Mean = 2.02) and that humans and machines cannot interact (Mean = 2.18). The aggregate mean score of 2.68, above the criterion mean of 2.50, suggests significant concern and uncertainty about using the 5th IR in library services.

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Table 4: Strategies and best practices that be recommended for librarians in open and distance learning institutions to enhance diversity and inclusion of the 5th Industrial Revolution

Statement	Mean	SD
Creating awareness through seminars and workshops about the 5th IR aid its implementation.	3.51	.661
Librarians should anticipate and respond to curriculum changes resulting from the 5th IR.	3.38	.576
Motivated librarians are more likely to adopt new technology and practices relevant to the 5th IR.	3.47	.548
Training and retraining of librarians will enhance the implementation of the 5th IR in library services.	3.60	.539
Collaboration Training and retraining of librarians will enhance the implementation of the 5th IR in library services.	3.49	.549
Creativity, innovation, and dedication will enhance the implementation of the 5th IR Technology among librarians.	3.47	.505
The right skills/competencies for the implementation of the 5th IR will be an advantage.	3.42	.499
Improved power supply will enhance the implementation of 5th IR inclusion in open and distance learning libraries.	3.62	.490
Libraries should be adequately funded by management and government for the successful implementation of the 5th IR.	3.60	.495
There should be experts to maintain and manage the 5th IR facilities.	3.62	.490
Aggregate Mean	**3.52**	

Majority of librarians, with a mean score of 3.62 (SD = 0.490), significantly agree that improved power supply will enhance the implementation of 5th IR inclusion in open and distance learning libraries. They also agreed that there should be experts to maintain and manage the 5th IR facilities, with a mean score of 3.62 (SD=0.490). Furthermore, majority of the respondents agreed that training and retraining of librarians will enhance the implementation of the 5th IR in library services (mean score = 3.60; SD = 0.539), and that Libraries should be adequately funded by management and government for the successful implementation of the 5th IR (mean score = 3.60; SD = 0.495). The aggregate mean of 3.52 which is above the criterion mean of 2.50 indicates overall agreement with these recommended strategies and practices.

Ho_1:There is no significant difference in the mean rating of male and female librarians on how the adoption of 5th Industrial Revolution technologies impacts the improvement of diversity and inclusive library services in open and distance learning.

Table 5: t-test analysis on the significant difference in the mean ratings of librarian on how adoption of 5th Industrial Revolution technologies

Gender	N	Mean	Std. Deviation	t	Df	Significance (2-tailed) P	Decision
Male	17	3.3882	.35157	-.318	43	.752	No Significant

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Female	28	3.4214	.33150	-.314	32.350

Table 2 presents the independent t-test analysis of the mean difference in the mean ratings of librarians on how the adoption of 5th Industrial Revolution technologies impacts the improvement of diversity and inclusive library services in open and distance learning. The results revealed that there is no significant difference ($t = -3.381$, $P > 0.05$). Therefore, the null hypothesis is rejected.

DISCUSSION CONCLUSIONS AND RECOMMENDATIONS

This study revealed in table 1 that there are more females (61.4%) than male (38.6%) librarians in National Open University of Nigeria.

Table 2 reveals that, majority of respondents believe the adoption of the 5th Industrial Revolution will significantly improve library services, enhance efficiency, productivity, and economic potential. This confirms Frank et al., 2021, Ibinaiye and Jiyane's (2021) and Noble et al.'s (2022) opinion that librarians must integrate data science and relevant competencies in order to manage and capitalise on the Fifth Industrial Revolution.

Table 3 revealed the challenges that librarians may encounter when implementing the 5th IR to improve diversity in open and distance learning. The study discovered that 43 (95.6%) respondents believed the 5th IR in libraries will regularly change curriculum, whereas 2 (4.4%) disagreed. Apriliyanti (2022) agreed that curriculum must change frequently to reflect present and future library services. This means that the curriculum adjusts to the available resources. The study also found that 18 (40.0%) respondents believed the 5th IR threatened their careers, while 27 (60.0%) disagreed. According to Okesar (2018), human-machine collaboration is a problem in the fifth industrial revolution, where superior technology reigns supreme. Thus, machines do not pose a danger to human jobs. Furthermore, 24 (53.4%) respondents stated that the advanced technologies used in the 5th IR are complex and difficult to maintain, whilst 21 (36.7%) disagreed. Akande etal. (2020) acknowledged that university libraries struggle to accommodate modern technology.

Table 4 revealed that, majority of respondents thought librarians should anticipate and adapt to changes in the 5th IR curriculum to keep services relevant and effective. According to Petcu etal. (2020), emphasised that AI, IoT, and big data as critical instruments for improving digital literacy and technological skills in school curricula. The majority of respondents are confident that 5th IR seminars and workshops will help them use it. According to Rushan, Madhu and Rifkat, (2024) they recommended that librarians to be creative in improving library service quality and standards in order to gratify consumers. They believe that mastering 5th IR skills will be advantageous. Organisations should leverage soft skills such as communication, listening, flexibility, problem solving, team building, emotional intelligence, leadership, and technical talents to provide appropriate services and prepare employees for Industry 5.0.

Table 5 independent t-test analysis examined whether there is a significant gender-based difference in how librarians perceive the adoption of 5th Industrial Revolution (5th IR) technologies for enhancing diversity and inclusive library services in Open and Distance Learning (ODL). The results showed that male (Mean = 3.3882, SD

= .35157) and female librarians (Mean = 3.4214, SD = .33150) had similar mean ratings, with no significant difference found (t = -0.318, df = 43, p = 0.752). Since the p-value exceeded 0.05, the null hypothesis was retained, indicating gender does not significantly influence perceptions. Both male and female librarians agree on the benefits of adopting 5th IR technologies in libraries, indicating that training and adoption strategies can be developed unifiedly, promoting inclusivity and enhancing library services in Open Access (ODL) contexts.

The study concluded that, the fifth Industrial Revolution (IR) will significantly impact library services, particularly in open and distance learning. Librarians must increase technology use and develop services like customised SDI and job automation. Given the above findings, it was recommended that Implementation strategies should include raising awareness, planning curricular changes, empowering librarians, offering training, and fostering collaboration.

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