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Impact of Selected Fourth Industrial Revolution Technologies on the Music Industry: An Exploration of the Pros and Cons

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Abstract

The fourth industrial revolution (4IR) is changing the creative industry. This article examines the impact of selected technologies within the 4IR—artificial intelligence, as well as virtual and augmented reality as case examples—on various aspects of creative production, distribution, and consumption of creative art. Using the theory of knowledge organisation, the article deals with the principles and practices of arranging information and concepts. This qualitative literature review focused on systematically collecting, analysing and synthesising data from existing research to gain a deeper understanding of 4IR from a creative arts perspective. Specifically, the article analyses how 4IR tools influence artistic expression in music and the evolving role of the artist in addition to exploring the transformation of musical art distribution and audience engagement through online platforms and immersive experiences. The impact of selected technologies on the art industry has both positive and negative consequences. Positive impacts include new forms of artistic creation and collaboration, composition with artificial intelligence, art installations with virtual reality and audience engagement, democratisation of art production and accessibility, opportunities for innovation and growth, new forms of creativity and better traceability of works. On the downside, there are technological challenges, skills and labour development, disruption of traditional art markets and business models, ethical considerations and concerns about 4IR-generated music art and information overload. This research contributes to a deeper understanding of the complex interplay between technology and artistic practise in the 4IR.

Keywords:
Creative industry, music, fourth industrial revolution, Artificial intelligence, virtual and augmented reality

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Introduction

The fourth industrial revolution (4IR) is a period of rapid technological progress characterised by the merging of the physical, digital and biological aspects (Schwab 2016). This unprecedented technological leap has engendered a significant impact on various sectors (Wanyama et al. 2024), the creative industries no exception. The 4IR continues transforming our world through the convergence of new technologies such as artificial intelligence, and virtual and augmented reality. Although it is often and largely associated with manufacturing and robotics, the impact of the 4IR extends to the creative sector (Mhlanga & Ndhlovu 2023; Jindala & Sindhu 2022). Yet, there are few studies that have looked closely at the effect of 4IR on the creative industry, hence making this lacuna a fertile ground for further exploration to bridge the unfamiliarity gap on the topic as it relates to the creative arts. Even though the 4IR provides artists with improved tools to tailor their output to their respective audiences and democratise art, it also brings with it numerous challenges. These challenges include the originality of works, constant learning and the fact that technology is replacing the human element in art (Vinchon et al. 2023).

Artificial intelligence or simply AI, with its ability to analyse large volumes of data and simulate human cognitive processes, is revolutionising the creative process by enhancing artists' skills, generating new ideas (can provide critique) and automating repetitive tasks through data analysis and pattern recognition, exploration of possibilities, AI can recognise similarities and relationships between seemingly different concepts and—in the process—help to quickly create and test multiple variants of an idea. Virtual and augmented reality technologies are also changing the way audiences perceive and interact with art. Moreover, they offer immersive experiences that transcend physical boundaries and traditional exhibition formats (Mohamed et al. 2024). Furthermore, 3D printing has democratised art production, and allowed artists to transform their digital creations into tangible form with unprecedented alacrity and precision (Nwoga 2023). Traditionally, the creation of art often presupposes specialised skills, expensive equipment, and gatekeepers in the art world such as galleries, recording studios, museums and the like. In this regard, democratisation aims to break these barriers down through advances in technology. Furthermore, by offering transparent and unchangeable mechanisms for provenance, authenticity, and ownership tracking and resolving long-standing problems with fraud and piracy,

blockchain technology is revolutionising the art industry (Ramani et al. 2022).

The Problem Statement

The creative industries are traditionally an area characterised by human creativity and expression (Gohoungodji & Amara 2023; Szakálné-Kanó et al. 2023). However, the advent of the 4IR with its transformative technologies presents a unique challenge. One of the new concerns is how the creative industries may use and incorporate these technologies while maintaining the fundamental principles of human expression and artistic freedom (Bouquillion & Ithurbide 2023). A thorough investigation is, thus, necessary to grasp fully the potential and problems associated with integrating certain 4IR technologies into the creative industries. After all, technological developments raise important concerns about the sustainability of cultural ecosystems, the preservation of artistic integrity, and the democratisation of access, even as they have the potential to transform creative processes, increase audience engagement, and alter market dynamics.

Many studies have hitherto focused on established technologies such as social media for the commercialisation of art, rather than examine the impact of new technologies such as AI on art production or virtual reality for immersive art experiences (Dwivedi, Ismagilova, Rana, & Raman 2023). In fact, research often does not go deep enough to explore how 4IR technologies have impacted different artistic disciplines. The needs of a sculptor, for example, differ significantly from those of a digital artist when integrating new technologies into their respective creative processes (Zhao & Cai 2023; Pisani, Miller, & Hall 2023). Moreover, studies have often looked at the immediate impact of technologies, hence leaving a gap in understanding the long-term social, economic, and even philosophical consequences for the art world (Birsel, Marques, & Loots 2023). This article will focus on the music arena as an artistic expression that has not exceed from the ensnares of 4IR.

Even though 4IR technologies have immense potential to revolutionise music creation, its dissemination, and audience engagement, there is a lack of clear understanding of their specific impact on the creative industries. This article, generally, explores this challenge by focussing on

specific technologies such as Artificial Intelligence and Augmented Reality. After all, they can also influence the creative process itself, including artistic expression and innovation (Koch et al. 2023); transform the way music art is distributed and consumed by audiences (Christensen et al. 2023); and potentially disrupt traditional music art forms and industry business models (Kanbach et al. 2023; Cavazza et al. 2023). In this regard, the following questions arise: Will AI-generated music art be valued in the same way as human-created works? How will these technologies affect the concept of artistic originality in music? As many studies of this nature have focused on industrialised countries generally, there is a need for research on how 4IR technologies will impact and be adopted by creative industries in the developing world's context, including Africa. In this case, the n the question becomes: How can art education be adapted to equip artists with the technical and creative skills they need to utilise these new technologies effectively? Moreover, there are ethical implications of AI-generated musical art, privacy concerns, and the potential for manipulation of creative expression through technology that remain under-researched, particularly as they relate to the developing countries' contexts.

In its exploration of the impact of selected 4IR technologies on the music industry, the article aims to examine how these technologies impact on the artistic creation, distribution and consumption of musical art in addition to critically analysing both the potential challenges and opportunities they present. Through this analysis, the article attempts to contribute to a better understanding of this evolving landscape vis-à-vis the future of music creative expression in the context of 4IR. For instance, there may be a loss of creative originality and difference as a result of the possible homogenisation of art, or the 4IR-generated art being indistinguishable from human-created art (Boden 2016); whether the role of the artist in the creative process as technology takes over certain aspects of art-making will be reduced to that of mere curation or control of machines (Baradaran 2024); the ownership and control of art generated by technology; also, there is a chance that algorithms used for selection and curation of art might introduce algorithmic bias, which could reinforce preexisting prejudices in the art world and restrict access to a variety of creative perspectives (Galvão 2023).

This article aims to investigate the many effects of these chosen technologies on the music business, considering their consequences for

artists, fans, cultural establishments, and the broader socio-economic environment, by means of an extensive examination of these technologies. The article sheds light on the potential and problems that technological innovation presents for the pursuit of creative excellence and cultural advancement by analysing prior research, industry trends, and theoretical frameworks. Through an analysis of these technologies' effects, the article seeks to provide a thorough picture of how the music arts sector is changing in 4IR. Policymakers, artists, and cultural institutions will all find value in this research. They will be more equipped to deal with the ever-changing landscape and take use of the possibilities that these technologies provide to foster creative innovation and audience participation.

Significance of the Study

As the article explores the transformative potential of 4IR technologies in the creative industry, particularly music, and their impact on artists, cultural institutions, policymakers, and society, it highlights the potential for artists to experiment with new creative expression avenues, while policymakers can use this research to inform decisions on funding, copyright protection, and ethical considerations for 4IR-generated art. The study also highlights the potential disruption and job displacement that use of these technologies can engender, helping policymakers develop strategies to support artists and ensure fair compensation in the digital age. Moreover, it also contributes to discussions on digital rights, cultural diversity, and democratisation of access to musical arts and culture. The article further stimulates innovation and experimentation in the creative industries, and encourages the development of new artistic forms, collaborative practices, and business models that utilise technology's potential to create value and impact. It also contributes to the ongoing dialogue about the future of music art in the digital age.

Scope and Limitations

Though there are 12 main technologies in 4IR, this article only focuses on artificial intelligence and virtual and augmented reality. This article does not cover technologies related to nanotechnology, biotechnology, pervasive network sensors (such as the Internet of Things),

geoengineering, quantum technology, space technology, distributed ledger technology, additive manufacturing, neurotechnology or energy generation, storage, and transmission. Nevertheless, the article does not imply or assert that the technologies that are left out have no bearing on the creative musical industries. After all, any technology in the 4IR influences the creative sector.

Methodology

Using the theory of knowledge organisation, the article deals with the principles and practices of arranging information and concepts. It serves as the fundamental framework for how we organise and classify knowledge to facilitate its location and eventual utilisation. This article is based on a qualitative literature analysis. This methodology engendered the better comprehension of 4IR from the standpoint of the creative arts by methodically gathering, evaluating, and synthesising evidence from previous studies. The utilisation of a qualitative method also facilitates the examination of intricate subjects from several angles and aligns well with the study objective of evaluating the influence of 4IR on the creative sectors. Primarily, Reese (2022) guided the study.

4IR and Creative industry

In general, the term "creative industry" refers to business ventures including the creation of information, knowledge, and material intended for consumer consumption. The following are a few examples of creative products: games, films, TV shows, books, artwork, music, and fashion items (Malik et al. 2023; Fürst & Aspers 2023). The "creative industry" that emerged in the late 20th century highlighted the economic value of artistic and cultural activities. It contributes to innovation, employment, and national competitiveness. As a result, programmes and policies evolved to support creative enterprises, nurture creative talent, and promote cross-cultural exchange (UNESCO 2013). The digital revolution has significantly transformed the creative business, enabling new content development, dissemination, and consumption channels. Digital marketing, social media, streaming services, and online platforms have facilitated global access to creative goods and services, blurring the lines

between conventional industries and fostering creative business ideas and interdisciplinary cooperation.

The creative economy is a dynamic and continually evolving sector that thrives on the unique talents and skills of individuals (Shan & Wang 2024; Chen & Yu 2023). It serves as a driving force for cultural expression, entertainment and the creation of intellectual property (Xiaojuan 2023). By merging art, technology and business, the creative economy fosters innovation and creativity that resonates with global audiences (Donelli & Panozzo 2024). These streaming platforms use 4IR technologies such as big data analytics and AI to personalise music recommendations for users. Moreover, the 4IR is having a profound impact on the marketing and promotion of music (Melville et al. 2023).

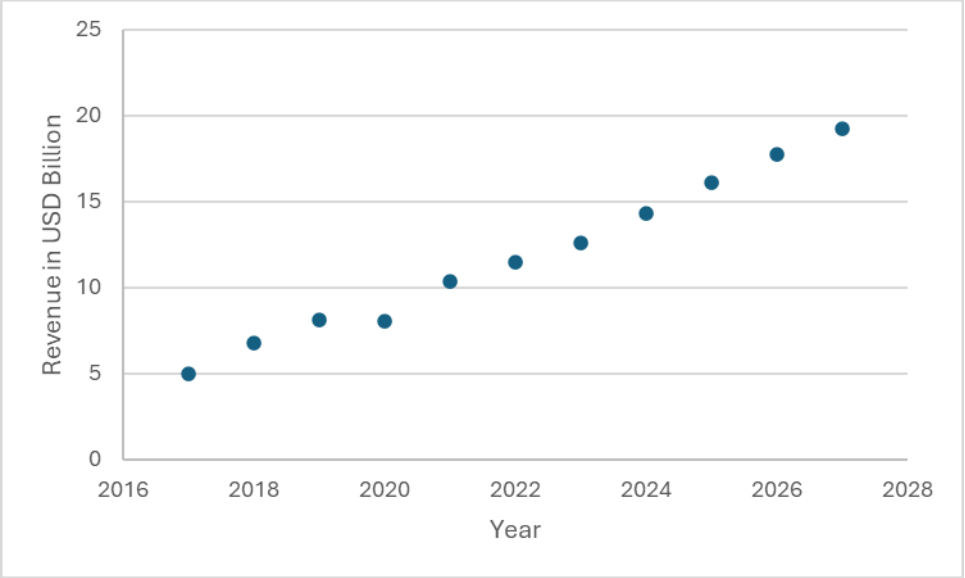
Creativity is the cornerstone of the creative economy (Amankwah-Amoah et al. 2024) and serves as a lifeblood and driving force. Creativity drives innovation by generating fresh ideas, novel concepts and original content (Kochet al. 2023). This innovation is essential in staying ahead in a highly competitive market and retaining public attention. The creative industries help with problem solving, audience engagement, cultural expression, economic/technological growth, and social impact (Kim & Lee 2023). To summarise, creativity is the driving force behind the creative industries. Its importance lies not only in artistic expression, but also in its ability to inspire innovation, foster emotional connections, engage audiences, drive economic growth and have a positive impact on society as a whole. The Policy Circle (2023) notes:

> The creative industries contribute just over 6.1 % to global gross domestic product (GDP) and account for between 2 % and 7 % of national GDP on average worldwide. According to UN estimates, the creative industries generate an annual turnover of over 2 trillion dollars and provide almost 50 million jobs worldwide. About half of these workers are women, and more people between the ages of 15 and 29 are employed in these industries than in any other sector. Television and visual arts are the largest creative industries in terms of revenue, while visual arts and music are the largest industries in terms of employment.

Creative industries are characterised by three main features: human creativity as input; symbolic messages, which are conveyors of meaning and messages; and intellectual property belonging to an individual or a group (Sigthorsson & Davies 2013). To emphasise the importance of the creative industries, the UN General Assembly has declared 2021 the International Year of Creative Industries for Sustainable Development.

Music industry

The music industry is a complex network of individuals and organisations that create, distribute, sell, and promote music. It involves various activities such as songwriting, production, artist management, live music events, and music streaming services. The recording industry involves record companies, studios, and sound engineers. Music distribution ensures the music reaches listeners, with distributors sending physical or digital copies to retailers and streaming services. Music promotion involves publicists, marketing teams, and radio stations. The live music sector includes concert promoters, booking agents, managers, and touring crews. The music rights sector includes copyright and other rights associated with music, including organisations collecting royalties for songwriters and musicians, and lawyers specialising in music law. Global growth of music industry is presented in Figure 1. In 2025, it is estimated to be 14.34 USD. Nearly one third of the countries in the world have yet to reach that GDP.



Source: Statistica (2024)

Figure 1: Global Growth of Music Industry

Even though 4IR encompasses many technologies, this article focuses AI as well as virtual and augmented reality. AI is increasingly being used in the music creative industry to enhance content creation, artistic expression, and automation. Technologies like machine learning, deep learning, computer vision, and natural language processing are being integrated to boost human creativity, provide fresh ideas, and improve the overall artistic experience. This is transforming the way information is produced, listened to, and shared in the music industry (Kanbach et al. 2023; Vinchon et al. 2023). It offers new opportunities for innovation, efficiency, and artistic expression while raising questions about the role of technology in the creative process and the future of human creativity (Tigre-Moura et al. 2023). The article covers topics such as content creation, personalisation, enhanced production procedures, copyright protection, content identification, and artistic collaboration. It also discusses streaming services using AI to recommend artistic works based

on user preferences, enhanced production procedures, and AI's role in detecting plagiarism and infringement (Hitsuwari, et al., 2023). Tables 1 and 2 exemplify some of the artificial intelligence tools and what they can do, respectively:

Table 1: Examples of AI Tools in Music Industry

System	What can do
AI Music Generator SOUNDRAW	Create unique songs.
Music AI: The Audio Intelligence Platform™	Can Stem Separate (breaks down a mixed audio track into its individual components - so you can remix the music or create karaoke versions of songs), beat detection, vocal synthesis, chord detection and others.
Beatoven.ai: Royalty Free AI Music Generator.	An intuitive AI music generator that allows you to create and customise tracks to your liking.
AIVA, the AI Music Generation Assistant	An AI music generator wizard that lets you create new songs in more than 250 different styles in seconds

Source: Compiled from Literature

Table 2: Examples of What AI Tools Can Do in Music Industry

AI-Technology	Music Production Stage	Impact on Workflow
AI-powered Music Composition	Songwriting	Increases composition speed, generates new ideas
AI-powered Mixing and Mastering	Production	Improves audio quality, reduces production time
AI-powered Virtual Instruments	Sound Design	Expands sonic palette, creates unique sounds
AI-powered Music Recommendation	Distribution	Improves audience targeting, increases engagement

Source: Summed Up from Diverse Sources also cited in this paper.

Virtual Reality and Augmented Reality

Virtual and augmented reality technologies in the creative industries offer new opportunities for artistic expression, storytelling and audience engagement. They grant the creative arts the freedom to experiment with the limits of conventional media and produce immersive experiences that captivate people in fresh and memorable ways (Doerner & Horst 2022). Virtual reality is a technology that creates simulated environments for users to interact with and allows them to explore and experience various forms of artistic expression. It also allows users to wear headsets that block out the real world and project computer-generated images and sounds. In the creative industry, virtual reality allows artists to create virtual exhibitions and immersive narratives that allow viewers to become active participants in the story (Panhale et al. 2023), allowing audiences to engage with the artwork in unconventional ways through gesture-based interactions or spatial exploration, thereby enhancing the immersive experience of the narrative. Artists use virtual reality to create art that you can interact with in amazing, novel ways. Instead of just listening to music, one can immerse oneself in the artwork and control it with your body movements.

By fusing virtual features with real-world surroundings, augmented reality improves user perception and may be accessed through smartphones, tablets, or special eyewear. Because it enables artists and creative arts to combine digital and physical worlds, this technology is immensely helpful in the creative industries (Stubbs 2024). Augmented and virtual reality are revolutionising the music industry by providing enhanced marketing and branding, interactive installations, and spatial design and navigation. Augmented Reality (AR) superimposes digital features on the real world, like interactive record covers or live concert photos whereas Virtual Reality (VR) produces immersive experiences like virtual concerts or three-dimensional music videos. These technologies enable more ways to interact with fans, promote music, and provide unique experiences. Table 3 contrasts augmented and virtual reality:

Table 3: Comparative Analysis of VR and AR in the Music Industry

Feature	Virtual Reality (VR)	Augmented Reality (AR)
Immersive Experience	High	Medium
User Interaction	Isolated	Interactive with real world
Technology Requirements	High-end hardware	Smartphones or AR glasses
Applications in Music	Concerts, music creation, music therapy	Live performances, music education, marketing
Revenue Generation	Virtual concerts, merchandise, advertising	Live event enhancements, music product promotion, advertising
Job Creation	VR content creators, developers, engineers	AR app developers, designers, marketers
Investment	VR hardware and software development	AR app development and distribution
Job Creation	VR content creators, developers, engineers	AR app developers, designers, marketers

Impact of Selected Technologies on Musical Industry

The 4IR, characterised by advancements in artificial intelligence and automation, is significantly affecting the music industry. New technologies such as AI-powered design software and 3D printing are transforming creative content production, while distribution channels are being revolutionised. Virtual and augmented reality experiences also enhance audience engagement. Automation threatens some creative professions but opens new opportunities for collaboration between

humans and machines. The creative musical industry must also adapt and capitalise on these advances to succeed in this rapidly evolving landscape.

New Forms of Artistic Creations and Collaboration

The 4IR offers artists unprecedented opportunities to explore new forms of artistic creation and collaboration in music. It utilises advanced technologies, global connectivity and collaborative networks to push the boundaries of creativity and innovation in the digital age.

Digital tools and technologies: 4IR has also produced a wealth of digital tools and technologies that enable artists to create and collaborate in ways that were previously impossible. These tools include digital painting software, 3D modelling programmes, virtual reality and augmented reality platforms, and online collaboration platforms. Artists can use these technologies to experiment with new artistic media, techniques and styles and push the boundaries of traditional artistic forms (Bender 2023).

Interdisciplinary collaboration: 4IR fosters interdisciplinary collaboration by bringing together artists, technologists, scientists, engineers and other experts from different fields to work together on creative musical projects (Vinchon et al. 2023; Hitsuwari et al. 2023).

Global connectivity: The digital connectivity enabled by 4IR also allows artists to collaborate with colleagues and collaborators from around the world in real time (Vinchon et al. 2023; Hitsuwari et al. 2023). Online collaboration platforms and digital communication tools enable artists worldwide to connect, share ideas, and collaborate on creative projects, promoting cultural exchange, diversity, and artistic perspectives. Also, 4IR's cloud-based platforms enable real-time collaboration, enabling artists to create unique projects and intercultural exchange, thereby enhancing the global artistic landscape.

Crowdsourced Creativity: 4IR enables crowdsourced creativity by providing platforms for musical artists to collaborate with the public to co-create artworks, share ideas and gather feedback (Basaraba, 2023). Crowdsourcing platforms, online communities and social media channels enable artists to engage with their audience, involve them in the creative

process and utilise collective intelligence to create innovative artistic content.

Artificial intelligence powered composition

The 4IR supports AI-powered music composition software by utilising advanced technologies such as machine learning, deep learning, and natural language processing to automate and improve various aspects of the production process. In music, for example, AI-powered music composition software can autonomously create music compositions based on input parameters such as genre, mood, tempo, and instrumentation. AI can serve as a creative partner for musicians by suggesting new ideas, harmonies, or melodic variations, pushing the boundaries of composition. In addition, AI-powered music composition software supports human creativity by providing composers with new tools, ideas, and inspiration for their compositions. These tools can generate musical motifs, chord progressions, melodies, and harmonies that composers can use as starting points or building blocks for their own compositions. This collaboration between humans and artificial intelligence results in music that combines the unique abilities of both.

Furthermore, by creating compositions that are specific to each user's interests, likes, and circumstances, AI-powered music composition software may personalise the process of creating music. When listening to music, the user is more engaged and satisfied owing to this customisation. This program democratises music creation by making it possible for those without formal expertise in music to make music. AI-powered music composition software also makes the process of producing music more efficient and allows composers to produce high-calibre works more quickly. Composers may concentrate on more creative elements like melody, harmony, and expressiveness by using these technologies to automate monotonous processes like orchestration, arrangement, and notation. As a result, composers are more productive and have more time to explore a larger variety of musical ideas. This holds true for creating narratives, painting, sculpting, and other media.

Virtual reality art installations and audience engagement

The 4IR supports virtual reality art installations and increases audience engagement through the integration of advanced technologies and immersive experiences. Virtual reality art reaches new dimensions of immersion, engagement, and interactivity. This opens doors for innovative artistic expression and fosters a deeper connection between art and audience. The 4IR has led to advances in virtual reality hardware and software that make it more accessible, affordable, and immersive than ever before. High-resolution virtual reality headsets, motion-tracking controllers, and spatial audio systems allow artists to create realistic and immersive virtual environments for their installations, enhancing the sensory experience for audiences. In addition, virtual reality art installations utilise interactive technologies such as motion tracking, gesture recognition, and haptic feedback to engage the audience in immersive and participatory experiences. Viewers can explore virtual spaces, interact with virtual objects, and manipulate their surroundings, blurring the boundaries between the physical and digital worlds.

Virtual reality musical art installations may have an enormous impact on culture and education because they offer immersive experiences that encourage empathy, spark creativity, and provoke thought. In addition to enhancing the cultural environment and fostering multicultural understanding, these installations can tackle intricate subjects, historical occurrences, and societal challenges. With the advent of graphics processing units and increased processing power, 4IR technology also enables artists to produce realistic and immersive virtual reality experiences. These installations have interactive features that enable spectators to take an active role in shaping the virtual environment and the story. The way music audiences interact with these experiences might cause them to change and adapt.

Democratisation of Art Production and Accessibility

The 4IR also encourages the integration of innovative technology, digital platforms, and cooperative networks to democratise the creation and accessibility of art. By providing artists with a plethora of digital tools and venues to facilitate the easier and more affordable creation and distribution of their work, the 4IR has democratised the process of

producing art. The use of easily available technology, such as digital painting software, 3D modelling programs, music composition software, and video editing tools, enables artists to produce high-quality artworks. By establishing online markets and distribution platforms that let artists in direct contact with collectors and viewers worldwide. Artists can sell their artwork online without the need for traditional shows or intermediaries thanks to platforms such as Etsy, Redbubble, and Society6. They may now reach a worldwide audience and have more influence over their creative endeavours as a result.

Through the provision of online learning tools, tutorials, and communities for artists, the 4IR seeks to improve digital education and skill development. There are courses available in digital art, graphic design, music production, and creative programming on platforms such as Coursera, Udemy, and Skillshare. These platforms aid in the skill development and digital era adaptation of artists. By lowering obstacles to participation and involvement, the 4IR also improves art's accessibility and inclusion. People from different backgrounds may access and interact with art through digital platforms, virtual reality experiences, and online exhibits, which promote diversity, inclusion, and representation. For those who live in remote locations or have impairments, technologies like virtual reality and augmented reality provide access to artistic expressions including contemporary musical productions. Bypassing conventional gatekeepers, musical artists can showcase their work worldwide thanks to social media platforms and online communities. Widely available at reasonable rates, streaming services democratise the consumption of creative material by giving users access to enormous libraries of music, films, and books.

New Forms of Creativity

The 4IR technologies open up avenues for entirely new forms of creative expression, such as virtual reality experiences, interactive installations and 4IR-generated musical art. The 4IR enabled access to music streaming via various mobile applications. Due to lower production and distribution costs, music streaming services are generally far cheaper than physical formats (such as audio CDs or vinyl) and digital download services that offer a pay-per-song option.

Increase Traceability of works

Traceability of artworks is crucial for preserving cultural and monetary value, ensuring authenticity, and maintaining transparency in the art market. It involves documenting the journey of a work, which can increase its value. Understanding the previous owners can reveal interesting stories, artistic significance, recover stolen or looted artworks, and combat illicit trade (Trautmann et al. 2022; Lu et al. 2022).

Opportunities for Innovation and Growth

Opportunities for innovation and expansion in the musical arts sector abound in the 4IR. Together with human artistes, the 4IR may produce whole new kinds of music that fuse human vision with machine inventiveness, for example, music generated by artificial intelligence that changes based on the listener's mood (Roscoe et al. 2023).

Virtual and augmented reality tools can create immersive design environments and enable remote collaboration on projects. Big data analytics can personalise the artistic experience for the viewer/listener, hence allowing museums to curate exhibitions based on visitors' preferences or music streaming services to recommend artists based on listening habits. These tools can create interactive experiences and allow audiences to engage with music in new ways. Data analytics and machine learning algorithms also enable the creation of personalised content tailored to individual preferences, interests, and demographics. In this regard, musical artists can use this data to tailor artworks, exhibitions, and experiences to specific audiences, increasing engagement and building a deeper connection with viewers. The convergence of musical art and technology opens the door to innovative business models, such as selling limited editions of AI-generated musical works or offering virtual or augmented reality experiences as part of shows. These platforms allow you to do the same with digital music and often use blockchain technology to verify the ownership and authenticity of the artwork.

Challenges and Opportunities

Nevertheless, the rise of the 4IR is a double-edged sword for the creative arts. Though these technologies offer exciting opportunities, they also raise the question of human job displacement. The automation of repetitive tasks such as graphic design elements or music composition, for example, could impact on the livelihoods of some creative arts.

Technological Challenges

There are several technological obstacles that artists, technologists, and the creative arts must overcome to incorporate 4IR technology into their work. Artificial intelligence and augmented and virtual reality exemplify that are complicated 4IR technologies and call for specific knowledge and skills to comprehend and use successfully. It might be difficult for creative artists to learn these technologies and integrate them into their work. Additionally, creative arts may face obstacles in gaining access to innovative technical tools and resources, particularly those from disadvantaged or under-represented areas. Inadequate availability of hardware, software, training materials, and technical assistance might impede the integration of 4IR technologies in the creative industries and intensify existing disparities in the field.

Integrating 4IR technologies into creative workflows can be challenging due to interoperability issues and compatibility limitations. Artists may struggle to integrate AI algorithms into existing software platforms, transfer data between virtual reality environments, or ensure compatibility between blockchain-based applications and traditional art production processes. AI algorithms require high-quality, diverse data sets for accurate results, but sourcing, curating, and managing datasets can be time-consuming. Virtual reality experiences, AI algorithms, and blockchain applications require significant computational resources and processing power, making it challenging for artists to optimize performance, reduce latency, and manage resource constraints, especially when creating immersive virtual reality environments or performing compute-intensive blockchain transactions.

Skills and Workforce Development

As 4IR continue shaping and changing the creative industries requiring new skills and leading to alterations in the development of the labour force (Li 2022; Ammirato et al. 2023), artists will need to be increasingly familiar with various technologies such as AI, 3D printing, Virtual reality/augmented reality and others. Analysing audience preferences and engagement metrics is crucial for artists to tailor their work to specific audiences and platforms. With the rise of immersive experiences and interactive platforms, artists need to develop new skills in digital storytelling and content creation. Ethical and legal considerations around privacy, intellectual property, and data security are essential. Understanding issues such as algorithmic bias, digital rights management, and copyright can help artists navigate ethical dilemmas and protect their creative rights in the digital age. Art and musical schools, universities, and training institutions must integrate these new technologies and skills into their curricula to prepare future generations of music artists for the demands of the 4IR creative landscape. Existing professionals may also need to participate in workshops or training programmes to improve their technological knowledge. Collaboration between creative, music industries and technology companies can promote knowledge sharing and allow artists to experiment with new technologies. Entrepreneurial and business skills are also essential for success in a competitive and rapidly evolving industry.

Disruption of Traditional Art Markets and Business Models

The 4IR has revolutionised the art market by introducing digital technologies, data-driven insights, and decentralised platforms. As such, artists, including musicians, can now sell their productions directly to the consumers through digital distribution channels and e-commerce platforms, bypassing traditional galleries and intermediaries. Online marketplaces such as Etsy, Saatchi Art, and Artsy offer artists a global platform for showcasing and selling their artwork, allowing them to reach a wider audience and control their sales and pricing strategies. Blockchain technology and cryptocurrency have also revolutionized the art market, ensuring transparency and authenticity in transactions. Blockchain-based

platforms like Verisart and Artory use distributed ledger technology to create tamper-proof records, while Bitcoin and Ethereum enable secure payments for art purchases. The 4IR also introduces virtual and augmented reality experiences, transforming traditional art consumption and engagement. These technologies allow audiences to explore artworks in virtual galleries, interact with digital installations, and participate in collaborative projects. The democratisation of art making, changing consumption patterns, digital art platforms, and subscription-based access have also led to new business models, such as fractional ownership of art and immersive art experiences.

Another important impact of virtual and augmented reality on music consumption is the creation of interactive and personalised music experiences. With the help of VR and AR technologies, users can now interact with music in new and unique ways (Onderdijk, et al., 2023). For example, a blockchain-based platform that allows artists to sell their music directly to fans without the need for traditional distribution channels. By selling music directly to fans on blockchain platforms, artists can have greater control over their content and receive a larger share of the revenue (Whitaker & Kräussl 2020). Blockchain technology also boosts transparency and accountability, which has been a major problem in the music industry. Artists often faced difficulties tracking the use of their music and there were instances where sales and plays were not reported. The technology improves royalty payments and rights management by automating calculations and ensuring accurate distribution (Sitonio & Nucciarelli 2018).

Ethical Considerations and Concerns in 4IR-Generated Art

The use of 4IR technologies in musical art creation raises ethical concerns, particularly regarding authenticity and authorship. The blurring of the line between human creativity and machine-generated content raises the question of who should be recognised as the musica creator. Additionally, intellectual property rights are complex issues, as determining ownership rights, copyrights, and licensing agreements for AI-generated artworks can be challenging, especially when multiple stakeholders are involved, such as the creator, algorithm developer, and training data owner. Therefore, responsible and ethical use of these technologies is crucial to ensure the responsible and ethical use of these technologies (Fenwick &

Jurcys 2023; Khosrowi et al. 2024). The overuse of technology in creativity can also stifle human creativity.

The training of artificial intelligence algorithms on biassed datasets leads to the persistence of stereotypes, prejudices, and discriminatory representations in the artworks that are created. To stop the propagation of damaging stereotypes in art, ethical concerns include making sure that the training data is equitable, diverse, and inclusive as well as removing prejudice from the algorithms. To grasp how artworks are created and the rationale behind the algorithm's creative choices, AI in art production ought to be clear and comprehensible. To foster responsibility and confidence in the usage of AI-generated art, artists and developers should work to make the creative process clear and visible to the public as well as to the artists themselves.

Ethical concerns arise from the use of personal data and images in AI-generated music productions, particularly in relation to facial recognition technologies and deepfake techniques (Pantserev 2020). AI can help create highly realistic but fake images and videos (deepfakes). This raises concerns about the potential spread of misinformation and the erosion of trust in the media and public figures. Musical artists must obtain consent from individuals whose likeness or personal data is used in artificial intelligence -generated artworks and ensure that privacy rights are respected throughout the creative process. Deepfakes are videos or audio recordings that have been manipulated to show someone saying or doing something they never actually did. Deepfakes can create fake music by replacing the vocals of a real singer with a fake one.

Since 4IR relies on the collection of data and user profiles for targeted advertising has raised concerns about data protection and data security (Krafft et al. 2020), the issue of data security has become more serious after its introduction, especially for music consumers, as they are concerned about the collection, storage and use of personal data by advertisers. A brand's reputation can be harmed, and trust undermined by data leaks and abuse. The art market, artists, and producers may all face socioeconomic challenges because of the growing usage of AI in the creation of art. The concentration of power and resources in the hands of artificial intelligence developers and technology businesses, as well as the

loss of jobs and economic disparity, are among the concerns. Concerns about ethics include making sure that artists from all backgrounds have equal access to artificial intelligence resources and opportunities, as well as encouraging just compensation and acknowledgement for works of art produced by AI.

Information Overload

The 4IR has driven the rapid rise of digital platforms and channels in marketing, hence resulting being inundation of customers with an unprecedented amount of marketing communications (Krafft et al. 2020). The proliferation of online spaces and the wide range of communication channels have led to a landscape where customers are exposed to a variety of advertising information, resulting in an oversaturation of marketing messages. This information overload can lead to a reduced attention span and greater difficulty in effectively capturing consumers' attention (Ungerman et al. 2018). Even though this abundance of data has its advantages, it also brings with it significant challenges, such as the difficulty of finding relevant information, decision paralysis, reduced attention span, and reduced productivity.

Conclusion and Recommendations

The 4IR is undeniably transforming the creative landscape. On the one hand, advances such as AI and automation present challenges; on the other, they also open up a treasure trove of opportunities. New tools are giving artists opportunities to redefine creative processes and find innovative means for engaging their audiences in novel ways. The impact of selected technologies on the art industry has both positive and negative consequences. Positive impacts include new forms of music artistic creation and collaboration, composition with AI, art installations with virtual reality and audience engagement, democratisation of art production and accessibility, opportunities for innovation and growth, new forms of creativity and better traceability of works. On the negative side, there are technological challenges, skills and labour development, disruption of traditional music art markets and business models, ethical considerations and concerns about 4IR-generated musical art, content, and information overload.

Recommendations

For Artists

Musical artists must embrace new technologies for creative expression and experiment with new media to foster artistic innovation and audience engagement. They must protect their intellectual property rights, such as watermarking digital artworks and using digital rights management tools. Musicians must communicate their unique value proposition in a technology-dominated world and focus on human strengths in areas where 4IRs struggle, such as critical thinking, emotional intelligence, and storytelling ability. It is also crucial to diversify revenue streams beyond traditional avenues like musical shows and exhibitions, such as selling their musical pieces online, licensing digital content, or offering workshops and tutorials. This reorientation could help musical artists stand up for their values and showcase their unique human strengths in a technology-dominated world and boost their business prospects.

For Business

The article implores businesses in the musical industry to invest in innovation, particularly in human-machine collaboration. It suggests fostering a work environment where human creativity and AI capabilities work together for optimal results. Firms should also invest in research and development to explore new technologies that can further improve their musical products and services. Supporting artistic innovation among musicians, especially emerging talent, is also crucial. Organisations should provide resources for experimentation with new technologies and artistic forms, mentorship, funding, and resources to help them overcome the challenges of 4IR. Additionally, ethical considerations need prioritisation, including factoring in issues of privacy, transparency, and inclusivity when developing and deploying technology-enabled solutions to AI-aided musical creations. In the same vein, artificial intelligence tools should be unbiased and promote musical artistic freedom. Recognising the role of human expertise alongside technological advances is also essential and so

is collaboration, with business entities in the music creative industry fostering a culture of interdisciplinary teamwork. Subsequently, organisations should remain adaptable and flexible enough to respond to the changing market dynamics and technological advances, such as restructuring business models, revising product offerings, or exploring new markets and distribution channels.

For Policy

The article recommends several policy recommendations to support creative industries. These include promoting innovation ecosystems, supporting cultural education, strengthening intellectual property rights, promoting access to technology, and promoting diversity and inclusion. There is also a need for funding for research and development, establishing incubators and accelerators, and tax incentives for creative businesses. Additionally, the work suggests strengthening copyright laws, improving enforcement mechanisms for online piracy, and promoting international cooperation on intellectual property protection. Also, there is a need to providing resources and training opportunities for artists to effectively use new technologies, such as integrating digital tools into arts curricula and creating support programmes, venture funds, or tax incentives for creative entrepreneurship, can also help. Finally, promoting diversity and inclusion in the creative industries can be achieved by supporting initiatives that improve representation and access for under-represented communities, such as funding diversity in hiring and recruitment, inclusive cultural policies, and enabling marginalised communities to access cultural education and resources.

For Further Research

This article offers insights into how music creation is changing in the digital era using an interdisciplinary and multidimensional approach that considers ethical, educational, technological, cultural, and economic factors. This encompasses multidisciplinary comprehension, cultural and sociological dynamics, ethical deliberations, the evolving function of musicians, the influence on the dissemination and appreciation of art, and the cooperation between humans and machines. The creative arts are

being impacted by the 4IR. This offers fascinating research options related to audience involvement in music, new business models, technological integrations, and ethical challenges that can provide significant insights to this changing scene.

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