# THE ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN MUSIC PRODUCTION

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**Abstract**
The predominant focus of research in the music industry has been centered on the generation and marketing of songs and albums, with a restricted examination of the influence of information and communication technology (ICT) software and tools on various aspects of music production. Various tools and applications employed in music production include digital sheet music and notation software, virtual instruments and plugins, acapella makers, digital audio workstations (DAWs), copyright detection applications, video mixing and streaming software, live performance applications, music distribution software, and electronic instruments, among others. This study adopted a qualitative research approach to examine the influence of ICT in the field of music production. This involves in-depth observation as well as the review of relevant literature, out of which discussions are made. This study examines the challenges related to the use of ICT in music production while also offering suggestions on how to tackle them. ICT has undoubtedly contributed to the efficient production of music and expanded the range of opportunities accessible to musicians. The implementation of this technology has resulted in the ease of the creation process and subsequently revolutionized the global distribution and consumption of music.
**Keywords:** ICT, Music, Production, technology, Digital Audio Workstation, Digital sheet music

## INTRODUCTION
New technologies are developing quickly and have become major drivers of social progress (Zhang et al., 2021). Music production involves creating, recording, and shaping musical content for release (Upwork, 2022; Walzer, 2021). Upwork (2022) explains that it includes every stage in a song's life cycle, from the first idea and songwriting to recording, mixing, and mastering. Although the process is long and detailed, understanding these steps is a good foundation. Modern music technology has transformed how producers work by offering endless creative possibilities (Thomas, 2021).

Fast growth in information and communication technologies (ICT) is affecting many industries (Gorgoretti, 2019). During the COVID-19 pandemic, teaching moved fully online, making ICT essential and forcing schools to change how they taught (Birsa et al., 2022). Music streaming platforms such as Spotify also help users understand how different parts of the music industry connect, including record labels, film studios, and ICT companies (Ithurbide, 2020). These platforms make it easy for anyone to access huge collections of both mainstream and niche music, often at little or no cost.

Recently, AI companies and start-ups have created smart tools that improve workflows and generate music for specific needs. Streaming services also personalise listening. Webster (2020) notes that recommendation systems, which predict what users might like, can widen social class differences in musical tastes. Digital platforms now influence global markets and shape economic, political, and social life. Srnicek (2017), as cited in Webster (2023), explains that platforms are reshaping how markets function, how people interact, and how value is created and shared. Services like Spotify, Netflix, and Amazon Prime offer large libraries of digital content, while platforms such as Airbnb, Uber, and TaskRabbit allow people to earn money using their skills, vehicles, or properties (Webster, 2023).

## Methodology
The study uses a qualitative method based on detailed observation and a review of relevant literature. Sources include peer-reviewed articles, books, conference papers, reliable online materials, and interviews with experts. Searches are carried out on databases such as Google Scholar, IEEE Xplore, ScienceDirect, and JSTOR, using keywords like "ICT in music production".Publications are included if they were written in English, published between 2010 and 2023, and come from reputable academic sources. Studies that fall outside this time frame, are not in English, or are not peer reviewed are excluded. Two independent reviewers screen the studies, and full-text articles that meet the criteria are examined further.

During data extraction, details such as authors, publication year, research methods, key findings, and ICT's impact on music production are recorded. Quality assessment follows established standards, focusing on methodological strength and contribution to the field.Data is then synthesised using a narrative approach to

identify common themes and patterns related to how ICT influences music creation. The study also acknowledges limitations such as publication bias and rapidly changing technology, while stressing the importance of ethical referencing. Overall, the method aims to provide a clear and thorough understanding of ICT's role in modern music production for researchers, professionals, and educators.

**Discussion**

How has ICT impacted music production?The music industry is complex and ever-changing, with a rich musical and technological heritage. Technology has shaped musical instruments and genres. Technological advances have impacted the music industry's industrial structure and commercial and distribution options. ICT is crucial to modern music production. This technology has revolutionised music composition, recording, editing, and distribution. Here are some key ways ICT affects music production:

Digital Audio Workstations (DAWs)

Figure 1 shows the sample digital and workstation interface used in music production



**Figure 1: Picture of a digital workstation**

Figure 1 shows the sampleDAW. DAWs help artists and producers record, edit, and arrange digital audio recordings. Artists can create and manipulate sounds in a virtual world. Rogerson (2023) compilation listed several DAW software suites. Ableton Live, Image-Line FL Studio, Apple Logic Pro, Steinberg Cubase, PreSonus Studio One, Cockos Reaper 6, Reason Studios Reason, Bitwig Studio, Apple GarageBand, AcousticaMixcraft, Avid Pro Tools, Cakewalk by BandLab, and Audacity. DAWs are flexible tools used in music production. These include music invention, recording, arrangement, and production. A flexible and user-friendly interface lets users create and organise musical themes. The Roland TB-303 bass synthesiser is popular in techno, house, EDM, and experimental electronic music. Due to its significant MIDI sequencing, sampling, and synthesis capabilities, musicians and producers in these genres value it. Due to its ability to instantly activate loops, samples, and effects, DJs, electronic musicians, and performers use this technology in live performances.

Virtual Instruments and Plugins

Figure 2 shows the sample instrument and plugin interface used in music production



**Picture 2: Sample Instrument and Plugin**

ICT has brought about a vast array of virtual instruments and audio plugins. These software-based instruments mimic the sounds of real-world instruments, synthesisers, and effects processors. This allows for a much broader sonic palette without the need for physical equipment. Landr (2023) lists the following plugins as useful: LANDR Chromatic, SpectrasonicsOmnisphere, Analogue Lab Lite, Xfer Serum, Native Instruments

Massive, Lethal Audio, Native Instruments FM8, Arturia V Collection, UJAM USynth, Native Instruments Kontakt 6, Reveal Sound Spire, u-he Hive, and REFX Nexus 2.

**MIDI (Musical Instrument Digital Interface):**

Figure 3 shows the sample musical instrument digital interface used in music production



Figure 3: Sample MIDI

MIDI is a communication protocol that allows electronic musical instruments, computers, and other devices to communicate with each other. It's used to control parameters like pitch, velocity, and duration, enabling the creation of intricate musical arrangements. MIDI is widely known for helping electronic musical instruments and computers work together. It offers many benefits in multimedia, such as flexibility in creating music, efficient storage and sharing, easy editing, precise sound control, and even use in therapy, like helping stroke patients. MIDI tools allow therapists to create personalized treatments, making therapy engaging and easy for patients. While mainly used in multimedia production, MIDI boosts creative control and ensures compatibility across platforms. (Saide, 2024).

Sampling and Sound Libraries:

Figure 4 shows the sample sound and sampling libraries interface used in music production



**Figure 4: sample sound libraries interface**

Sampling involves creating a collection of recorded instrument sounds, known as a sample library. These libraries are primarily used in film, television, and video game composition. They help composers make adjustments to recordings, fill in parts when live performances differ from intended interpretations, and provide directors with previews of the music without needing a full orchestra. High-quality libraries allow composers to layer instrument sounds, test how music fits with a screenplay, and save costs by avoiding unnecessary recording sessions (Daly, 2021). ICT facilitates easy access to extensive sample libraries. Musicians can integrate pre-recorded sounds into their compositions, from realistic instrument samples to abstract and experimental noises.

Digital Effects Processors

Figure 5 shows the sample digital effects processors interface used in music production



**Figure 5: sample digital effects processor interface**

ICT has replaced many hardware-based effects units with software equivalents. This allows for more flexible and versatile signal processing within the DAW environment.

Internet Collaboration and Distribution
Figure 6 shows the sample social media platforms relevant to music production



**Figure 6: Sample social media platforms used in music production**

The internet now allows musicians to collaborate from anywhere in the world. Online platforms and cloud-based services make file sharing easier, enabling artists to work together remotely. Tools such as Dropbox and Google Drive are commonly used for sharing project files, although this method requires users to manually track the latest version. Dedicated online collaboration platforms, such as BeatConnect, offer built-in features that support joint project work and even allow users to view changes in real time.

Acapella maker
Figure 7 shows the sample acapella maker interface related to music production



**Figure 7: Sample acapella maker interface related to music production**

Acapella creator software or applications let users create acapella music. Acapella music is performed without instruments. Instead, they harmonise to make music. Acapella Creator software frequently allows for recording and organising several vocal files, altering pitch and tempo, adding effects, and even video production. Solo singers and ensembles can utilise these tools to create acapella renditions, covers, and original music. Each Acapella Creator programme and piece of software has its own features and capabilities. Some are geared towards professional musicians, while others are easier for enthusiasts or people wanting to try acapella music. To discover an acapella creator that meets your needs and ability level, try several.

Educational Resources and Teaching Aid:
Figure 8 shows the sample resources and teaching aid interface related to music production



**Figure 8: Sample educational resources and teaching aids**

Aspiring musicians and producers now learn through online tutorials, forums, and courses, where they can receive feedback, develop new skills, and keep up with current trends. ICT also directly influences teaching

methods in the classroom (Zhang et al., 2021). Ding (2020) explains that modern teaching requires the use of computer technology to meet students' individual needs, support active learning, create positive learning environments, and improve skills such as vocal and ear training. As society evolves, these tools continue to develop to help learners adapt.

With the growth of science and technology, and ongoing curriculum reforms, multimedia has become an important part of teaching. It is used for sight-reading, ear training, music theory comparisons, and showing instrument demonstrations. By presenting content in an engaging way, multimedia helps create immersive learning experiences and makes abstract concepts easier to understand, such as recognising musical scales. Zhao (2022) found that students show greater interest when music education is combined with computer music technology, making it essential for learners to build knowledge and skills in this area. The development of computer music technology is closely linked to wider advances in modern information technology.

Social Media and Streaming Platforms
Figure 9 shows the sample social media streaming platforms related to music production



**Figure 9: Sample Music streaming platform**

These platforms allow musicians to reach a global audience without the need for traditional record labels. It also provides opportunities for direct interaction with fans and fellow artists. Curry (2023) estimates that $43.3 billion, or about 80% of all recorded music revenues, came from music streaming applications in 2022. YouTube is often regarded as the most popular online platform in terms of overall usage. Spotify holds the highest number of subscribers among all services. There has been a notable increase in the average duration of music consumption during the preceding five-year period, with individuals dedicating an average of 20.1 hours per week to this activity in the year 2022. According to Statista's report for 2023, the number of music streaming customers exceeded 616 million during the second quarter of 2022. Spotify has established itself as the industry leader in music streaming, boasting a sizable global market share of 32% among subscribers, according to the findings of a study by SoftwareTestingHelp (2023) and supported by Statista (2023) and Curry (2023). According to Curry (2023), Spotify currently holds the most market share among music streaming platforms, catering to approximately one-third of the global audience. Apple Music follows as the second most popular platform. Tencent and Netease are the prominent platforms in China; however, it is noteworthy that Spotify and Apple Music remain accessible in the country without any governmental restrictions. According to SoftwareTestingHelp (2023), Apple Music is closely behind Spotify, with a member base comprising 18% of the global total. Following Apple Music, there is a relatively recent contender known as Amazon Music, which boasts a worldwide subscriber base equivalent to 14% of the overall total.

Digital Sheet Music and Notation Software:
Figure 10 shows the sample digital sheet music interface for sheet music production



Figure 10: Sample sheet music production interface

Digital sheet music composition, modification, and distribution are possible using software. Composers, arrangers, and performers can collaborate more readily. Each notation software is equipped with features and tools that enable you to compose beautiful sheet music for any size group, from piano-vocal to symphony. Finale as a notation software, excels in capabilities and learning curves. From a lead sheet to an avant-garde cello and hair dryer piece. Finale is perfect for composers who seek full score layout and appearance control. Another fantastic scoring application is Sibelius. It is a renowned music-writing programme. Sibelius is recognised for cinema and TV scoring. Sibelius is easier than Finale and has more sheet music formatting possibilities. The programme contains a light photo score and an audio score. Photoscore scans and modifies sheet music. AudioScore transforms audio into editable notation. Purchase entire versions of these programmes to add functionality. The desktop has an iPad app. This programme enables you to edit scores on the fly, and the handwriting recognition feature scans smart pen scribbles.

Virtual Choir:

Figure 11 shows the sample virtual choir maker interface related to music production



**Figure 11: Sample virtual choir interface**

Online or home choirs use virtual meeting platforms or choir software. Choirs serve several purposes. Some are religious; others celebrate people or events. Some choirs record and submit sections digitally, while others go live when everyone joins the meeting link. Choirs perform from recordings. Online choirs practice and reproduce, unlike congregational choirs. Gupta (2023) states that Simon Lubkowski's March 2020 Collective Virtual Choir was the most notable COVID-19 virtual choir. A few examples of virtual choir applications include: Easy The Virtual Choir was designed by pre-pandemic California churchgoer Allan. The virtual choir software has enabled churches to release 4–30-person choir videos every other week since COVID. The choir software's contact form promotes local events and collects donations. Get a virtual choir creator from Google Play or Apple. Adobe Premiere Pro simulates choirs.

Video Mixing and Streaming Software

Figure 12 shows the sample video mixing interface related to music production



**Figure 12: Sample video mixing interface**

vMix is robust live production software that offers a wide range of features, enabling users to efficiently record and stream professional videos using a single PC or laptop. The vMix software is capable of facilitating productions in many resolutions, including standard definition (SD), high definition (HD), and ultra-high definition (4K). VMix is a software application that can be used for the purpose of pre-recording choir

ministrations or singing performances in advance of the actual live performance. In the event that the artist is absent, a prerecorded video is presented in real-time, creating the illusion that the performer is physically there on stage at a certain venue. The use of VMIX for live streaming on platforms such as Facebook and YouTube has proven to be very effective. Wilbert (2023) extensively discussed various live streaming software and listed some popular ones as Wirecast, VidBlasterX, OBS Studio, Streamlabs OBS, FFmpeg, XSplit Broadcaster, SplitCam, Switchboard Live, FFsplit, Prism Live Studio, OpenShotFXhome, etc.

Copyright Tracking of Music Online

Online music copyright tracking manages music use. It aims to reward authors and copyright holders and stop unauthorised music use. A procedure includes: Copyrighted music in various forms can be identified via audio fingerprinting and watermarking. Services check Spotify, Apple Music, YouTube, and social media for copyrighted content and compare it to a database. It collects copyrighted music usage data by platform, user account, location, and demographics.It can enforce copyright policies through takedown notices, content monetization, or litigation.

**Challenges**

Freudenberg (2023) found that 61.4% of artists produce music in their first year, but this drops sharply to 8% in the second year and 5.3% in the third. This shows that many young vocalists quit early, often because the production process is complex and they expect quick fame. Although colleges and schools are adopting new technologies, many music teachers still lack the skills needed to use them effectively. Zhang et al. (2021) argue that educators must understand technology to manage the challenges and uncertainty of integrating it into their teaching. Birsa et al. (2022) identified two major challenges in educational music production: limited understanding of how ICT can be used in teaching and difficulty linking music with visual arts during remote learning. Even though computers and digital tools are widely used in education, their impact is not always guaranteed. Many teachers show only basic computer skills, revealing limited awareness of how modern ICT can support stronger interdisciplinary connections.

In the wider industry, sound engineers often criticise producers for creating music that is overly compressed or poorly mixed, even though producers must satisfy audience expectations. Freudenberg (2023) also notes that the cost of music production equipment and software is a major challenge, as some tools are affordable only for large companies. Other challenges include compatibility issues between software and hardware, system stability, latency problems in live performance, and risks created by software updates. Musicians must also manage large file sizes, ensure digital security, and comply with licensing and copyright rules.

**Recommendations**

Although musical ideas are more important than production quality, experts note that the difference between amateur and professional mixing and mastering should not be ignored. Professionally produced songs tend to perform better, especially in competitive environments (Freudenberg, 2023). Freudenberg (2023) also highlights that many online resources and courses can help aspiring producers improve their skills. Good courses offer a strong curriculum, organisation, accountability, and structure, while also providing creative inspiration and opportunities to network with like-minded people.

Technology can greatly enhance music education, but it must be integrated properly. Education equips learners with essential skills for future employment, and in the modern, technology-driven world, schools must teach collaboration and interaction skills (Modeme, 2022). Teachers need to innovate and use technology to meet the needs of the next generation. Gorgoretti (2019) emphasises the need for curriculum updates so student music teachers—and practising educators—can keep up with new technologies. Future studies should compare music education practices across cultures and explore ways to maximise the benefits of technology for music educators.

Laato et al. (2020) explain that music theory has logical structures similar to computer programming. As a result, composers must also understand digital tools and techniques used in modern music creation. Learning music in school supports implicit learning in areas such as modularity, loops, conditionals, data structures, input/output, and software architecture, while also improving cooperation, technical skills, and design thinking. Success in ICT-based music production requires continuous learning, staying updated with new technologies, using reliable equipment, and maintaining organised workflows. Creativity should lead the process, while collaboration, practice, and a willingness to learn from challenges help producers achieve long-term excellence.

**Conclusion**

New technology has changed how music is made, from the first idea to the final release. Modern tools give musicians many new options for writing, recording, mixing, and sharing their music. ICT has also changed education, with schools moving to online learning, and streaming platforms like Spotify now allow anyone to access a wide range of music. AI tools have made parts of music production easier, too. However, there are still challenges, such as the high cost of equipment, the need for special training, and the pressure to meet industry standards while staying creative. To succeed, musicians need to keep learning, invest in good tools, and work with others. Overall, ICT has made music production more open to everyone, increased creativity, and changed how music is made, shared, and enjoyed around the world.

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