



**THE ROLE OF TECHNOLOGY IN ENHANCING OUTDOOR TELEVISION
PRODUCTION IN GHANA: AN EXAMINATION OF TECHNOLOGICAL
ADVANCEMENTS AND THEIR IMPACT**

BY

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DECLARATION

I hereby declare that except for the references to other researchers which have been duly acknowledged, this dissertation is solely the result of my own research and has neither in part nor in whole been presented for a degree. I accept responsibility for any errors in this work.

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CERTIFICATION BY SUPERVISOR

This dissertation has been prepared and presented under my supervisor according to the guidelines for supervision and formatting of dissertation laid down by the University of Media, Arts and Communication UniMAC-IJ.

Prof. Godwin Etse Sikanku
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11TH DECEMBER, 2025
Date

DEDICATION

I dedicate this dissertation to God Almighty for His grace, strength, and guidance. I also dedicate it to my beloved wife, Mrs. Audrey Ibrahim, for her unwavering love, patience, and support, and to my wonderful children, Jeffrey and Jesse, who have been my constant source of motivation and joy.

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ABSTRACT

This study examined the role of technology in enhancing outdoor television production in Accra, Ghana, focusing on the types of technologies used, their influence on broadcasts, and the challenges associated with their adoption. Employing a mixed-methods approach, quantitative data were gathered from 283 production personnel via questionnaires, supplemented by qualitative insights from eight key informant interviews. The findings reveal that Ghanaian television stations rely heavily on core production technologies such as editing software (80.2%), lighting kits (78.1%), HD cameras (71.7%), and wireless intercom systems (69.9%) to ensure basic production quality and operational coordination. While OB vans (64.7%) and live streaming encoders (56.9%) are commonly used, adoption of more advanced tools remains limited, with lower usage of 4K cameras (42.0%), satellite uplinks (49.1%), and drones (34.3%). Overall, 58.6% of respondents rated equipment availability as adequate or very adequate. Technology was found to significantly enhance several aspects of outdoor production. A majority of respondents agreed that it improves production efficiency and speed (73.1%), enhances video and audio quality (74.2%), increases creativity in event coverage (66.5%), improves crew coordination (65.0%), strengthens audience engagement (73.5%), and reduces errors in live broadcasts (67.5%). These improvements collectively contribute to greater competitiveness for television stations, confirmed by 61.2% of respondents. Despite these benefits, adoption of advanced technologies is hindered by key challenges. High equipment costs (67.8%), inadequate staff training (55.8%), unstable power supply (71.8%), and poor internet connectivity (66.8%) create major constraints. Additional challenges include frequent technical. Keywords :Technology, Audio quality , Crew coordination, broadcast , Internet , HD camera , Ghanaian television stations .

breakdowns (34.3%) and difficulties in maintaining equipment (72.4%). Outdoor production conditions are further complicated by adverse weather (77.4%), crowd control issues (73.5%), noise interference (69.2%), equipment transport difficulties (72.5%), and limited setup spaces at event venues (69.2%). Overall outdoor production conditions were rated as average by 43.5% of respondents. The study recommends increased investment in modern technologies, structured staff training, improved technical infrastructure, and better logistical planning. Future research should explore emerging technologies such as virtual reality, augmented reality, and artificial intelligence in outdoor broadcasting.

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LIST OF ABBREVIATIONS AND ACRONYMS

AI – Artificial Intelligence

AR – Augmented Reality

BBC – British Broadcasting Corporation

CNN – Cable News Network

DOI – Diffusion of Innovations Theory

DTT – Digital Terrestrial Television

EFP – Electronic Field Production

ENG – Electronic News Gathering

GBC – Ghana Broadcasting Corporation

HD – High-Definition

IP – Internet Protocol

MOJO – Mobile Journalism

NCA – National Communications Authority

NMC – National Media Commission

OB – Outside Broadcasting

OTT – Over-The-Top

REMI – Remote Integration Model

SDI – Serial Digital Interface

SPSS – Statistical Package for the Social Sciences

TAM – Technology Acceptance Model

TV3 – Television 3 (Ghanaian television station)

UAV – Unmanned Aerial Vehicle

VR – Virtual Reality

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Technological advancements have significantly reshaped outdoor television production worldwide, improving how live events such as sports, festivals, and political activities are filmed and transmitted through innovations like HD cameras, satellite links, drones, portable broadcast units and wireless systems (Cianci, 2021). Outdoor production includes Outside Broadcasting (OB), which refers to the use of mobile, multi-camera production units designed to deliver high-quality live coverage, and Electronic Field Production (EFP), which involves any portable video production carried out outside the studio for interviews, features or location shoots (Compesi, 2020). These forms of production are crucial because they deliver immediacy and authenticity, allowing viewers to experience events as they unfold (Millerson & Owens, 2016). They also widen content options, support public participation by covering important national events, and strengthen the commercial value of broadcasters through live-event advertising and sponsorship (Stephens, 2019; Luther, 2022). In Ghana's active media landscape, these technologies continue to enhance broadcasters' ability to connect audiences with key cultural, social, and political experiences (Anokye & Asare, 2020; Cianci, 2021).

In Ghana, the shift from analog to digital terrestrial television (DTT), which began in 2015, has created new opportunities for enhancing both indoor and outdoor broadcast quality (National Communications Authority [NCA], 2016). This transition improved signal transmission, expanded geographical coverage, and enabled more robust content delivery. It also encouraged

local television stations to adopt mobile production vans, real-time streaming systems, and internet-based distribution channels to cover outdoor events more effectively (Asante, 2020).

Outdoor production presents unique challenges compared to studio-based content. It often involves working in unpredictable environments, ranging from stadiums to remote villages, and requires mobile setups, reliable power sources, and fast content transmission systems. The use of mobile journalism (MOJO) tools such as smartphones, portable tripods, live streaming apps, and cloud editing software has enabled journalists and producers to work efficiently from the field (Owusu-Afriyie et al., 2022). This form of digital media integration has significantly increased the speed and flexibility of content delivery in Ghana's broadcast sector.

Globally, newer technologies such as 5G networks, artificial intelligence (AI), augmented reality (AR), and virtual reality (VR) are further advancing outdoor television production. These tools allow for faster signal transfer, improved audience interactivity, and real-time video enhancements (Kwon et al., 2020). For example, VR can provide immersive coverage of live events, while AI can automate post-production editing processes (Seibert & Shafer, 2018).

In Ghana, the practical adoption of these tools can already be seen in the improved coverage of large-scale national events such as presidential inaugurations and football tournaments. Broadcasters like GBC and TV3 have begun integrating wireless microphones, multiple camera angles, and satellite links to improve the clarity and reliability of their outdoor broadcasts (Amoakohene & Amoakohene, 2021). These enhancements have made live television not only more informative but also more entertaining for viewers.

As outdoor television production continues to evolve, understanding the role of technology in enhancing the quality, efficiency, and creativity of such broadcasts becomes increasingly important. Technological integration does not just improve production. It influences how stories are told, how audiences engage with content, and how media houses compete in a fast-changing digital environment (Budnik, Gaputina, & Boguslavskaya, 2019).

1.2 Statement of the Problem

Technological innovation has significantly transformed the global broadcasting landscape, improving the processes of newsgathering, production, and delivery (Gomez-Mensah, 2016). In Ghana, outdoor television production, particularly live coverage of events such as political rallies, festivals, and sports, has seen the gradual integration of digital tools like satellite uplinks, portable broadcasting units, and real-time streaming systems (Kpelleguba, 2020). Ghana Television (GTV) and private stations such as TV3 have made commendable progress in adopting digital tools, moving from analog tapes to memory cards, and shifting from manual editing to computer-based processing (Gomez-Mensah, 2016). Yet, the extent to which these advancements have improved outdoor television production remains under-examined.

Despite the promise of digital technologies, many television stations in Ghana continue to face constraints that limit their ability to maximize these tools. Guba (2020) reports that while TV3 has adopted more new media technologies to facilitate faster news transmission, GTV often experiences delays due to human factors and a lack of adequate logistics. These challenges include limited funding, outdated infrastructure, unstable internet connectivity, and inadequate training in digital tools. Similar findings by Chimezie (2022) suggest that while convergence

technologies offer immense potential, their full implementation is often hindered by high costs, limited technical expertise, and slow institutional adaptation.

Moreover, while global media leaders such as CNN use highly sophisticated production systems, broadcasters in Ghana often settle for basic technology due to financial constraints and inconsistent technological upgrades (Chimezie, 2022). Virtual reality, augmented reality, and the Internet of Things are reshaping media experiences in developed markets (Xie, 2020), but their practical application in Ghanaian outdoor broadcasting is minimal. The lack of access to advanced tools like AI-based editing systems, panoramic sound, and multi-platform interactivity continues to affect production quality and audience engagement.

As new digital broadcasting standards evolve, there is a growing need to critically assess how Ghanaian television stations, particularly in outdoor production settings, are incorporating these advancements. Understanding both the benefits and limitations of technology use in this domain is essential for building a more competitive, efficient, and responsive media industry. This study therefore seeks to examine how technological innovations are influencing outdoor television production in Ghana, with a focus on their impact on production efficiency, content quality, and audience experience.

1.3 Purpose of the Study

The purpose of this study is to examine the role of technology in enhancing outdoor television production in Ghana, focusing on how technological advancements affect production efficiency, content quality, and audience experience.

1.4 Objectives of the Study

1. To explore the types of technologies currently used in outdoor television production in Ghana.
2. To assess the influence of these technologies on outdoor broadcasts.
3. To identify the challenges television stations face in adopting and implementing these technologies.
4. To identify and examine the nature and challenges of an outdoor event in Ghana

1.5 Research Questions

1. What technologies are commonly used in outdoor television production in Ghana?
2. How do these technologies influence the quality and efficiency of outdoor broadcasts?
3. What challenges do broadcasters face in adopting and applying advanced technologies in outdoor production?
4. What is the nature and the challenges of an outdoor event in Ghana?

1.6 Significance of the Study

This study is significant on both practical and academic levels. Practically, it offers relevant insights to Ghanaian television broadcasters, producers, technical staff, and media regulators about the role of technology in improving outdoor television production. Media houses which regularly engage in outdoor broadcasts like live news coverage, sports events, political rallies, and cultural festivals, can use the findings to identify gaps in their current production methods and adopt more efficient technological tools. By understanding what technologies are currently

being used, their limitations, and their impact, media professionals can make more informed decisions regarding training, investment, and operational efficiency.

Policymakers and regulators such as the National Communications Authority (NCA) and the Ministry of Information will also benefit from this study, as it provides evidence-based recommendations for creating favorable policies that support digital migration, funding for media innovation, and training initiatives to enhance media quality in the public interest.

Academically, this study contributes to the body of knowledge in media and communication studies, particularly in the area of digital broadcasting and technological adaptation in sub-Saharan Africa. While global studies have explored the impact of technologies such as artificial intelligence, virtual reality, and digital streaming on media production, there is limited localized research focused on how these tools are transforming the outdoor television production landscape in Ghana. This study fills that gap by offering empirical evidence rooted in Ghanaian experiences, infrastructure realities, and resource constraints.

1.7 Delimitation of the Study

This study is limited to examining how technology enhances outdoor television production in Ghana, focusing on selected urban-based TV stations. It covers only outdoor production activities like live event coverage and excludes indoor studio operations. The study is confined to current technologies in use, such as mobile broadcast vans, satellite links, and live streaming tools, and involves only media professionals directly engaged in outdoor production.

1.8 Scope of the Study

This study focuses on the role of technology in enhancing outdoor television production in Ghana, specifically examining how technological tools affect production efficiency, content quality, and audience experience. It investigates the types of technologies used, their influence on outdoor broadcasts, and the challenges faced by television stations in adopting and implementing them, including financial, infrastructural, and human resource constraints. The study also explores the nature of outdoor events commonly covered such as; sports, political rallies, entertainment shows, and festivals and the environmental and logistical factors affecting production. The research is limited to professional personnel involved in outdoor production in Accra, providing first-hand insights into technology use and operational practices.

1.9 Organization of the Study

The study will be presented in five chapters. Chapter One provides the background to the study, the problem statement, purpose of the study, the significance of the study, the research objectives, the research questions, significance of the study, delimitation and the organization of the study. Chapter Two will present the review of relevant literature. Chapter Three will outline the research design, target population, sample size, sampling techniques, data collection instruments, data collection procedures, methods of data analysis, and ethical considerations. Chapter Four will provide a detailed analysis and discussion of the data collected from the field. Finally, Chapter Five will summarize the main findings of the study and provide practical recommendations and conclusions.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter provides a comprehensive review of literature on outdoor television production technologies, focusing on their adoption, influence, and associated challenges. It draws on the Diffusion of Innovations Theory and the Technology Acceptance Model. The chapter defines outdoor broadcasting (OB) and electronic field production (EFP), explores current technologies, and evaluates their impact on production efficiency and audience engagement. It also identifies key barriers to adoption. The chapter concludes with a conceptual.

2.1 Theoretical Framework

This study is anchored on two complementary theories: Diffusion of Innovations Theory (DOI) by Everett Rogers (2003) and the Technology Acceptance Model (TAM) by Davis (1989). Both theories are widely used in media and communication research to understand how technologies are introduced, accepted, and used within organizations and among individuals. While the DOI theory emphasizes the spread and adoption of innovations through social systems over time, TAM focuses on individual and organizational perceptions that influence the acceptance and use of specific technologies.

2.1.1 Diffusion of Innovations Theory

This study is guided by the Diffusion of Innovations Theory, first developed by Everett M. Rogers in 1962 and refined in subsequent editions of his work. Rogers (2003) defines diffusion

as “the process by which an innovation is communicated through certain channels over time among members of a social system.” The theory outlines four key elements in the diffusion process: the innovation itself, the communication channels through which information about the innovation spreads, the time it takes for adoption, and the nature of the social system in which the innovation is introduced. According to Rogers, the adoption of any innovation typically follows a predictable pattern, with individuals or organizations falling into five categories: innovators, early adopters, early majority, late majority, and laggards. Each group adopts the innovation at a different point based on their openness to change, access to resources, and exposure to information.

In the context of this study, outdoor television production technologies in Ghana such as; satellite uplinks, mobile production vans, live streaming tools, drones, and digital editing software represent the innovations. The television stations (e.g., GTV, TV3, Metro TV) form the social system, while professional training, peer collaboration, media workshops, and industry conferences serve as communication channels through which knowledge about these technologies spreads. Applying Rogers’ theory allows the study to explore how different stations adopt these tools, at what pace, and with what outcomes. As noted by Straub (2009), the theory is particularly useful in studies examining the implementation of information and communication technologies, as it offers insights into both the process and conditions of adoption. It will guide this study in categorizing stations based on their level of technological integration, those leading with innovation versus those lagging behind.

The strength of the Diffusion of Innovations Theory lies in its structured approach to explaining how new technologies spread across social systems. According to Dearing and Cox (2018), the

theory remains one of the most robust frameworks for understanding why some innovations succeed while others fail, particularly in sectors like health, education, and media. It emphasizes the role of decision-making within institutions, showing that adoption is not just about access to new tools but also about internal readiness and cultural acceptance. For broadcasters in Ghana, this means that adoption of outdoor production technologies depends not only on the availability of equipment but also on managerial support, staff training, and willingness to embrace new methods of content creation.

However, the theory has some limitations. One major critique is that it assumes a fairly linear and rational decision-making process, which may not reflect the complexities of institutional change in resource-constrained environments (Greenhalgh et al., 2004). In countries like Ghana, where financial constraints, bureaucratic inertia, and inconsistent internet infrastructure are common, the path to adoption is often fragmented and influenced by external pressures such as donor funding or political events. Moreover, the theory underrepresents the role of resistance to change. As noted by Wilson and Peterson (2002), cultural and institutional barriers can be just as influential as technological availability in determining whether an innovation is adopted or not. For instance, despite the availability of mobile journalism (MOJO) tools, some newsrooms in Ghana have been slow to adopt them due to concerns about job security, mistrust of digital tools, or lack of technical training.

Nonetheless, the theory remains highly relevant to this study. It provides a framework for analyzing how different television stations in Ghana respond to new production technologies and what factors enable or hinder their adoption. It allows for the examination of differences between public and private broadcasters in their uptake of tools like live-streaming platforms, cloud-based

editing software, and augmented reality graphics. This is particularly important in a competitive media environment where audience expectations are shifting rapidly. As observed by Rogers (2003), successful adoption of innovation not only improves operational efficiency but also enhances the quality of service delivery and consumer engagement. In this case, the theory supports the investigation into how technology adoption is transforming outdoor television production in Ghana, from content creation to audience experience.

2.1.2 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is also adopted in this study. TAM, introduced by Davis (1989), proposes that two main factors influence a user's decision to accept and use a technology: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Perceived usefulness refers to the degree to which a person believes that using a particular system would enhance their job performance, while perceived ease of use refers to the degree to which the user expects the system to be free of effort. Venkatesh and Davis (2000) extended the model by showing that organizational support, training, and prior experience also affect how users perceive and eventually use new technologies.

In the context of outdoor television production in Ghana, TAM helps explain why some production teams embrace tools such as live streaming platforms and mobile journalism kits while others resist them. As Owusu-Afriyie and Asare (2022) observed, many journalists in Ghana are aware of mobile reporting tools, but their actual use depends on whether they see them as reliable, user-friendly, and supported by their organization. Therefore, TAM provides a micro-level understanding of user attitudes, while DOI gives a macro-level view of how innovations spread across institutions.

The strength of TAM lies in its simplicity and predictive power. It is one of the most widely validated models in technology adoption research and provides clear variables for measurement (King & He, 2006). However, it has been criticized for being too narrow, as it does not account for external constraints such as financial limitations, policy regulations, or cultural attitudes factors that are critical in the Ghanaian media environment (Bagozzi, 2007). TAM is best applied in combination with broader models like DOI, which contextualize technology use within wider social systems.

Together, these two theories provide a robust framework for this study. DOI allows an understanding of how outdoor broadcasting technologies spread among television stations in Ghana, while TAM explains the behavioral and attitudinal factors influencing their use at the individual and organizational level. This dual approach is essential for a comprehensive analysis of how technological innovations enhance outdoor television production, what barriers exist, and how they can be addressed to improve production quality and audience engagement in Ghana's fast-evolving media landscape.

2.2 Outdoor Television Production

Outdoor television production commonly referred to as Outside Broadcasting (OB) or Electronic Field Production (EFP), encompasses the capture, management, and live transmission of audio-visual content from locations outside conventional studio environments (Swinnen, 2024). OB operations deploy mobile units often OB vans or truck-based control rooms equipped with switchers, audio mixers, replay servers, graphics systems, and uplink technologies, enabling live coverage of field events such as sports matches, concerts, and news gatherings (Ross Video Team, 2024; Digital Studio India, 2020).

These productions blend the flexibility and immediacy of Electronic News Gathering (ENG) with the visual and technical rigour typical of studio-based production. Zettl (1992) highlights that EFP involves producing on location with high-quality execution comparable to studio standards, emphasizing careful planning to address rigging, lighting, sound design, and real-time transmission challenges under variable field conditions (Electronic Field Production, 2024). Such planning ensures that crews can dynamically select camera angles, manage audio feeds, and coordinate live replays through a mobile production control room (Samim Group, 2023; ScreenSkills, 2021).

Technological evolution has significantly reshaped OB practices. According to Ross Video Team (2024), modern OB systems increasingly embrace IP-based workflows, bonded cellular networks, and software-defined production platforms like Ross Video's Ultrix. These technologies facilitate high-resolution (HD, 4K, 8K) signal transmission and offer flexible, scalable infrastructure that adapts to diverse production demands from sporting events to corporate live streams (Ross Video Team, 2024; Ross Video, 2023). As Swinnen (2024) explains, OBs require highly coordinated crews that include camera operators, technical directors, sound engineers, replay operators, and even remote uplink specialists, all collaborating seamlessly under tight live broadcast pressures.

Outdoor television production represents a sophisticated convergence of mobility, technical infrastructure, and dynamic teamwork. It transforms the complexities of live field coverage into broadcast-quality content through mobile studios, advanced signal processing, and agile operational workflows that make high-quality, real-time broadcasting possible from nearly any location (Ross Video Team, 2024; Samim Group, 2023).

2.3 Current Technologies in Outdoor Television Production

Outdoor television production has evolved significantly with advancements in technology, enabling high-quality viewing experiences in various environmental conditions.

2.3.1. High-Brightness Displays for Outdoor Visibility

Modern outdoor television production relies heavily on advanced display technologies that can overcome the challenges of ambient sunlight and variable viewing conditions. Leading manufacturers have developed specialized high-brightness displays that maintain visibility even in direct sunlight. Samsung's The Wall Outdoor Display (2023) represents a significant leap forward, achieving an impressive 5,000 nits brightness with an ultra-fine 0.63mm pixel pitch, making it particularly suitable for sports broadcasting applications where clarity is paramount. Sony's Crystal LED B-Series (2023) offers another robust solution, delivering 1,800 cd/m² brightness combined with a 120Hz refresh rate that proves critical for live HDR event coverage, ensuring smooth motion reproduction. LG has entered this competitive space with its Magnit MicroLED (2023), featuring 4,000 nits brightness and innovative modular waterproof panels that allow for flexible installation configurations in challenging outdoor environments.

Beyond raw brightness, display manufacturers have made substantial progress in optical technologies that enhance outdoor visibility. NEC's MultiSync X Series (2023) incorporates advanced optical bonding techniques combined with multi-layer anti-reflective coatings, demonstrating a 90% reduction in glare compared to conventional displays. These optical enhancements work in tandem with high-brightness backlighting to maintain image quality across various daylight conditions. The combination of these technologies has enabled outdoor

displays that can maintain color accuracy and contrast ratios previously only achievable in controlled indoor environments, revolutionizing how television content is produced and consumed outdoors.

2.3.2. Weatherproofing and Durability

The harsh conditions of outdoor environments demand television production equipment that can withstand extreme weather while maintaining reliable operation. Manufacturers have responded with increasingly sophisticated weatherproofing solutions. Panasonic's Tough panel (2023) exemplifies this trend with its remarkable operating temperature range of -30°C to 55°C, protected by IP66-rated enclosures that ensure resistance against dust and water ingress. These rugged displays have become essential for productions in extreme climates, from Arctic documentaries to desert-based sporting events. Barco's Folsom Encore Outdoor Processor (2023) takes a different approach to environmental challenges, implementing liquid cooling systems that enable 24/7 operation even in the most demanding desert climates where air cooling alone would be insufficient.

Corrosion resistance has become another critical focus area, particularly for coastal productions where saltwater exposure can rapidly degrade electronic components. Nokia's 5G Broadcast Units (2023) address this challenge through the use of marine-grade aluminum alloys and specialized protective coatings. These materials have proven effective in preventing saltwater corrosion while maintaining the structural integrity needed for mobile broadcasting units that frequently relocate between different environments. The development of these durable solutions has significantly expanded the range of locations where professional-grade television production

can occur; enabling new types of outdoor programming that were previously impractical due to environmental constraints.

2.3.3. Connectivity and Power Innovations

The evolution of connectivity solutions has dramatically transformed outdoor television production capabilities in recent years. 5G technology has emerged as a game-changer, with the BBC's 5G Remote Production Trial (2023) successfully demonstrating 4K/120fps streaming over bonded 5G connections. This breakthrough has enabled broadcast-quality outdoor production with significantly reduced infrastructure requirements compared to traditional satellite or wired solutions. LiveU's LU800 (2023) has pushed these capabilities further, supporting 12x 5G/4G aggregation to create ultra-low-latency feeds that rival wired connections in reliability and quality. These advancements have made remote production workflows more feasible, allowing production teams to work from centralized facilities while capturing content from multiple outdoor locations simultaneously.

Power systems for outdoor production have undergone parallel innovations, particularly in weight reduction and efficiency. Grass Valley's AMPP (2023) exemplifies this progress with its implementation of GaN (Gallium Nitride) power technology, resulting in outdoor broadcast rigs that are 40% lighter than previous generations while maintaining or improving power delivery. This reduction in weight has significant implications for mobile production units, enabling faster setup times and greater mobility between locations. Additionally, these modern power systems often incorporate smart power management features that optimize energy use based on real-time production needs, extending operational times in remote locations where power sources may be limited.

2.3.4. Audio and Smart Production Technology

Outdoor audio capture presents unique challenges that recent technological advancements have effectively addressed. Shure's Microflex Advance (2023) system employs AI-driven beamforming technology that can isolate dialogue even in windy conditions, a common challenge for outdoor productions. This intelligent audio system dynamically adapts to environmental conditions, maintaining clear audio capture regardless of changing wind patterns or background noise. Sennheiser's MobileConnect (2023) offers complementary innovation by enabling real-time audio streaming directly to audience smartphones, creating new possibilities for interactive outdoor events and personalized audio experiences in large venues.

Virtual production techniques, popularized by indoor productions like "The Mandalorian," have begun transitioning to outdoor applications. Disney's StageCraft technology, as detailed in their Virtual Production in Daylight (2023) documentation, has been adapted for outdoor use with specialized LED walls that maintain performance in natural lighting conditions. These outdoor-capable virtual production systems allow for realistic environmental integration while providing the creative control and flexibility that virtual production offers. The convergence of these audio and production technologies is creating new paradigms for outdoor television production, enabling more sophisticated content creation with greater efficiency and creative possibilities than ever before.

The integration of these various technologies from ruggedized displays to advanced connectivity solutions has created a new generation of outdoor television production capabilities that are expanding the boundaries of what can be achieved outside traditional studio environments. As

these technologies continue to evolve, they promise to further blur the line between indoor and outdoor production quality while opening up new creative possibilities for content creators.

2.3.5 Emerging Immersive Technologies: Holography

Building upon core display and production technologies, cutting-edge immersive solutions are transforming outdoor television production, particularly in sports broadcasting. Hologram technology has emerged as one of the most revolutionary advancements, creating three-dimensional visual representations that appear to float in physical space. As Ahmed and Mohamad (2019) explain, this technology reconstructs object images across multiple dimensions using optical wave interference patterns, producing high-efficiency volumetric displays that maintain full 3D perspective regardless of viewer position (p. 125). The technical implementation involves sophisticated laser systems where a coherent light source splits into symmetrical beams - one illuminating the target object and another serving as a reference wave that establishes spatial coordinates for image reconstruction (Karar & Bashir, 2018).

2.4 The Influence of Modern Technologies on Outdoor Broadcasts

Modern outdoor television broadcasts have evolved significantly through the integration of advanced technologies such as 5G-enabled drone streaming, IP-based low-latency media workflows, and remote (REMI) production models.

2.4.1. Technological Advancements in Production and Transmission

Modern outdoor broadcasting has been revolutionized by cutting-edge technologies that enhance both production quality and transmission efficiency. The integration of 5G-enabled drone

streaming has introduced unprecedented flexibility in capturing dynamic aerial footage, with Sharma et al. (2023) demonstrating how UAVs equipped with 360° cameras can deliver immersive viewing experiences. However, challenges persist in optimizing bitrate and latency for real-time applications (Sharma et al., 2023). Similarly, IP-based low-latency workflows have transformed live event coverage, with Bentaleb et al. (2023) highlighting systems capable of achieving one-second latency, crucial for sports and news broadcasts (Bentaleb et al., 2023). These advancements are complemented by Remote Integration Models (REMI), which allow centralized production teams to process live feeds from multiple locations; significantly reducing on-site staffing needs (Remote integration model, 2024).

2.4.2. Cost Efficiency and Production Optimization

The economic impact of modern broadcast technologies is profound, particularly in reducing operational costs while maintaining high production values. Smartphone-based production tools have democratized content creation, enabling professional-quality broadcasts with minimal equipment (Alawneh & Nadi, 2021). Virtual studios, utilizing green screens and real-time graphics software, further cut costs by eliminating the need for physical sets (Bernis, 2010; Sheikh, 2014). Despite these savings, high-end technologies like augmented reality (AR) and advanced graphics remain capital-intensive, with Saidhum (2020) noting their substantial budget requirements and occasional technical failures during live broadcasts (Saidhum, 2020). The adoption of Electronic Field Production (EFP) systems has also streamlined workflows, particularly in educational and corporate settings, by enabling real-time editing and multi-site broadcasting (You, 2020; Xu, cited in Zhang, 2017).

2.4.3. Enhanced Viewer Engagement and Experience

Audience engagement has reached new heights through innovative display and interactive technologies. Augmented reality has proven particularly effective in news and sports broadcasting, with Zaki (2022) finding that AR-enhanced reports significantly improve viewer comprehension and retention (Zaki, 2022). Large-scale LED displays at outdoor venues create immersive environments; ensuring audiences do not miss critical moments (Liu & Hao, 2020). Additionally, drone technology has introduced dynamic aerial perspectives that were previously cost-prohibitive, though regulatory constraints still limit their use in continuous live coverage (Lynn, 2019). These technologies collectively enhance the visual and interactive quality of broadcasts, making them more engaging and accessible.

2.4.4. Operational and Logistical Challenges

Despite their benefits, modern broadcast technologies present several operational hurdles. Network reliability is a persistent concern, particularly for remote productions that depend on stable internet connectivity (Coleman, 2020). The technical complexity of systems like AR and virtual studios demands skilled personnel, and their high costs can be prohibitive for smaller producers (Saidhum, 2020). Furthermore, regulatory restrictions on drone usage and the environmental vulnerabilities of outdoor equipment (e.g., weather resistance, power management) add layers of logistical difficulty (Lynn, 2019; FieldCasts case study, 2024). These challenges underscore the need for robust infrastructure and adaptive planning in outdoor broadcasting.

2.4.5. Future Directions and Innovations

The future of outdoor broadcasting lies in the continued integration of emerging technologies. Advances in AI-driven production tools and quantum computing for data processing promise to further reduce latency and enhance real-time analytics (Bentaleb et al., 2023). The expansion of 5G networks will likely overcome current bandwidth limitations, enabling more reliable high-definition streaming from mobile units (Bertizzolo et al., 2021). Additionally, the development of more affordable AR solutions and lightweight, durable equipment could democratize access to high-end production capabilities, bridging the gap between large-scale and independent broadcasters.

2.5 Challenges in Adopting Outdoor Broadcast Technologies

Outdoor broadcasting presents unique technical, financial, and logistical challenges that can hinder the adoption of advanced production technologies. These obstacles range from environmental factors to financial constraints and workforce readiness, all of which impact the efficiency and feasibility of outdoor productions.

2.5.1. Environmental and Weather-Related Challenges

Outdoor productions must contend with unpredictable weather conditions, including rain, wind, dust, and extreme temperatures, which can damage sensitive broadcasting equipment. Cameras, microphones, monitors, and mixing consoles require robust waterproof and dustproof enclosures to ensure operational reliability (Seven Production, 2024). Additionally, heat dissipation becomes a critical issue, as overheating can disrupt electronic components,

necessitating specialized cooling systems for lighting and processing units. Without proper protection, equipment failure can lead to costly delays and compromised broadcast quality.

2.5.2. Power Supply and Electrical Demands

Unlike studio-based productions, outdoor broadcasting relies heavily on portable power solutions, such as generators, to support high-energy-consuming equipment like lighting rigs, OB (outside broadcast) trucks, and transmission systems. However, generators must be properly shielded to prevent weather-related malfunctions and require careful load management to avoid overloading local power grids (Seven Production, 2024). In areas with unreliable electricity infrastructure, such as rural or remote locations, maintaining a stable power supply becomes even more challenging, often necessitating backup battery systems or hybrid power solutions.

2.5.3. Infrastructure and Connectivity Limitations

Outdoor broadcasts depend on high-bandwidth, low-latency networks for live streaming, particularly when using 5G, bonded cellular, or IP-based workflows. However, many regions especially in developing markets suffer from inconsistent internet coverage, weak cellular signals, and frequent power outages, making real-time transmission difficult (Afolayan et al., 2015). Additionally, the transition from traditional SDI to IP-based production introduces complexity, requiring broadcasters to upgrade their entire signal distribution infrastructure, which can be prohibitively expensive (Broadcasting Innovation Overview, 2025).

2.5.4. High Costs and Financial Barriers

The adoption of cutting-edge broadcast technologies such as; IP-enabled OB trucks, drone systems, augmented reality (AR) graphics, and virtual studios requires significant capital investment. Smaller broadcasters, particularly in emerging markets like Ghana, struggle with the high costs of upgrading equipment, leading to reliance on outdated technology (Mensah & Osei, 2022; Nyarko, 2019). Additionally, maintenance, licensing fees for software, and the need for continuous upgrades further strain budgets, making it difficult for mid-tier and independent producers to compete with larger networks.

2.5.5. Workforce Skill Gaps and Training Needs

The rapid evolution of broadcast technology including; AI-driven production tools, 5G streaming, and cloud-based workflows demands a highly skilled workforce. However, many media organizations face a shortage of trained personnel capable of operating advanced systems (Ozturk et al., 2016). Without proper training programs, employees may resist adopting new technologies due to perceived complexity, slowing down innovation (Bhatt, 2023). This skills gap is particularly pronounced in regions with limited access to technical education, where broadcasters must invest heavily in upskilling their teams.

2.5.6. Regulatory and Policy Constraints

Broadcasters often face slow regulatory approvals for spectrum allocation, drone usage, and new transmission standards, delaying the deployment of advanced technologies (Prasad, Analysys Mason). In some countries, outdated policies such as; restrictions on 5G frequency bands or prolonged analog-to-digital transitions hinder the adoption of IP-based and remote production

workflows. Additionally, safety regulations for aerial broadcasting (e.g., drone restrictions in urban areas) limit the creative and operational flexibility of outdoor productions.

2.5.7. Organizational Resistance to Change

Media institutions, particularly traditional broadcasters, often exhibit resistance to technological change due to entrenched workflows, risk aversion, and misalignment between management and technical teams (Atkin et al., 2015). Without clear incentives for innovation, organizations may stick to legacy systems, missing opportunities to improve efficiency and viewer engagement through modern outdoor broadcasting techniques.

2.6 Nature and Challenges of Outdoor Events

The fundamental nature of outdoor television production is defined by its operational context, which is the antithesis of the controlled studio environment. This paradigm is characterized by an inherent lack of control, where production teams must surrender command over core environmental variables such as lighting, acoustics, and power, instead adapting to the existing and often unpredictable conditions of the venue (Millerson & Owens, 2016). Unlike a studio where every element is designed for broadcasting, an outdoor broadcast (OB) involves infiltrating a space for a temporary period, requiring the team to build a complete, self-sufficient broadcast infrastructure from the ground up. This process is inherently logistical and mobile, centering on the deployment of sophisticated mobile units like Outside Broadcast (OB) vans that act as portable control rooms, and the complex orchestration of personnel and equipment across a dynamic physical space (Cianci, 2021). Furthermore, the production is entirely event-driven, meaning its schedule, pacing, and narrative arc are locked to the live event's progression,

whether it is a sporting match, a political rally, or a cultural festival, allowing for no pauses, retakes, or corrections once the broadcast is live (Compesi, 2020). This subservience to the live event, combined with the logistical complexity of temporary deployment in an uncontrolled setting, defines the core, challenging nature of outdoor television production.

The reliance on complex technology in non-ideal environments presents a formidable set of technical and infrastructural challenges. The primary concern is often power generation and stability, as outdoor broadcasts cannot depend on the public grid and must instead rely on heavy-duty generators, which are prone to mechanical failure and can produce "dirty power" with voltage fluctuations that can damage sensitive broadcast equipment, a problem exacerbated in regions with unreliable infrastructure (Awuah, 2021). Securing a reliable transmission path back to the broadcast station or direct-to-air is another critical hurdle; this typically involves either expensive satellite uplinks, which are vulnerable to signal degradation from atmospheric conditions like heavy rain, or terrestrial microwave links, which require a clear, unobstructed line-of-sight that can be difficult to establish in urban landscapes or rugged terrain (Fosu & Mensah, 2023). Furthermore, the broadcast equipment itself, including cameras, audio mixers, and miles of cabling, must be rugged enough to withstand harsh field conditions like dust, humidity, and extreme heat, yet its deployment is always a race against the clock, where a single faulty cable or connector can compromise an entire production (Cianci, 2021). The integration of all these technical systems; power, capture, processing, and transmission into a seamless, reliable chain under such pressures represents the central technical challenge of outdoor broadcasting.

Operational teams must continuously contend with a host of environmental and site-specific challenges that directly impact both the quality of the broadcast and the safety of the crew and

equipment. Weather and climate are perhaps the most unpredictable adversaries, with intense sun creating harsh lighting conditions and causing equipment to overheat, while sudden rain or high winds can damage gear, disrupt satellite signals, and create unsafe working conditions, necessitating robust contingency plans (Awuah, 2021). Acoustic management is another significant hurdle, as crews must strive to capture clean, intelligible audio from the desired source, such as a commentator or a performer, while filtering out a constant barrage of ambient noise, including crowd sounds, wind buffeting the microphones, and background traffic, all without the benefit of a soundproofed studio (Compesi, 2020). Additionally, operating within public spaces introduces complex logistical and security concerns, as production teams must manage dense crowds to protect high-value equipment from theft or damage, safely route countless cables to prevent public tripping hazards, and ensure the crew can move freely to perform their duties in a often chaotic and crowded environment (Anokye & Asare, 2020).

Underpinning all operational efforts are the significant regulatory, financial, and human resource constraints that can make or break an outdoor production. The regulatory landscape is often a maze of bureaucracy, requiring broadcasters to secure multiple permits from local authorities for public space usage, police clearance for security, and, most critically, frequency licenses from national communications regulators for any wireless equipment, a process that can be slow and fraught with potential for delay (National Communications Authority [NCA], 2022). Financially, outdoor broadcasting is exceptionally capital-intensive, demanding huge investments in acquisition, maintenance, and fuel for OB trucks and transmission technology, alongside high operational costs for satellite airtime, permits, and temporary staff, placing it out of reach for many broadcasters without substantial funding (Agyeman, 2023). Compounding these issues is a critical human resource challenge, namely a skills gap where technicians may be proficient in

studio operations but lack the specialized, real-world experience and problem-solving agility required to rapidly troubleshoot complex technical failures under the extreme pressure of a live broadcast, highlighting a pressing need for continuous, targeted professional development in this high-stakes field (Agyeman, 2023).

2.7 Television Industry in Ghana

The television industry in Ghana serves as a critical case study of a media landscape in the Global South navigating the complex interplay of digital disruption, regulatory adaptation, and cultural preservation. The industry has undergone a significant transformation, moving from a state-controlled, analogue system to a pluralistic, digitally transitioning market. This evolution, however, is not without its profound challenges. A central defining moment for the sector has been the transition from analogue to digital terrestrial television (DTT), a shift mandated to improve signal quality, increase channel capacity, and offer interactive features (Asante, 2025; Nyarko, 2019). While this digital transition theoretically empowers local broadcasters with more bandwidth and enhanced technical capabilities, its implementation has been fraught with technical and financial hurdles that have strained the resources of many local production houses.

A primary challenge exacerbating this digital shift is the intense and evolving competitive landscape. Ghanaian television stations no longer compete solely amongst themselves but must now contend with the pervasive influence of global Over-the-Top (OTT) platforms such as Netflix, YouTube, and Showmax (Asante, 2025; Kperogi, 2021). These platforms have fundamentally redefined audience consumption patterns, fostering a preference for on-demand, personalized content that often bypasses traditional linear broadcasting schedules. This has forced local broadcasters to urgently reinvent their production and monetization models, pushing

them towards digital storytelling techniques and new revenue strategies to retain audience share. However, their ability to compete is severely constrained by persistent economic limitations. Many local production houses operate on limited budgets, relying heavily on advertising revenue and sponsorships, and lack access to the large-scale investment, advanced production facilities, and skilled personnel necessary to produce content that meets global technical standards (Owusu, 2021).

Compounding these technological and economic pressures is a regulatory environment that struggles to keep pace with the rapid evolution of the media ecosystem. The regulatory framework, overseen by the National Communications Authority (NCA) and the National Media Commission (NMC), has been critiqued for its lack of clarity in addressing the realities of digital and OTT broadcasting (Asante, 2025; Mensah & Osei, 2022). Key issues such as licensing structures for digital platforms, content regulation in the online space, and robust intellectual property protection for local productions remain areas of policy uncertainty. This regulatory lag creates an uneven playing field and raises critical questions about content sovereignty, as the influx of foreign programming threatens to overshadow local productions.

Amidst these disruptions, the struggle for cultural authenticity emerges as a central theme. Television is a powerful medium for shaping national identity, and Ghanaian broadcasters face the dual challenge of preserving indigenous storytelling traditions while meeting the evolving aesthetic expectations of a modern, globalized viewership (Alhassan, 2018). In response, some media houses have adopted a strategy of cultural fusion, integrating African narratives, languages, and themes into globally accepted production formats. Despite these efforts, the dominance of Western media aesthetics and narrative structures continues to exert a significant

influence on local content creation, leading to ongoing concerns about the potential erosion of a distinct Ghanaian cultural identity within its own television programming. Consequently, the Ghanaian television industry stands at a crossroads, where its future sustainability and cultural relevance depend on its ability to overcome significant financial and regulatory hurdles while strategically leveraging technological advancements to tell authentic stories that resonate both locally and globally.

2.8 Outdoor Production in Ghana

Outdoor television production in Ghana represents a critical and dynamic segment of the broadcast industry, reflecting both the unique opportunities and systemic challenges present within the nation's media landscape. The significance of outdoor broadcasting is deeply rooted in Ghana's vibrant cultural and social fabric, where live events including political rallies, cultural festivals, religious gatherings, and major sporting events command substantial public attention (Asante, 2025). These events are not merely entertainment but are central to public discourse and community identity, creating a high demand for live, on-the-ground coverage that brings the energy and immediacy of these occasions directly to viewers. The ability to broadcast such events live is a powerful tool for broadcasters, fostering a sense of national community and shared experience, which is a cornerstone of the medium's public service role (Anokye & Asare, 2020).

However, the execution of high-quality outdoor broadcasts is severely constrained by the technological and infrastructural limitations prevalent in the Ghanaian context. The reliable transmission of live signals from remote or crowded locations remains a primary obstacle. While larger networks may utilize satellite uplinks, the exorbitant cost of satellite airtime is a

significant barrier for many stations (Fosu & Mensah, 2023). The alternative, terrestrial microwave links, is often compromised by the need for a clear line-of-sight, which is frequently obstructed in urban areas like Accra and Kumasi by evolving skylines, or by challenging topography in rural regions. Furthermore, the foundational requirement for stable and continuous power is a persistent challenge. With the national grid being unreliable, productions are almost entirely dependent on fuel-powered generators, introducing major cost, noise, and logistical complications, with the constant risk of mechanical failure threatening to derail a live broadcast entirely (Awuah, 2021).

These technical challenges are compounded by significant financial and human resource constraints. The capital investment required for state-of-the-art outside broadcast (OB) vans, robust cameras, and portable audio equipment is prohibitive for many Ghanaian broadcasters, whose operational budgets are already strained by intense competition and fluctuating advertising revenues (Agyeman, 2023). This financial reality directly impacts the quality of outdoor productions and limits their frequency. Moreover, there exists a pronounced skills gap in the industry. While technicians may be proficient in standard studio operations, the high-pressure, problem-solving intensive environment of a live outdoor event demands a specialized skill set for rapid troubleshooting of transmission, audio, and power issues—a level of expertise that is not yet widespread (Asante, 2025). This gap highlights an urgent need for targeted, practical training that equips broadcast professionals with the specific competencies required for field production.

Despite these hurdles, Ghanaian broadcasters have demonstrated remarkable resilience and ingenuity. There is a growing trend of employing cost-effective digital solutions, such as

leveraging cellular bonding technology (e.g., LiveU units) that use multiple 4G/5G SIM cards to create a stable video uplink, providing a more affordable and agile alternative to traditional satellite trucks. Furthermore, to navigate the competitive pressure from global OTT platforms, stations are increasingly focusing on hyper-local content (Kperogi, 2021). By dominating the live coverage of uniquely Ghanaian events from traditional festivals like Homowo and Akwasidae to local political debates broadcasters leverage their proximity and cultural competence to create content that international players cannot easily replicate, thus asserting their cultural and market relevance. Outdoor production in Ghana is a sector characterized by a stark contrast between its immense socio-cultural value and the significant practical obstacles it faces. Its future growth and sustainability hinge on strategic investments in more affordable and resilient technology, the development of a highly skilled technical workforce, and the con

2.9 Conceptual Framework

The conceptual model underpinning this study is based on the interrelationship between technological advancements, outdoor television production processes, and broadcast outcomes. The model assumes that modern technological tools, including high-definition cameras, satellite uplinks, portable live production units, and mobile data transmission systems, serve as critical inputs that shape production efficiency, content quality, and viewer experience. These technologies enable faster setup, flexible coverage, real-time streaming, and high-resolution broadcasting, which collectively redefine the standards and reach of outdoor productions.

At the core of the model is the outdoor television production system, which acts as the focal point where technologies are deployed and utilized. This production system includes pre- production planning, live event coverage, and post-production editing. It operates under the

influence of technological tools and expertise, suggesting that without appropriate infrastructure and trained personnel, the potential of these technologies may not be fully realized. Thus, human resource capacity also plays a supporting role in the system.

Furthermore, the model incorporates feedback loops to represent the challenges and constraints faced by television stations. These include issues such as high costs of acquisition and maintenance of modern equipment, inadequate technical training, unreliable internet connectivity, and regulatory constraints. These challenges act as moderating variables that can dampen the positive influence of technology on production outcomes if not adequately addressed.

Finally, the model concludes with the outcomes, which are improvements in production efficiency (timeliness, mobility, adaptability), enhanced content quality (clarity, relevance, creativity), and enriched audience experience (engagement, satisfaction, accessibility). These outcomes serve as indicators for evaluating the impact of technology adoption. By mapping these relationships, the model provides a structured framework for understanding how technological advancements can be effectively leveraged to transform outdoor television broadcasting in Ghana and beyond.

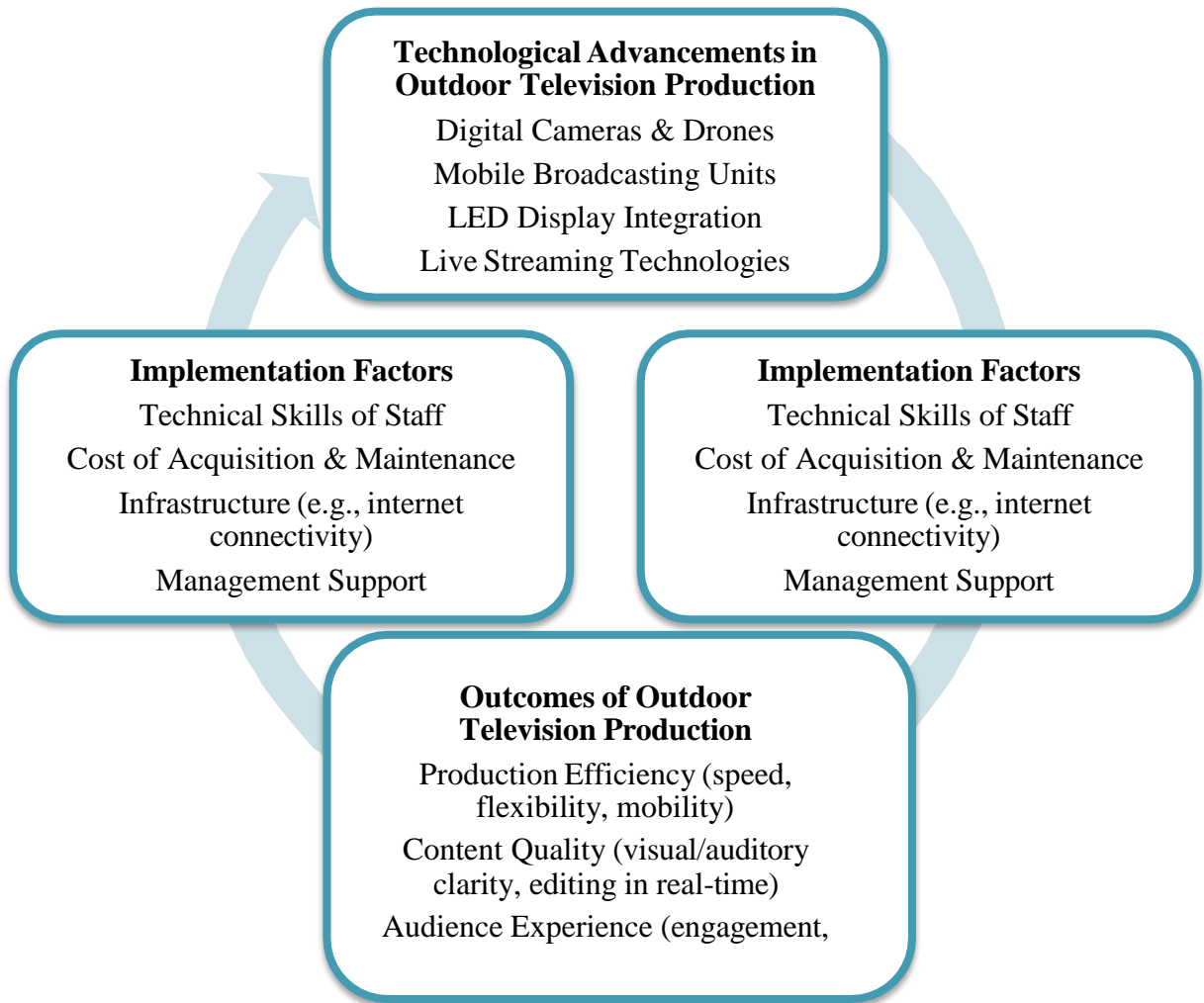


Figure 2.1: Conceptual Framework **Source: Author’s construct**

2.10 Summary of the Chapter

This chapter reviews literature on outdoor TV production technologies, framing the study within DOI and TAM theories. It explores current innovations (e.g., 5G streaming, drones, AR), their impact on production quality and audience experience, and key adoption challenges (costs, skills, infrastructure). A conceptual model ties these elements together, illustrating how technology transforms broadcasting amid real-world constraints. The discussion sets the stage for analyzing Ghana’s media environment in subsequent chapters.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter presents the research methodology employed to examine the role of technology in outdoor television production in Ghana. The study adopts a mixed methods approach to comprehensively address the research objectives. The methodology is structured into eight main sections: research design, study area, population, sampling procedure, data collection instruments, data collection procedures, data processing and analysis and ethical considerations.

3.1 Research Design

This study adopted a mixed methods research design, which integrated both quantitative and qualitative approaches to provide a comprehensive understanding of how modern technologies influence outdoor television production in Ghana. Mixed methods research is particularly effective when exploring complex phenomena involving technical processes, human experiences, and organizational challenges, as it enables triangulation and enhances the validity of findings (Creswell & Plano Clark, 2018).

The quantitative component of the study involved structured questionnaires administered to a sample of media professionals actively involved in outdoor production across selected urban-based television stations. This helped quantify the types of technologies in use, measure perceptions of their influence on production efficiency and audience engagement, and assess the extent of their adoption. The qualitative component included semi-structured interviews with

production managers, engineers, and content producers. These interviews aimed to explore deeper insights into the challenges faced in adopting these technologies, and to capture contextual realities that may not emerge through surveys alone. The use of qualitative data allows the researcher to examine lived experiences, operational constraints, and perceptions in more depth (Patton, 2015).

Several research paradigms offer different lenses through which studies can be approached. Positivism emphasizes objectivity and measurable outcomes, making it suitable for the quantitative part of this study. Interpretivism, on the other hand, acknowledges subjectivity and context, aligning with the qualitative component (Cohen, Manion, & Morrison, 2018). The adoption of a pragmatic paradigm, which emphasizes practical solutions to research problems and values both objective and subjective knowledge, justifies the combination of both approaches (Tashakkori & Teddlie, 2010).

The strengths of a mixed methods design include its ability to offset the weaknesses of individual approaches, offer multiple perspectives, and provide richer data for interpretation. It also enhances generalizability through the quantitative strand while improving contextual depth via qualitative inquiry (Johnson & Onwuegbuzie, 2004). However, the design also presents weaknesses, such as increased time and resource demands, complexity in data integration, and the requirement for skills in both qualitative and quantitative analysis.

Given the multifaceted nature of technology adoption in television production combining technical, human, and organizational dynamics a mixed methods approach is appropriate and well aligned with the research objectives. It enables the researcher to explore “what” technologies are used and “how” and “why” they impact production practices and outcomes.

3.2 Study Area

This study was conducted in Accra, the capital city of Ghana. Accra serves as the country's primary media and communication hub, hosting the headquarters of major television stations. These stations are well-known for their involvement in outdoor broadcasting, including live coverage of political events, entertainment programs, sports, and national celebrations.

Accra was chosen for this study because of its concentration of advanced broadcasting infrastructure, media professionals, and access to modern technologies such as mobile broadcast vans, satellite uplinks, and live streaming tools. The city's dynamic media environment provides a suitable setting to explore how technology enhances outdoor television production and to assess the challenges stations face in adopting these technologies. By focusing on Accra, the study aims to generate in-depth insights into outdoor broadcasting practices within Ghana's most developed and media-active urban area.

3.3 Population

The target population for this study comprised television production personnel involved in outdoor broadcasting in Accra. These include broadcast engineers, camera operators, directors, producers, OB van technicians, and digital content managers working in selected urban-based television stations. These professionals are directly involved in the use and management of technology during live outdoor productions such as political rallies, entertainment shows, sports events, and national ceremonies.

The background characteristics of this population vary but are typically composed of adults aged 25 to 55 years, with a mix of male and female professionals. Most hold at least a tertiary

qualification in media, communication, journalism, or engineering-related fields. The employment status of this group is mainly full-time, with some part-time or freelance personnel engaged during large-scale or special events.

The estimated size of the population is difficult to determine precisely due to the diversity of roles and fluctuation in outdoor production staffing; however, an approximate figure across major stations in Accra is between 150 and 300 individuals who regularly participate in outdoor broadcast production.

The accessible population is limited to professionals currently active in outdoor television production within the selected stations in Accra. This choice was justified because these individuals are more likely to have first-hand knowledge and experience with technological tools, challenges, and innovations in outdoor broadcasting. Their involvement provides the most relevant and reliable data aligned with the study's objectives.

3.4 Sampling Procedure

This study adopted a mixed methods approach, integrating both quantitative and qualitative data to gain a deeper understanding of how technology enhances outdoor television production in Accra. As such, a combination of probability and non-probability sampling techniques were employed to select participants for each component of the study.

For the quantitative phase, the sample size was determined using Cochran's formula for sample

size estimation when the population size is unknown:
$$n_0 = \frac{Z^2 \cdot P \cdot (1-P)}{e^2}$$

Where:

- n_0 = sample size for an unknown population
- Z = Z-value corresponding to the desired confidence level (1.96 for 95%)
- p = estimated proportion of the population with the attribute of interest (0.5 used when the proportion is unknown)
- e = margin of error (0.05)

$$n_0 = \frac{(1.96)^2 \cdot (0.05) \cdot (1 - 0.5)}{(0.05)^2}$$

$$n_0 = 384.16$$

Therefore, a minimum of 384 respondents were selected for the quantitative component. A simple random sampling technique was used to select outdoor television production staff from lists provided by selected TV stations in Accra. This approach ensured fairness and representativeness in the selection process. However, due to time and logistical constraints, the final number of respondents successfully reached was 283.

For the qualitative phase, the study initially selected eight (6) key informants through purposive sampling. These informants included individuals such as technical directors, production managers, engineers, and OB coordinators who have extensive knowledge and experience in outdoor television broadcasting. The sample size was increased incrementally to 8 participants until data saturation is reached i.e., when additional interviews no longer provide new information or insights. This strategy ensured depth and richness in the qualitative data collected. This combination of sampling techniques allowed the researcher to obtain both statistically generalizable results and contextually nuanced perspectives (Creswell & Plano Clark, 2018).

3.5 Data Collection Instruments

This study employed two main instruments for data collection: a structured questionnaire for the quantitative aspect and a semi-structured interview guide for the qualitative component. These tools were selected because they were well-suited to the mixed methods design of the study and align directly with the research objectives. The instruments were developed by the researcher, guided by existing literature, the study's conceptual framework, and insights from initial discussions with the research supervisor. The content of both the questionnaire and interview guide were informed by themes drawn from the Diffusion of Innovations Theory and the Technology Acceptance Model, as well as empirical findings from previous studies on media technology and production processes.

The questionnaire used mostly closed-ended items, including Likert scale questions, multiple-choice questions, and yes/no responses. These formats were selected to facilitate easy coding, quantification, and statistical analysis. The interview guide, on the other hand, consisted of open-ended questions that allowed participants to share detailed experiences and insights related to the use of technology in outdoor broadcasting.

The questionnaire was structured into five major sections. The first section gathered demographic information such as age, sex, education level, job role, and years of experience. The second section focused on the types of technologies currently used in outdoor television production. The third section assessed the influence of these technologies on production efficiency, content quality, and audience experience. The fourth section examined the challenges associated with adopting and implementing these technologies. The final section examined the nature and challenges of an outdoor event in Ghana.

To ensure validity, both content and construct validity was addressed. Content validity was established by submitting the instruments to expert review by academic supervisor. His feedback helped refine the language, relevance, and structure of the questions. Construct validity was achieved by ensuring that each item corresponds clearly with the core concepts and research objectives. For the questionnaire, reliability was tested using Cronbach's alpha during the pilot phase to measure internal consistency, with an alpha score of 0.70 or higher considered acceptable.

A pilot test was conducted to evaluate the clarity, flow, and appropriateness of both instruments. For the questionnaire, twenty (20) outdoor television personnel from a TV station not involved in the main study participated in the pilot. For the qualitative tool, two key informants were interviewed to assess the effectiveness of the interview guide. Based on the feedback from the pilot, ambiguous or redundant questions were revised or removed, and new items were added to improve the comprehensiveness and clarity of the instruments.

The final instruments reflected the adjustments made from the pilot testing process, thereby enhancing their reliability and contextual relevance. One major strength of the instruments lied in their ability to capture both numerical trends and detailed qualitative insights. However, a potential weakness is the reliance on self-reported data, which may introduce bias. To address this, anonymity was maintained, and triangulation of data was used to strengthen the credibility of the findings.

3.6 Data Collection Procedures

Data for this study was collected over a six-week period between September and October 2025. The quantitative data collection spanned the first four weeks, while the qualitative interviews were conducted in the final two weeks. Data was collected during both morning and afternoon sessions (between 9:00 a.m. and 4:00 p.m.) to accommodate the availability of participants, especially those actively engaged in production duties at various television stations in Accra.

The researcher was responsible for administering the structured questionnaires and conducting the semi-structured interviews. For the quantitative aspect, questionnaires were distributed in person to eligible respondents at selected television stations. Where feasible, online versions were shared through email or WhatsApp to respondents who may prefer digital submission. Respondents were given 20–30 minutes to complete the questionnaire. Follow-up visits and reminders were made to increase the response rate.

Qualitative data was collected through face-to-face interviews using the semi-structured guide. Each interview lasted approximately 30–45 minutes and was conducted at a time and place convenient for the participants. With consent, interviews were audio-recorded and later transcribed for analysis. While data collection is expected to proceed smoothly, potential challenges included limited availability of some participants due to tight work schedules, reluctance to disclose operational challenges, and delays in securing appointments for interviews. To address these issues, the researcher maintained regular communication with key contact persons at the selected stations and ensure that participation is voluntary, confidential, and flexible enough to accommodate participants' time constraints.

3.7 Data Processing and Analysis

Data processing began immediately after data collection. For the quantitative data, all completed questionnaires were carefully reviewed (data editing) to check for completeness, consistency, and clarity. Any responses that are incomplete or ambiguous were excluded from the final dataset. Following this, data was coded according to the structure of the questionnaire using a pre-defined coding scheme. Each response category was assigned a numerical code to facilitate computer-based analysis. Data was then entered into the Statistical Package for the Social Sciences (SPSS) version 25.0. To minimize data entry errors, double data entry was employed, where two datasets were entered independently and then compared to identify and correct discrepancies.

The units of analysis for the quantitative component were individual media professionals involved in outdoor television production activities in Accra. For the qualitative component, the units of analysis were in-depth interview transcripts from selected professionals who provide rich, contextual insights into the influence of technology on outdoor television production.

Quantitative data was analyzed using descriptive. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize respondents' demographic characteristics and responses to closed-ended questions. Objectives of this study were all addressed using quantitative methods. This purely quantitative approach ensures objectivity, generalizability, and ease of comparison across variables.

For the qualitative data, thematic analysis was used. Audio-recorded interviews were transcribed verbatim and uploaded into qualitative analysis software, NVivo. The transcripts were read

multiple times to become familiar with the content. Codes were generated and categorized into themes aligned with the study objectives. This allowed for the exploration of nuanced experiences and insights, particularly regarding the challenges and opportunities associated with technological adoption in outdoor television production.

The mixed-method approach enhanced the depth and validity of the findings by allowing for triangulation of data from different sources. Statistical tools and thematic coding are justified as they directly address the nature of the research questions, which seek both to measure patterns and to explore subjective experiences.

3.8 Ethical Considerations

This study adhered to ethical standards and procedures to protect the rights and welfare of all participants. Ethical approval was sought from the academic department of the University of Media, Arts and Communication, followed by clearance from relevant institutional review boards where necessary. Participation in the study was strictly voluntary, and no individual was coerced or compelled to take part.

Informed consent was obtained from all participants before data collection begins. A written consent form was provided, detailing the general purpose of the study, the procedures involved, and why the individual has been selected to participate. Participants were informed that they were free to decline or withdraw from the study at any point without any penalty or consequence. The consent form also emphasized the confidentiality of the information provided. Personal identifiers were removed during data processing, and data was stored securely and used solely

for academic purposes. These procedures ensured that the study upholds the principles of respect, autonomy, and confidentiality.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

This chapter presents and discusses the findings of the study on The Role of Technology in Enhancing Outdoor Television Production in Ghana: An Examination of Technological Advancements and Their Impact. It begins by outlining the background characteristics of the survey respondents and key informants. The chapter then sequentially addresses the research objectives, providing a detailed analysis of the types of technologies currently in use, their influence on broadcasts, and the key challenges faced in their adoption and implementation. Finally, the specific nature and challenges of covering outdoor events in Ghana are examined. Both quantitative data and qualitative insights are integrated to offer a comprehensive understanding of the results.

4.1 Background Information

The study involved a total of 283 respondents engaged in outdoor television production in Accra. The gender distribution revealed a predominance of male professionals, with 199 respondents (70.3%) being male and 84 respondents (29.7%) female, reflecting the male-dominated nature of the field.

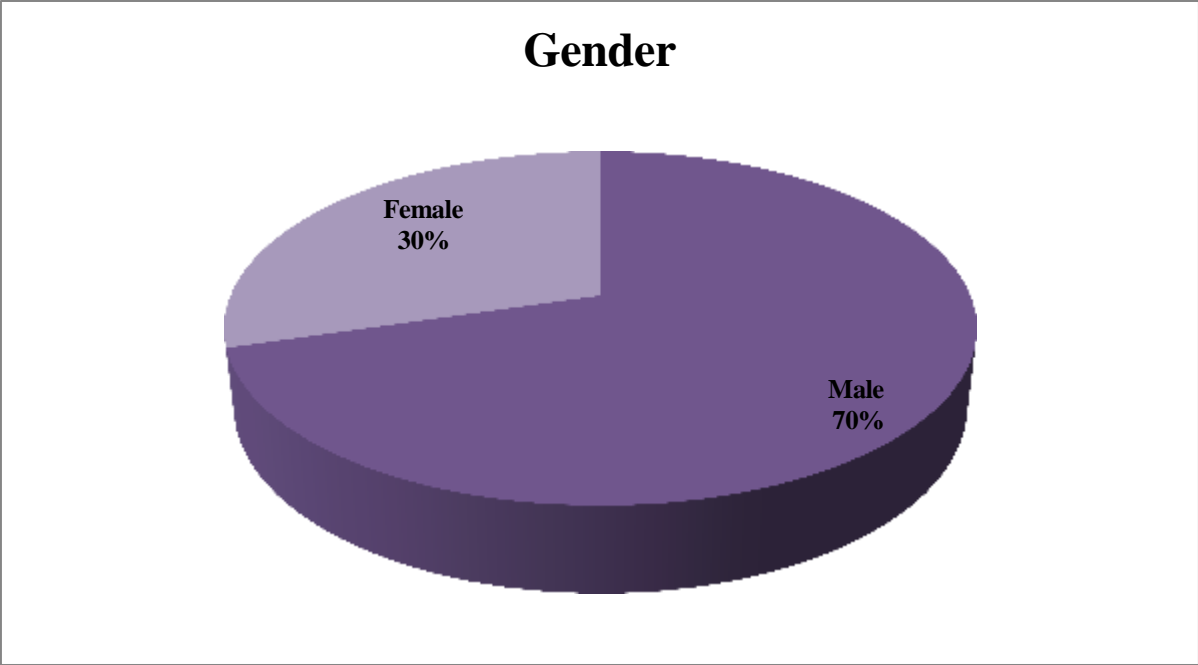


Figure 4.1 Gender Distribution

Source: Field Survey, 2025

Regarding age, the majority of respondents were between 26 and 35 years (111; 39.2%), followed by those aged 36–45 years (95; 33.6%). A smaller proportion of respondents were aged 46–55 years (45; 15.9%), 18–25 years (29; 10.2%), and 56 years and above (3; 1.1%), indicating that outdoor television production is mainly staffed by mid-career professionals.

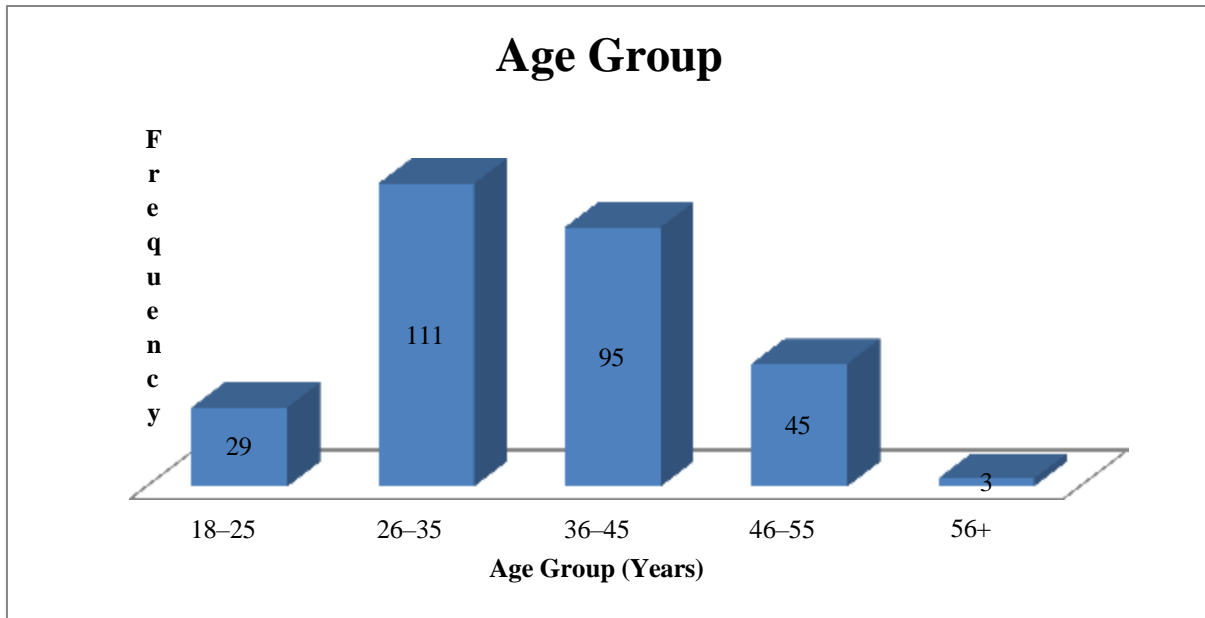


Figure 4.2: Age Group Distribution

Source: Field Survey, 2025

In terms of educational background, more than half of the respondents held a degree (159; 56.2%), while 61 respondents (21.6%) had a diploma. A smaller number had a master’s degree (53; 18.7%) or a PhD (10; 3.5%), suggesting that most personnel possess at least a tertiary qualification relevant to media, communication, journalism, or engineering-related fields.

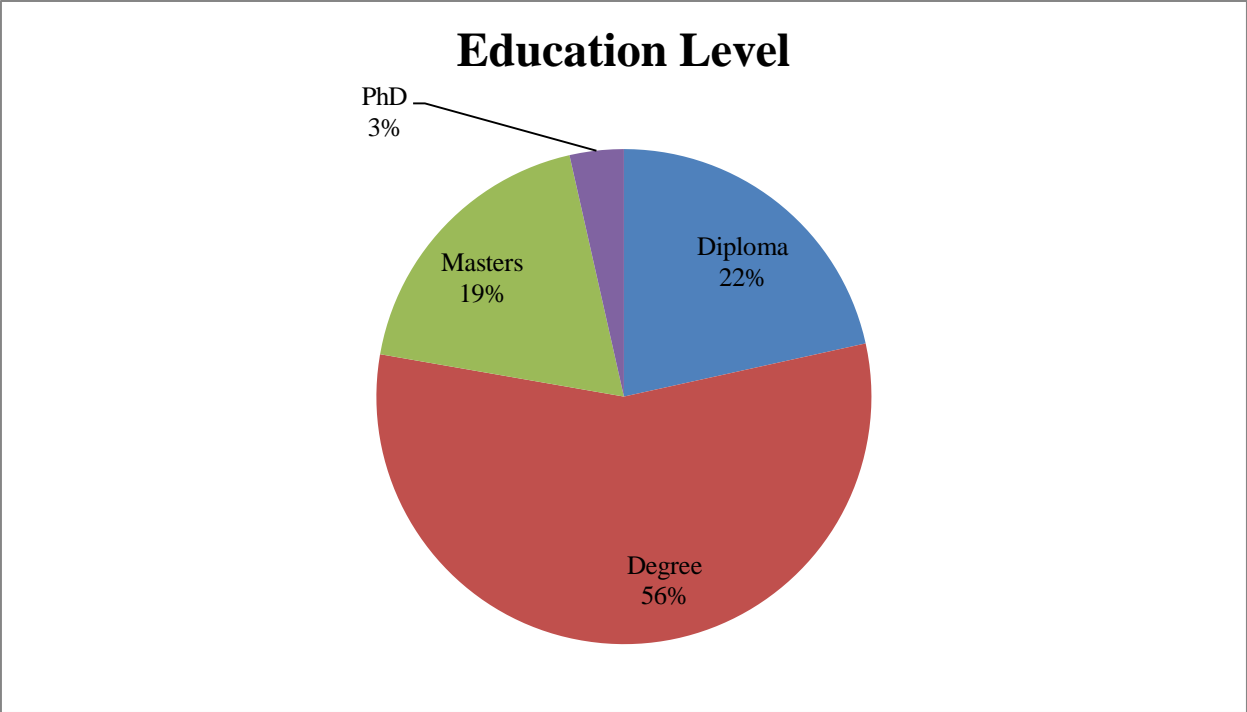


Figure 4.3: Highest Educational Level

Source: Field Survey, 2025

The respondents occupied various roles within the television production environment. Camera operators constituted the largest group (87; 30.7%), followed by engineers (49; 17.3%) and producers (45; 15.9%). Editors (39; 13.8%), OB technicians (28; 9.9%), directors (25; 8.8%), and other roles (10; 3.5%) also participated, highlighting the diverse professional expertise required for outdoor production.

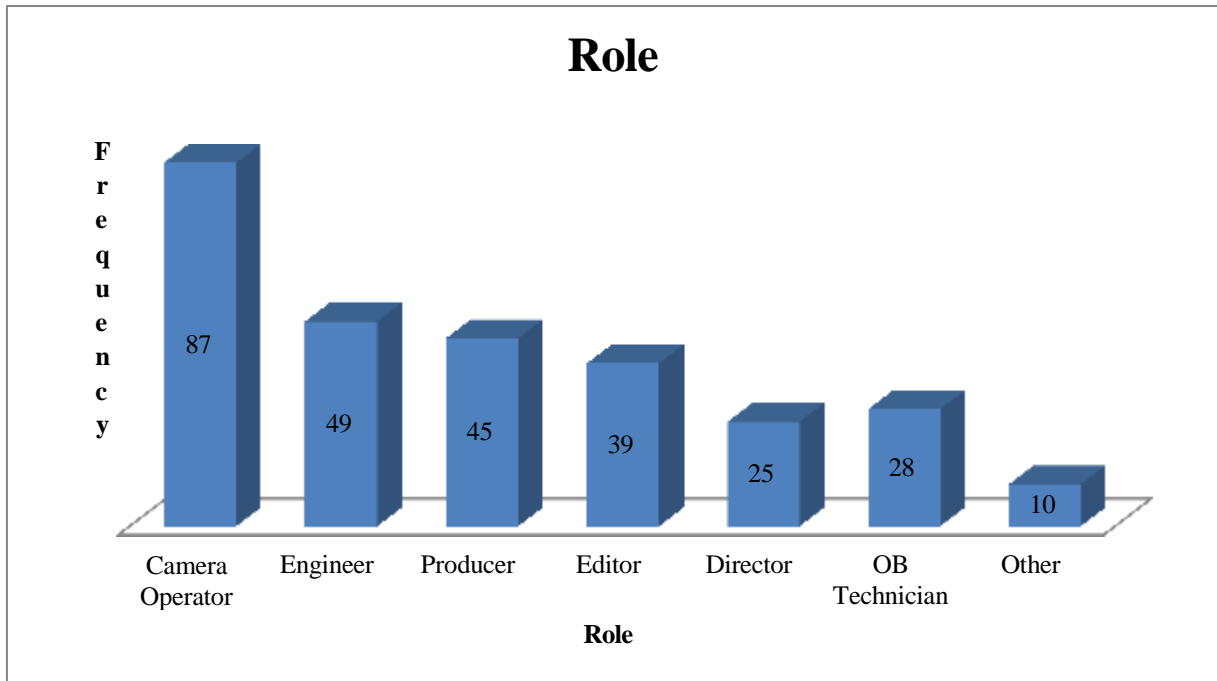


Figure 4.4: Position/Role in Organization

Source: Field Survey, 2025

Finally, respondents' experience in outdoor television production varied. A majority had between 4 and 6 years of experience (81; 28.6%), followed by those with 1–3 years (73; 25.8%) and 7–10 years (57; 20.1%). Professionals with over 10 years of experience comprised 51 respondents (18.1%), while those with less than one year of experience were 21 (7.4%). This distribution demonstrates a mix of relatively new and seasoned professionals contributing to outdoor television production in Accra.

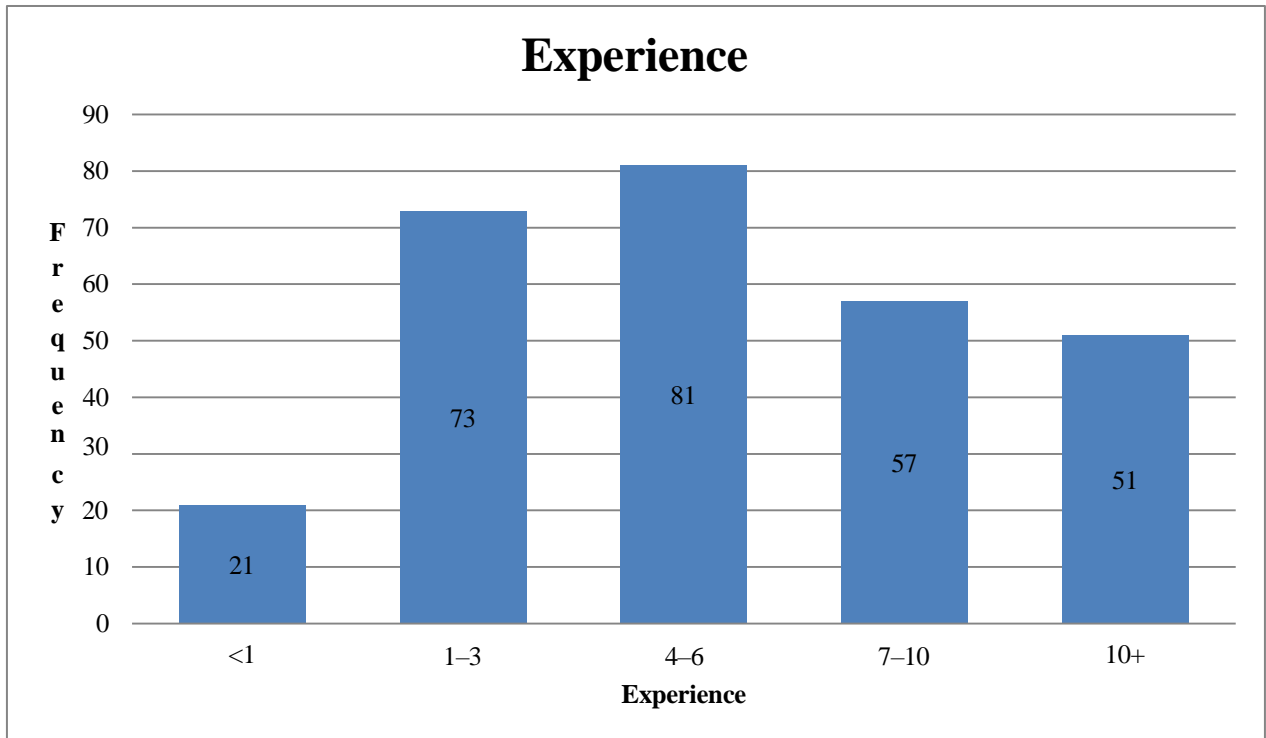


Figure 4.5: Years of Experience in Outdoor Production

Source: Field Survey, 2025

For the qualitative phase, eight key informants were purposively selected, comprising a mix of technical directors, production managers, engineers, and OB coordinators with extensive experience in outdoor television broadcasting in Accra. Among them, five were male and three were female, with ages ranging from 26 to 55 years. Experience in the field varied from six to eighteen years, ensuring inclusion of both mid-career and senior professionals. Educationally, senior engineers and technical directors generally held master’s degrees, while production managers and OB coordinators had bachelor’s degrees. Each informant was assigned a code (KI1–KI8) to maintain anonymity while linking their insights during analysis, providing a diverse and knowledgeable group to capture rich, contextually nuanced perspectives on technological adoption and challenges in outdoor television production.

Table 4.1: Demographic Characteristics of Key Informants

Code	Gender	Age Group (years)	Role/Position	Years of Experience	Education Level
KI1	Male	36–45	Technical Director	12	Master’s Degree
KI2	Female	26–35	Production Manager	7	Bachelor’s Degree
KI3	Male	36–45	OB Coordinator	10	Bachelor’s Degree
KI4	Male	46–55	Senior Engineer	18	Master’s Degree
KI5	Female	26–35	Production Manager	8	Bachelor’s Degree
KI6	Male	36–45	Technical Director	14	Master’s Degree
KI7	Male	26–35	OB Coordinator	6	Bachelor’s Degree
KI8	Female	36–45	Senior Engineer	11	Master’s Degree

Source: Field Survey, 2025

4.2. Objective 1: To explore the types of technologies currently used in outdoor television production in Ghana.

The study found that a wide range of technologies is used in outdoor television production in Accra, reflecting both the diversity of events covered and the technological capabilities of urban- based stations. Quantitative results indicated that the most commonly used equipment included editing software (227; 80.2%), lighting kits (221; 78.1%), HD cameras (203; 71.7%), and wireless intercom systems (198; 69.9%). OB vans were also frequently used by 183 respondents (64.7%), followed by live streaming encoders (161; 56.9%), satellite uplinks (139; 49.1%), 4K cameras (119; 42.0%), and microwave links (109; 38.5%). Other specialized equipment was less

common (27; 9.5%). These findings suggest that most stations prioritize core technologies that enhance both the visual and operational quality of outdoor broadcasts, while more advanced tools such as drones and 4K cameras are less widespread.

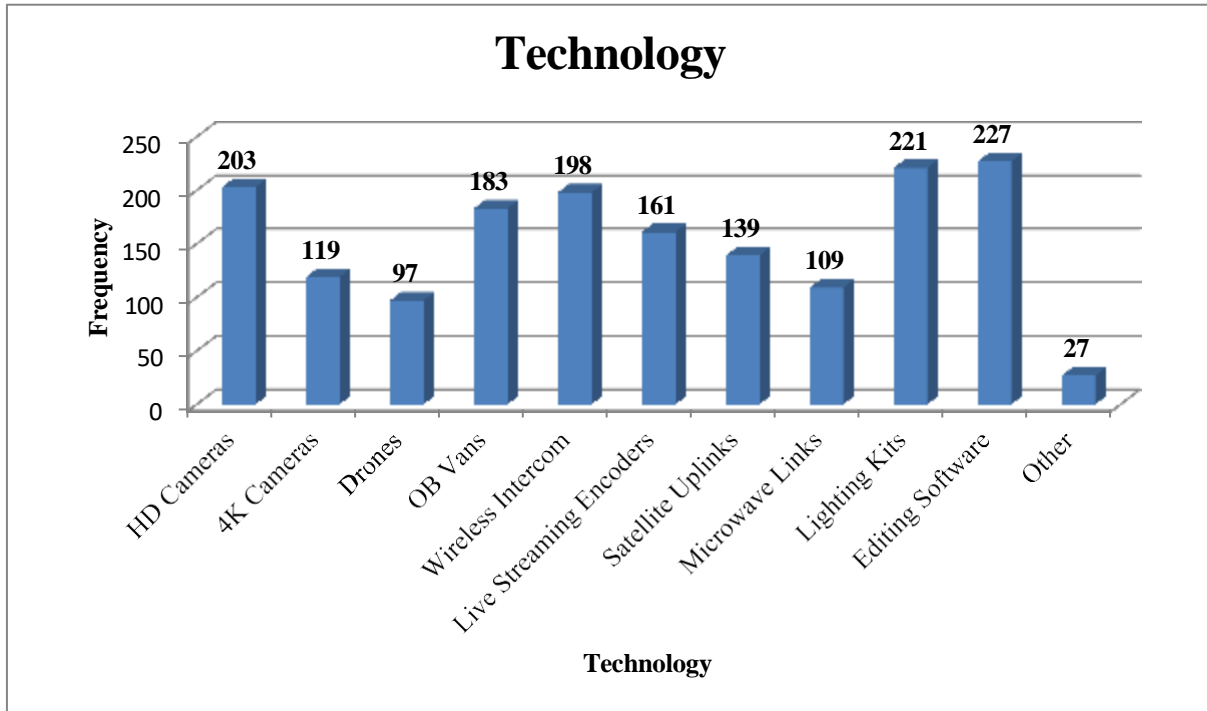


Figure 4.6: Technologies Used (Multiple Responses) **Source: Field Survey, 2025**

In terms of equipment availability, 117 respondents (41.3%) described their organization’s technologies as adequate, while 49 (17.3%) considered them very adequate. About a quarter of respondents (73; 25.8%) were neutral on availability, while 39 (13.8%) rated it inadequate and 5 (1.8%) as very inadequate.

Table 4.2: Availability of Modern Equipment

Availability	Frequency	Percentage (%)
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Very adequate	49	17.3
Adequate	117	41.3
Neutral	73	25.8
Inadequate	39	13.8
Very inadequate	5	1.8

Source: Field Survey, 2025

Frequency of technology usage also varied: most respondents reported using advanced technologies often (101; 35.7%) or always (79; 27.9%), with some using them sometimes (71; 25.1%) and a minority rarely (26; 9.2%) or never (6; 2.1%). These results highlight that while technology is widely used, its availability and frequency of application depend on station resources and the nature of outdoor events.

Table 4.3: Frequency of Using Advanced Technologies

Frequency	Frequency	Percentage (%)
Always	79	27.9
Often	101	35.7
Sometimes	71	25.1
Rarely	26	9.2
Never	6	2.1

Source: Field Survey, 2025

Regarding organizational support, 61 respondents (21.6%) strongly agreed and 111 (39.2%) agreed that their stations regularly invest in new technology, although 71 (25.1%) were neutral and a smaller proportion disagreed (30; 10.6%) or strongly disagreed (10; 3.5%). Staff training also reflected this trend: 53 respondents (18.7%) strongly agreed and 118 (41.7%) agreed that training accompanies new technology, while 78 (27.6%) were neutral and 34 (12.1%) disagreed or strongly disagreed. Similarly, 71 (25.1%) strongly agreed and 132 (46.6%) agreed that the technologies available met production needs, indicating a generally positive perception of adequacy and relevance.

Table 4.4: Organizational Technology Investment, Staff Training, and Adequacy

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Organization invests regularly in new technology	61	111	71	30	10
Staff are given training when new technologies are introduced	53	118	78	26	8
Technologies available meet your outdoor production needs	71	132	53	18	9

Source: Field Survey, 2025

The qualitative interviews provided rich insights into how technology is integrated into outdoor television production in Accra. Key informants highlighted both the benefits of technological innovations and the challenges that remain.

Efficiency and Production Enhancement

Technology was consistently reported to improve efficiency and the overall quality of outdoor broadcasts. A technical director (KI1) described the transformative impact of equipment such as HD cameras and OB vans:

"The introduction of HD cameras and OB vans has completely changed the way we cover live events. Before, we relied on basic cameras and limited mobile setups, which meant slower coverage and fewer camera angles. Now, we can broadcast multiple angles in real time, switch between them seamlessly, and even provide instant replays. It has not only improved production efficiency but also enhanced the storytelling aspect, making viewers feel like they are part of the event."

Coordination and Teamwork

Wireless communication systems were identified as essential for crew coordination during live outdoor events. A production manager (KI2) explained:

"Wireless intercoms and headsets are a lifesaver, especially during large outdoor events like political rallies or sports matches. Coordinating dozens of camera operators across a stadium without them would be chaotic. We can instantly relay instructions, change camera positions, and manage timing cues without stopping the broadcast. These tools have essentially become the backbone of our operations, ensuring that everyone stays connected and the production runs smoothly."

Creative Capabilities and Technological Limitations

Advanced tools like drones and 4K cameras provide new creative opportunities but are not always accessible. An OB coordinator (KI3) stated:

"Drones have added a creative dimension to our broadcasts that was impossible before. We can capture aerial shots that give viewers a new perspective of events, like festivals or concerts. However, not every station can afford multiple drones or the latest 4K cameras, so we often have to share equipment or prioritize certain events. This limitation affects the creativity and comprehensiveness of our coverage, and sometimes we cannot fully exploit the technology available."

Training and Organizational Support

The importance of training and institutional support was emphasized as critical to leveraging technology effectively. A senior engineer (KI4) noted:

"Introducing new technology is only part of the challenge. Staff must be trained adequately to use the equipment correctly. We have had situations where expensive cameras or streaming systems were underutilized because operators were unfamiliar with the features or the maintenance requirements. Ongoing training and technical support are critical; without them, the investment in technology does not translate into better production quality."

Challenges and Constraints

Despite the benefits, several recurring challenges were reported. Limited access to high-end equipment, inconsistent training, and occasional technical failures were identified as obstacles that constrain the full potential of technological innovations in outdoor television production.

Overall, these findings illustrate that while Ghanaian outdoor television production has made substantial technological advancements, the effectiveness of these innovations depends on adequate training, reliable maintenance, organizational support, and equitable access to advanced tools.

4.2. Objective 2: To assess the influence of these technologies on outdoor broadcasts.

The findings indicate that technology plays a significant role in enhancing various aspects of outdoor television production in Accra. Regarding production efficiency and speed, a majority of respondents agreed that technology has improved operations, with 85 respondents (30.0%) strongly agreeing and 122 (43.1%) agreeing, while a smaller proportion were neutral (45; 15.9%) or disagreed (31; 11.0%). This suggests that most personnel perceive technological tools as essential in facilitating faster and more efficient broadcast workflows.

In terms of video and audio quality, 91 respondents (32.2%) strongly agreed and 119 (42.0%) agreed that technology has enhanced broadcast standards. A smaller number were neutral (46; 16.3%) or disagreed (27; 9.5%). This finding highlights that modern equipment such as HD cameras, 4K cameras, and live streaming encoders contributes directly to improved visual and auditory output, thereby increasing audience satisfaction.

Technology was also reported to improve the creativity of event coverage. Specifically, 78 respondents (27.6%) strongly agreed and 110 (38.9%) agreed that tools like drones and multi-camera setups enable more innovative coverage. However, 62 respondents (21.9%) were neutral, and 33 respondents (11.7%) disagreed, indicating that while creativity has generally increased, resource limitations and uneven access to advanced technologies may constrain its full potential.

Coordination among production crew was another area positively influenced by technology. Here, 69 respondents (24.4%) strongly agreed and 115 (40.6%) agreed that wireless intercoms, headsets, and communication systems facilitate smoother collaboration during live events. About 67 respondents (23.7%) were neutral, and 32 respondents (11.3%) disagreed, suggesting that while technology improves teamwork, human factors and experience levels also play a role.

Regarding audience engagement and viewing experience, 88 respondents (31.1%) strongly agreed and 120 (42.4%) agreed that technology enhances the way audiences experience broadcasts. Only 50 respondents (17.7%) were neutral and 25 (8.8%) disagreed. These results indicate that technologies such as multiple camera angles, live streaming, and real-time graphics contribute significantly to viewer satisfaction and retention.

Technology was also perceived to reduce errors during live broadcasts, with 73 respondents (25.8%) strongly agreeing and 118 (41.7%) agreeing. A smaller number were neutral (63; 22.3%) or disagreed (29; 10.3%). This suggests that automated systems, live monitoring, and technical redundancy help minimize mistakes during complex outdoor productions.

Finally, 65 respondents (23.0%) strongly agreed and 108 (38.2%) agreed that technology has significantly improved their station's competitiveness, while 75 respondents (26.5%) were neutral and 25 respondents (8.8%) disagreed. This highlights that beyond operational efficiency,

technological adoption also supports market positioning, audience growth, and the ability to secure sponsorships or advertising opportunities.

Table 4.5: Influence of Technology on Outdoor Broadcasts (n = 283)

Statement	S A		A		N		D		SD	
	F	%	F	%	F	%	F	%	F	%
Technology Improves production efficiency and Speed	85	30.0	122	43.1	45	15.9	20	7.1	11	3.9
Technology enhances video and audio quality	91	32.2	119	42.0	46	16.3	17	6.0	10	3.5
Technology makes event coverage more creative (e.g., drone shots)	78	27.6	110	38.9	62	21.9	22	7.8	11	3.9
Technology Improves coordination among production Crew	69	24.4	115	40.6	67	23.7	23	8.1	9	3.2
Technology enhances audience engagement and Viewing experience	88	31.1	120	42.4	50	17.7	17	6.0	8	2.8
Technology reduces errors during live broadcasts	73	25.8	118	41.7	63	22.3	22	7.8	7	2.5

Source: Field Survey, 2025

The interviews with key informants highlighted several important themes regarding the influence of technology on outdoor television production in Ghana. Efficiency and Mobility emerged as a key theme. Respondents emphasized that modern equipment and communication systems have significantly sped up production processes and increased flexibility. A technical director (KI1) explained:

"With OB vans and wireless intercoms, we can set up an entire production in a fraction of the time it used to take. Camera operators, sound engineers, and directors are all connected, so we can reposition equipment quickly without disrupting the broadcast. This speed and mobility are crucial, especially during large-scale events with multiple locations."

Production Quality and Creativity was another prominent theme. Advanced cameras, drones, and audio systems were described as enhancing both the technical and creative aspects of broadcasts. A production manager (KI2) stated:

"Drones and 4K cameras have completely changed our coverage. We can capture aerial perspectives, create dynamic shots, and produce content that looks professional and engaging. Audio clarity has improved as well, which is essential during crowded or noisy outdoor events."

Audience Engagement and Experience was frequently mentioned. Key informants noted that multi-camera setups, live streaming, and real-time graphics improve viewer satisfaction and interactivity. An OB coordinator (KI3) commented:

"Technology allows us to give viewers a more immersive experience. Instant replays, multiple angles, and real-time graphics keep audiences engaged. Social media integration also lets viewers comment during live events, making the broadcast interactive."

Finally, Teamwork and Communication was highlighted as a crucial benefit of technology. Wireless intercoms and monitoring systems enhance coordination among crew members and reduce errors. A senior engineer (KI4) observed:

"Before wireless intercoms, coordinating a large team in the field was chaotic. Now, directors can communicate instantly with camera operators, sound engineers, and field producers. Everyone knows their responsibilities, which reduces mistakes and ensures smooth operations."

Overall, these themes illustrate that technology plays a central role in enhancing efficiency, production quality, creativity, audience experience, and crew coordination in Ghanaian outdoor television production. The findings also underscore the importance of training and access to advanced tools to maximize these benefits.

4.3. Objective 3: To identify the challenges television stations face in adopting and implementing these technologies

The study identified several challenges television stations face in adopting and implementing new technologies for outdoor production in Ghana. The most commonly reported barrier was high costs, with 192 respondents (67.8%) indicating it as a challenge. Inadequate training was another major issue, noted by 158 respondents (55.8%), followed by power issues (129; 45.6%), poor internet connectivity (103; 36.4%), and technical breakdowns (97; 34.3%). Limited support from management or external providers was highlighted by 85 respondents (30.0%), while resistance to change was identified by 76 respondents (26.9%). A small number of respondents (12; 4.2%) reported other miscellaneous challenges. These findings indicate that both financial and operational constraints significantly affect the adoption of technological innovations in outdoor television production.

Table 4.6: Main Challenges Faced When Adopting New Technology (Multiple Responses, n = 283)

Challenge	Frequency	Percentage (%)
High costs	192	67.8
Inadequate training	158	55.8
Poor internet	103	36.4
Technical breakdowns	97	34.3
Limited support	85	30.0
Power issues	129	45.6
Resistance to change	76	26.9
Other	12	4.2

Source: Field Survey, 2025

When examining specific challenges in more detail, 105 respondents (37.1%) strongly agreed and 110 (38.9%) agreed that the cost of equipment restricts technology adoption, while 42 (14.8%) were neutral and 26 (9.2%) disagreed or strongly disagreed. Poor technical skills were also a considerable barrier, with 92 respondents (32.5%) strongly agreeing and 115 (40.6%) agreeing that limited expertise hinders effective use of technology. Similarly, maintaining or repairing equipment was challenging, as 88 respondents (31.1%) strongly agreed and 117 (41.3%) agreed that their organizations struggle with upkeep and technical support.

Internet and bandwidth limitations were reported by 79 respondents (27.9%) who strongly agreed and 110 (38.9%) who agreed that these issues affect outdoor broadcasts, while 61 (21.6%) were neutral and 33 (11.7%) disagreed or strongly disagreed. Power instability was another key constraint, with 95 respondents (33.6%) strongly agreeing and 108 (38.2%) agreeing that unstable electricity supply negatively impacts production quality. These results collectively highlight that technological adoption in outdoor television production is influenced by a combination of financial, technical, and infrastructural challenges, which can affect both the efficiency and quality of live broadcasts.

Table 4.7: Specific Challenges

Statement	S A		A		N		D		S D	
	F	%	F	%	F	%	F	%	F	%
Cost of equipment restricts technology adoption	105	37.1	110	38.9	42	14.8	18	6.4	8	2.8
Poor technical skills hinder effective use	92	32.5	115	40.6	53	18.7	16	5.7	7	2.5
Organization struggles to maintain/repair equipment	88	31.1	117	41.3	55	19.4	17	6.0	6	2.1
Internet and bandwidth issues affect broadcasts	79	27.9	110	38.9	61	21.6	24	8.5	9	3.2

Source: Field Survey, 2025

The interviews with key informants revealed several recurring themes regarding the challenges faced by television stations in adopting and using new technologies. These themes highlight financial, technical, infrastructural, and human-related barriers that influence outdoor production.

Financial Constraints were consistently identified as a major challenge. Respondents explained that the high cost of equipment limits the ability of stations to acquire advanced technologies. A production manager (KI2) stated:

"Many stations simply cannot afford multiple drones, 4K cameras, or the latest OB vans. Even when budgets allow, we often have to prioritize certain events over others. Financial limitations prevent us from fully exploiting the technological tools that could improve production quality."

Training and Skills Gaps emerged as another significant theme. Several informants emphasized that even when technology is available, lack of adequate training reduces its effectiveness. An OB coordinator (KI3) noted:

"Introducing new technology is not enough. If staff are not properly trained, expensive cameras, encoders, or software are underutilized. Sometimes we have advanced equipment sitting idle because no one is fully confident in using it."

Technical and Operational Challenges were also prominent. Respondents described difficulties such as equipment malfunctions, software incompatibility, and maintenance issues. A senior engineer (KI4) explained:

"Equipment can break down at crucial moments, and sometimes we struggle to repair or replace it quickly. Even something as simple as a faulty encoder or drone malfunction can disrupt the entire broadcast. Technical reliability remains a constant concern."

Infrastructure Limitations were highlighted as critical barriers, particularly relating to power supply and internet connectivity. A technical director (KI1) said:

"Power outages and poor internet connectivity are common problems. They affect live streaming, drone operations, and communication between crew members. These infrastructural issues often force us to improvise, which can compromise broadcast quality."

Human and Organizational Factors also influenced technology adoption. Resistance to change, lack of managerial support, and workflow adaptation challenges were noted. An OB coordinator (KI3) observed:

"Sometimes people are hesitant to adopt new technology because it changes the way they work. Older staff may prefer familiar methods, and it can take time and guidance to get everyone on board. Without organizational support, adoption becomes slow and uneven."

Overall, these qualitative findings show that while technological innovations offer significant opportunities for improving outdoor television production, their full potential is constrained by financial, technical, infrastructural, and human factors. Respondents emphasized that addressing these challenges requires not only investment in equipment but also training, maintenance support, and organisational commitment.

4.6. Objective 4: To identify and examine the nature and challenges of an outdoor event in Ghana

The study explored the nature of outdoor events covered by television stations in Ghana and the challenges encountered during production. The findings indicate that sports events are the most frequently covered, with 178 respondents (62.9%) reporting regular coverage. Political events

were also widely broadcasted, as indicated by 155 respondents (54.8%), followed by entertainment shows (139; 49.1%), festivals (102; 36.0%), community gatherings (82; 29.0%), and religious events (68; 24.0%). A small number of respondents (17; 6.0%) reported covering other types of outdoor events. This diversity underscores the need for television production teams to adapt their strategies and technologies to different event contexts.

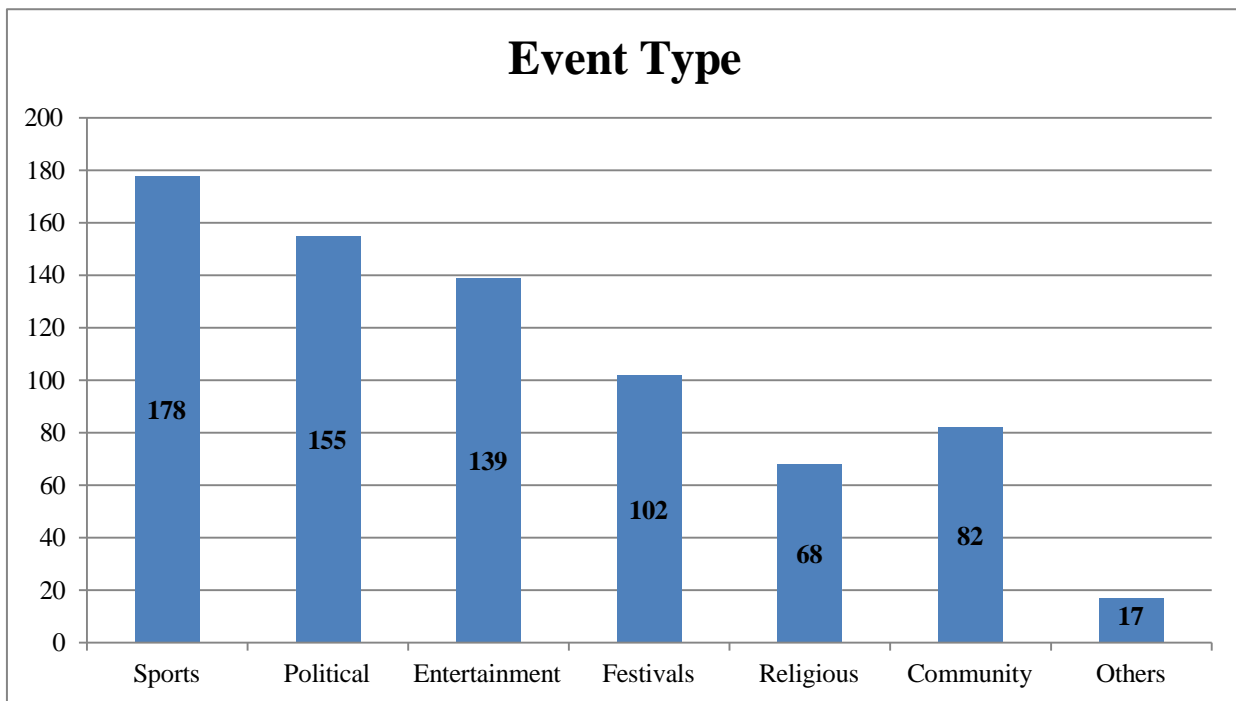


Figure 4.8: Types of Outdoor Events Frequently Covered **Source: Field Survey, 2025**

Several environmental and logistical challenges were identified as affecting outdoor production. Weather was reported as a significant factor, with 101 respondents (35.7%) strongly agreeing and 118 (41.7%) agreeing that adverse conditions such as rain or extreme heat impact broadcasts. Noise and sound interference was also common, with 79 respondents (27.9%) strongly agreeing and 117 (41.3%) agreeing that managing audio quality in outdoor settings is often difficult. Crowd control emerged as another major challenge, with 93 respondents (32.9%) strongly agreeing and 115 (40.6%) agreeing that large or uncooperative crowds complicate camera

positioning and mobility. Security concerns were also noted, as 67 respondents (23.7%) strongly agreed and 105 (37.1%) agreed that safety issues at outdoor venues affect production activities.

Logistical and infrastructural limitations further constrain outdoor production. Respondents highlighted that many outdoor locations lack suitable spaces for setting up cameras, OB vans, and other equipment, with 87 respondents (30.7%) strongly agreeing and 109 (38.5%) agreeing. Transporting heavy and sensitive equipment to event locations was also identified as challenging, with 95 respondents (33.6%) strongly agreeing and 110 (38.9%) agreeing that logistics often affect production efficiency.

Table 8: Challenges Affecting Outdoor Production (n = 283)

Statement	S A	%	A	%	N	%	D	%	S D	%
Weather affects outdoor production	101	35.7	118	41.7	40	14.1	17	6.0	7	2.5
Crowd control makes production difficult	93	32.9	115	40.6	50	17.7	18	6.4	7	2.5
Outdoor locations often lack suitable spaces for equipment	87	30.7	109	38.5	55	19.4	23	8.1	9	3.2
Noise/sound interference is common during outdoor events	79	27.9	117	41.3	60	21.2	20	7.1	7	2.5
Logistics and transportation challenges affect production	95	33.6	110	38.9	53	18.7	18	6.4	7	2.5
Security concerns affect outdoor production	67	23.7	105	37.1	68	24.0	30	10.6	13	4.6

activities

Source: Field Survey, 2025

When asked to rate the overall conditions for outdoor production in Ghana, most respondents considered them average, with 123 (43.5%) selecting this option. A further 81 respondents (28.6%) rated conditions as good, and 25 (8.8%) rated them as very good. Conversely, 40 respondents (14.1%) rated conditions as poor, and 14 (5.0%) as very poor. These findings suggest that while outdoor production is generally manageable, challenges related to weather, crowd control, logistics, and security continue to pose significant constraints to effective broadcasting.

Table 4.9: Overall Rating of Outdoor Production Conditions (n = 283)

Rating	Frequency	Percentage (%)
Very good	25	8.8
Good	81	28.6
Average	123	43.5
Poor	40	14.1
Very poor	14	5.0
Total	283	100

Source: Field Survey, 2025

The interviews with key informants revealed several recurring themes regarding the nature and challenges of covering outdoor events in Ghana. Respondents emphasized that environmental, logistical, and human factors all significantly affect production.

Environmental Challenges were consistently mentioned. Weather conditions, such as heavy rain, extreme heat, and sudden changes, were described as major obstacles to outdoor broadcasting. A senior engineer (KI4) explained:

"During a political rally last year, sudden rainfall forced us to cover cameras and protect cables, which delayed the broadcast. Weather is unpredictable, and it can disrupt the entire schedule if we are not prepared with protective gear and contingency plans."

Noise interference, especially in crowded urban locations, was also reported as a challenge. An OB coordinator (KI3) noted:

"Street noise, loud music, and shouting crowds often interfere with audio quality. We have to use directional microphones and adjust sound levels constantly to maintain clarity."

Logistical Constraints emerged as another major theme. Respondents described difficulties in transporting and setting up equipment at outdoor venues. A technical director (KI1) stated: *"Some festival sites are not designed for broadcasting. There's limited space for OB vans, cameras, and lighting equipment, so we have to improvise and sometimes reduce camera angles to fit the site. Moving equipment over rough terrain or long distances also slows production."*

Crowd Management and Security were highlighted as key factors affecting outdoor production. Large or unruly crowds can restrict camera movement, create safety risks, and require extra coordination. A production manager (KI2) shared:

"During a sports event, fans often block camera positions or get too close to equipment. We assign extra crew for crowd control and coordinate with security, but it still requires constant attention to avoid accidents."

Recommendations for Improvement were also discussed. Respondents suggested better planning, investment in portable and weather-resistant equipment, and improved training for crews to handle challenging conditions. An OB coordinator (KI3) remarked: *"Having compact, mobile equipment and rehearsing setups in advance can make a huge difference. Also, more training on handling emergencies, like power outages or weather issues, would improve production quality."*

Informants noted that outdoor television production in Ghana is dynamic and rewarding but requires adaptability, creativity, and problem-solving skills to navigate environmental, logistical, and human challenges. A technical director (KI1) summarized:

"Outdoor production is exciting because no two events are the same. But you need good planning, reliable equipment, and a skilled team to manage weather, crowds, and technical issues. When these factors align, the broadcasts are successful, and viewers notice the difference."

Discussion of Results

To explore the types of technologies currently used in outdoor television production in Ghana.

The study's findings demonstrate that Ghanaian outdoor television production has embraced a range of technologies that enhance both operational efficiency and creative output, aligning with the predictions of the Diffusion of Innovations (DOI) theory. Core tools such as editing software, lighting kits, HD cameras, and wireless intercom systems were widely used, reflecting the adoption of innovations that are accessible, reliable, and provide immediate functional benefits.

This pattern of adoption supports Rogers' (2003) premise that innovations with clear relative advantages, compatibility with existing workflows, and observable benefits are more readily adopted within a social system. Advanced technologies, such as drones, 4K cameras, and satellite uplinks, were less prevalent, likely due to their higher costs, infrastructure requirements, and need for specialized skills, which also aligns with DOI's concept of perceived complexity influencing adoption rates. The quantitative and qualitative results show that where technology is available, it substantially improves production efficiency, coordination, and audience engagement, echoing prior studies on media technology adoption in resource-constrained contexts (Owusu-Afriyie & Asare, 2022). The interviews underscored that technologies like OB vans, wireless intercoms, and drones have transformed operational workflows, enabling real-time multi-angle coverage, faster setup, and enhanced storytelling, which resonates with TAM's focus on perceived usefulness and ease of use as critical determinants of technology acceptance (Davis, 1989; Venkatesh & Davis, 2000). Practical implications of these findings suggest that stations that invest in both equipment and training can leverage technological adoption to achieve competitive advantage, improve broadcast quality, and elevate audience experiences, supporting both the DOI and TAM theoretical frameworks.

The findings also highlight significant challenges that temper the benefits of technological innovations, providing nuanced insights into the limitations of both DOI and TAM in this context. High costs, inadequate training, unstable power supply, and poor internet connectivity were consistently reported as barriers, illustrating that adoption is not only a function of perceived usefulness but is constrained by environmental and organizational factors, an observation supported by Greenhalgh et al. (2004). The qualitative interviews revealed that even when advanced tools such as drones and 4K cameras are available, their creative potential is

often underutilized due to limited access and skill gaps, demonstrating that technical capacity and institutional support are critical mediating variables in technology adoption. Environmental challenges, including weather, crowd control, and logistical constraints, further complicate outdoor production, highlighting that the practical application of technology in Ghana is context-specific and contingent on operational conditions. These findings suggest a need to extend TAM to incorporate external constraints and organizational readiness as key determinants of adoption and effective utilization, a limitation noted in prior literature (Bagozzi, 2007). Overall, the study contributes to a more comprehensive understanding of how innovation spreads within media institutions in Ghana, emphasizing that successful technological integration requires not only access to equipment but also robust training, infrastructure support, and organizational commitment, bridging the gap between theoretical predictions and the realities of practice in resource-limited settings.

To assess the influence of these technologies on outdoor broadcasts.

The findings of this study reveal that modern technologies have substantially transformed outdoor television production in Accra, enhancing efficiency, quality, and audience engagement in ways consistent with both the Diffusion of Innovations (DOI) theory and the Technology Acceptance Model (TAM). Quantitative results show that a majority of respondents perceive technology as improving production speed, video and audio quality, and creativity, with tools such as drones, 4K cameras, OB vans, and wireless intercoms playing critical roles. These outcomes align with Rogers' (2003) assertion that innovations with observable benefits and compatibility with existing practices are more readily adopted within social systems, while TAM's focus on perceived usefulness and ease of use (Davis, 1989) explains why production crews embrace these tools to improve workflows. The qualitative interviews further support this

interpretation, highlighting how modern equipment allows rapid setup, real-time multi-angle coverage, enhanced audio clarity, and seamless communication among crew members, thereby reducing errors and improving operational coordination. These findings corroborate prior studies on technological adoption in media production (Sharma et al., 2023; Lynn, 2019), suggesting that when appropriately integrated, technology not only optimizes production processes but also elevates creative possibilities and audience satisfaction.

Despite these benefits, the findings indicate that the impact of technology is mediated by resource availability, training, and infrastructural limitations, which introduces complexity beyond what traditional DOI or TAM models fully capture. While most respondents reported positive effects on efficiency, creativity, and engagement, a significant proportion remained neutral or disagreed, reflecting constraints such as limited access to high-end equipment, inconsistent staff training, and operational challenges like network reliability and power instability. These observations resonate with Bagozzi (2007) and Greenhalgh et al. (2004), who caution that external factors including; financial, infrastructural, and environmental conditions, affect the adoption and effective utilization of innovations. Practically, this suggests that broadcasters must not only acquire advanced tools but also invest in human capacity development, contingency planning, and supportive organizational structures to realize the full potential of technology. Moreover, the data hint at potential disparities in creative output between well-resourced and under-resourced stations, suggesting that strategic allocation of equipment and training could mitigate inequities and further enhance both operational efficiency and audience experience in Ghanaian outdoor broadcasting.

To identify the challenges television stations face in adopting and implementing these technologies.

The findings reveal that Ghanaian television stations face a multifaceted set of challenges in adopting and implementing modern technologies for outdoor production, consistent with prior literature on technological adoption in resource-constrained environments. Financial constraints emerged as the most significant barrier, with high equipment costs and limited budgets preventing stations from acquiring advanced tools such as drones, 4K cameras, and IP-enabled OB vans. This aligns with Mensah and Osei (2022) and Nyarko (2019), who note that capital-intensive technologies often disadvantage smaller broadcasters. Technical skill gaps and inadequate training further exacerbate these issues, as staff may be unable to operate or fully utilize available equipment, reflecting Bhatt's (2023) observation that workforce readiness is a critical factor in technology adoption. The data also underscore operational difficulties, including frequent technical breakdowns, maintenance challenges, and limited managerial or external support, highlighting that adoption is not solely about acquisition but also about ongoing capacity to sustain technology use effectively.

Infrastructural limitations, particularly unreliable power supply and poor internet connectivity, were also prominent, directly affecting production quality, live streaming, and real-time coordination, consistent with Afolayan et al. (2015) and the Broadcasting Innovation Overview (2025). Environmental and weather-related factors further complicate outdoor broadcasting, with heat, dust, and precipitation threatening equipment reliability. Additionally, human and organizational factors, such as resistance to change and insufficient management backing, hinder adoption and slow integration into standard workflows, supporting Atkin et al.'s (2015) findings

on institutional inertia. Collectively, these challenges indicate that while technology offers substantial benefits for efficiency, creativity, and audience engagement, its successful implementation in Ghana depends on addressing financial, technical, infrastructural, and organizational barriers simultaneously. This has practical implications, suggesting that targeted investments in staff training, maintenance support, and infrastructure development are as critical as equipment acquisition for maximizing the impact of modern broadcast technologies.

To identify and examine the nature and challenges of an outdoor event in Ghana

The findings on the nature and challenges of outdoor television production in Ghana indicate a complex interplay between environmental, logistical, technical, and human factors, confirming observations in existing literature. Sports and political events dominate outdoor coverage, reflecting the high public interest in these activities and the need for timely, live reporting (Millerson & Owens, 2016). The prominence of entertainment shows, festivals, and community gatherings further highlights the diverse operational contexts in which production teams must function. These findings a

re consistent with Cianci (2021), who emphasizes that outdoor production requires adaptability to a variety of events, each with unique spatial, temporal, and audience-related dynamics. From a theoretical perspective, the Diffusion of Innovations (DOI) theory helps explain how stations gradually adopt new technologies to meet these demands, with early adopters leveraging drones, mobile OB vans, and live streaming tools to handle complex and large-scale events more efficiently.

Environmental and logistical challenges emerged as major constraints, including adverse weather, crowd control, noise interference, and limited venue infrastructure. These challenges

are echoed in previous studies (Awuah, 2021; Anokye & Asare, 2020), which underscore the unpredictable and high-risk nature of outdoor broadcasting. The reliance on mobile, power-dependent systems and real-time transmission pathways, such as satellite uplinks or terrestrial microwave links, highlights the critical need for technical resilience, robust contingency planning, and skilled personnel. According to the Technology Acceptance Model (TAM), the ability of production teams to effectively use technology depends not only on availability but also on perceived ease of use and organizational support (Davis, 1989; Venkatesh & Davis, 2000). The observed difficulties in logistics, power stability, and crowd management suggest that without adequate training and institutional backing, even advanced technologies may not be fully leveraged. Practically, this implies that broadcasters must invest in portable and weather-resistant equipment, rehearsal planning, and staff capacity-building to mitigate operational risks. While the study clearly identifies key barriers, it is plausible that unmeasured factors such as informal local regulations, audience behavior patterns, and site-specific cultural norms also influence production outcomes, suggesting areas for future research. Overall, these findings highlight that successful outdoor broadcasting in Ghana hinges on the integration of technology with adaptive planning, skilled personnel, and organizational readiness, consistent with the dual framework of DOI and TAM.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents the summary of key findings, conclusions, and recommendations drawn from the study. The chapter also outlines areas for further research to guide future studies.

5.1 Summary of Findings

The findings reveal that Ghanaian television stations, particularly in Accra, utilize a diverse range of technologies, with a clear prioritization of foundational production tools. Core equipment such as editing software (80.2%), lighting kits (78.1%), HD cameras (71.7%), and wireless intercom systems (69.9%) are most prevalent, indicating a focus on ensuring baseline production quality and operational coordination. While OB vans (64.7%) and live streaming encoders (56.9%) are also commonly used, more advanced and capital-intensive technologies like 4K cameras (42.0%), drones (34.3%), and satellite uplinks (49.1%) are less widespread. Overall perceptions of equipment availability are generally positive, with a majority of respondents rating it as adequate or very adequate (58.6%), and most stations report regular use of advanced technologies, supported by organisational investment and accompanying staff training, though a significant portion of the workforce remains neutral or disagrees, pointing to areas for improvement in resource allocation and skill development.

The study demonstrates that technology has a profoundly positive influence on multiple facets of outdoor television production in Ghana. A strong majority of respondents agreed that

technological adoption has enhanced production efficiency and speed (73.1%), significantly improved video and audio quality (74.2%), and increased the creativity of event coverage through tools like drones (66.5%). Furthermore, technology was credited with improving coordination among production crews (65.0%), enhancing audience engagement and viewing experience (73.5%), and reducing errors during live broadcasts (67.5%). These operational and qualitative improvements collectively contribute to greater competitiveness for television stations, as affirmed by 61.2% of respondents, underscoring technology's role as a critical driver of both broadcast quality and market positioning in the evolving media landscape.

Despite the widespread use and positive impact of technology, its adoption is significantly hampered by a confluence of financial, infrastructural, and human resource challenges. The high cost of equipment is the most prominent barrier, identified by 67.8% of respondents, closely followed by inadequate training for staff (55.8%). Infrastructure deficits are also critical, with unstable power supply (71.8% agreement) and poor internet connectivity (66.8% agreement) frequently disrupting productions. Additional operational hurdles include frequent technical breakdowns (34.3%) and a struggle to maintain and repair existing equipment (72.4% agreement), revealing that the challenges extend beyond initial acquisition to encompass the ongoing sustainability and effective utilization of technological assets.

The nature of outdoor television production in Ghana is characterized by a diverse event portfolio, predominantly covering sports (62.9%), political rallies (54.8%), and entertainment shows (49.1%). The production environment for these events is fraught with significant environmental and logistical challenges. Adverse weather conditions (77.4% agreement), difficulties with crowd control (73.5% agreement), and pervasive noise interference (69.2%

agreement) are major concerns. Logistically, transporting equipment (72.5% agreement) and a frequent lack of suitable spaces for setup at venues (69.2% agreement) complicate productions. Consequently, while a plurality of respondents (43.5%) rated the overall conditions for outdoor production as "average," these persistent challenges highlight the demanding and unpredictable nature of producing television content outside the studio in Ghana.

5.2 Conclusions

This study has demonstrated that technology plays a pivotal role in enhancing outdoor television production in Ghana, particularly in Accra, by improving efficiency, content quality, and audience engagement. The widespread use of core technologies such as HD cameras, editing software, and lighting kits reflects a strategic prioritization of tools that ensure baseline production quality and operational coordination. At the same time, the relatively limited adoption of more advanced and capital-intensive technologies, including drones and 4K cameras, suggests that resource constraints continue to shape the technological landscape of Ghanaian outdoor broadcasting.

An unexpected finding from the study was the relatively high percentage of respondents who were neutral or disagreed regarding organisational investment and training, despite overall positive perceptions of technology use. This deviation may indicate uneven distribution of resources, differences in staff exposure to advanced technologies, or gaps in ongoing capacity- building initiatives within some stations. It also highlights that while technology adoption is generally progressive, not all personnel fully benefit from available innovations, pointing to potential disparities in skill development and operational integration.

Another notable observation concerns the persistent infrastructural and environmental challenges that continue to impact production quality. While technology has mitigated some difficulties, issues such as unstable power supply, poor internet connectivity, adverse weather conditions, and logistical constraints remain prevalent. These findings underscore the complex interplay between technological capability and contextual factors, suggesting that effective outdoor production requires not only advanced tools but also supportive infrastructure, contingency planning, and adaptive workflows.

Overall, this study provides new insights into the multifaceted ways technology influences outdoor television production in Ghana. It contributes to a better understanding of both the enablers and constraints of technological adoption, offering evidence that investment in equipment alone is insufficient without adequate training, maintenance, and organisational support. Furthermore, by highlighting the operational and environmental realities of outdoor broadcasting, the study emphasizes the need for holistic strategies that integrate technology, human capacity, and infrastructure. In conclusion, the research underscores that technological advancement can significantly enhance the quality and competitiveness of outdoor television production in Ghana, but its full potential will only be realized when financial, infrastructural, and human resource challenges are effectively addressed.

5.3 Recommendations

1. Television stations in Ghana should prioritize gradual investment in these high-end technologies. This will enable more creative and dynamic event coverage, particularly for sports, festivals, and political events. Station managers and media owners should develop equipment upgrade plans that align with their production needs and financial capacity.

2. It is recommended that television stations implement structured and ongoing training programs for all production staff whenever new technologies are introduced. This should include practical, hands-on workshops and refresher courses to ensure staff are competent in using advanced equipment. The National Media Commission and professional associations like the Ghana Journalists Association could provide support in designing industry-standard training modules.
3. Television stations should invest in reliable backup systems, such as power generators and uninterruptible power supply (UPS) units, and ensure regular maintenance schedules for all technical equipment. Collaboration with internet service providers to secure stable and high-speed connections at key production sites is also recommended. Policy makers and media regulators could incentivize infrastructure upgrades through grants or tax relief for stations that adopt robust technical support systems.
4. Television stations should engage in detailed pre-event planning, including site surveys and risk assessments, to identify potential logistical challenges. Coordination with local authorities, event organizers, and security personnel can help manage crowds and ensure safe and efficient equipment setup.
5. Management should ensure that all relevant personnel have equitable opportunities to work with advanced equipment and receive training. Rotational assignments and shared usage schedules for scarce resources like drones and 4K cameras can optimize their use while fostering skill development across the production team.
6. National media regulators and the Ministry of Communications should consider implementing policies that support outdoor television production, such as providing incentives for investment in modern production technologies, facilitating technical

training programs, and improving infrastructure at commonly used outdoor event sites. Such support would enhance the overall competitiveness and quality of Ghanaian television content on both local and international platforms.

5.4 Suggestions for Further Research

Future research could explore the impact of emerging technologies such as virtual reality (VR), augmented reality (AR), and artificial intelligence (AI) on outdoor production. These technologies are increasingly used globally but were not extensively adopted in the Ghanaian context, and understanding their potential benefits and challenges could guide strategic investment decisions.

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APPENDIX
QUESTIONNAIRE FOR OUTDOOR TELEVISION PRODUCTION STUDY

Title: The Role of Technology in Enhancing Outdoor Television Production in Ghana

Instructions: Please tick (✓) the option that best applies to you.

SECTION A: BACKGROUND INFORMATION

1. Gender Male Female Prefer not to say
2. Age Group 18–25 26–35 36–45 46–55 56+
3. Highest Educational Level Diploma Degree Masters PhD Other: _____
4. Position/Role in the Organisation
5. Camera Operator Engineer Producer Editor Director Other: _____
6. Years of Experience in Outdoor Production <1 year 1–3 4–6 7–10 10+

SECTION B: TECHNOLOGIES USED IN OUTDOOR PRODUCTION (Objective 1)

7. Technologies used in your outdoor production (tick all that apply): HD Cameras 4K Cameras Drones OB Vans Wireless Intercom Live Streaming Encoders Satellite Uplinks Microwave Links Lighting Kits Editing Software Others: _____
8. Availability of modern equipment in your organisation: Very adequate Adequate Neutral Inadequate Very inadequate
9. How often do you use advanced technologies during outdoor broadcasts? Always Often Sometimes Rarely Never
10. Your organisation invests regularly in new production technologies: Strongly Agree Agree Neutral Disagree Strongly Disagree
11. Staff are given training when new technologies are introduced: Strongly Agree Agree Neutral Disagree Strongly Disagree
12. The technologies available meet your outdoor production needs: Strongly Agree Agree Neutral Disagree Strongly Disagree

SECTION C: INFLUENCE OF TECHNOLOGY ON OUTDOOR BROADCASTS (Objective 2)

13. Technology improves production efficiency and speed: Strongly Agree Agree

Neutral Disagree Strongly Disagree

14. Technology enhances video and audio quality: Strongly Agree Agree Neutral Disagree Strongly Disagree
15. Technology makes event coverage more creative (e.g., drone shots): Strongly Agree Agree Neutral Disagree Strongly Disagree
16. Technology improves coordination among production crew: Strongly Agree Agree Neutral Disagree Strongly Disagree
17. Technology enhances audience engagement and viewing experience:Strongly Agree Agree Neutral Disagree Strongly Disagree
18. Technology reduces errors during live broadcasts: Strongly Agree Agree Neutral Disagree Strongly Disagree
19. Technology has significantly improved your station’s competitiveness: Strongly Agree Agree Neutral Disagree Strongly Disagree

SECTION D: CHALLENGES IN ADOPTING TECHNOLOGY (Objective 3)

20. Main challenges faced when adopting new technology (tick all that apply): High costs Inadequate training Poor internet Technical breakdowns Limited support Power issues Resistance to change Other: _____
21. Cost of equipment restricts technology adoption: Strongly Agree Agree Neutral Disagree Strongly Disagree
22. Poor technical skills hinder effective use of technology: Strongly Agree Agree Neutral Disagree Strongly Disagree
23. Your organisation struggles to maintain or repair equipment: Strongly Agree Agree Neutral Disagree Strongly Disagree
24. Internet and bandwidth issues affect outdoor broadcasts: Strongly Agree Agree Neutral Disagree Strongly Disagree
25. Unstable power supply affects production quality: Strongly Agree Agree Neutral Disagree Strongly Disagree

SECTION E: NATURE & CHALLENGES OF OUTDOOR EVENTS IN GHANA (Objective 4)

26. Events frequently covered: Sports Political Entertainment Festivals Religious Community Others: _____
27. Weather affects outdoor production: Strongly Agree Agree Neutral Disagree Strongly Disagree
28. Crowd control makes production difficult: Strongly Agree Agree Neutral

Disagree Strongly Disagree

29. Outdoor locations often lack suitable spaces for equipment: Strongly Agree Agree
 Neutral Disagree Strongly Disagree
30. Noise/sound interference is common during outdoor events: Strongly Agree Agree
 Neutral Disagree Strongly Disagree
31. Logistics and transportation challenges affect production: Strongly Agree Agree
Neutral Disagree Strongly Disagree
32. Security concerns affect outdoor production activities: Strongly Agree Agree
Neutral Disagree Strongly Disagree
33. Overall, how would you rate outdoor production conditions in Ghana? Very good
Good Average Poor Very poor

INTERVIEW GUIDE

Title: The Role of Technology in Enhancing Outdoor Television Production in Ghana

Purpose:

This interview seeks to gather in-depth views from professionals involved in outdoor television production about the technologies they use, their influence on production quality and efficiency, and the challenges they encounter.

SECTION A: INTRODUCTORY INFORMATION

1. Can you briefly describe your role in outdoor television production?
2. How long have you been involved in outdoor production activities?
3. Which types of outdoor events do you frequently work on (e.g., sports, political, entertainment, festivals)?

SECTION B: TECHNOLOGIES USED IN OUTDOOR PRODUCTION (Objective 1)

1. What types of technologies or equipment does your organisation currently use for outdoor television production? Prompt: (e.g., cameras, drones, OB vans, satellite links, wireless systems)
2. How would you describe the availability and condition of these technologies in your organisation?
3. In your experience, how has the introduction of new technologies changed the way outdoor production is done?
4. How often do you receive training or orientation when new equipment or technology is introduced?

SECTION C: INFLUENCE OF TECHNOLOGY ON OUTDOOR BROADCASTS (Objective 2)

1. In what ways has technology improved the efficiency of outdoor production? Prompt: (speed of setup, coordination, mobility)
2. How has technology influenced the quality of your outdoor broadcasts? Prompt: (audio, picture quality, creativity of shots)
3. Do you think technology has improved audience experience and engagement? If yes, how?
4. How does technology affect teamwork and communication during outdoor production?

SECTION D: CHALLENGES IN ADOPTING AND USING TECHNOLOGY (Objective 3)

1. What challenges do you face when adopting or using new production technologies? Prompt: (cost, training, support, compatibility issues)

2. How do financial constraints affect your organisation's ability to acquire new technology?
3. What technical or operational difficulties do you encounter when using advanced technologies during outdoor broadcasts?
4. How do internet connectivity, bandwidth limitations, or power supply issues impact your work?
5. Are there any organisational or human-related challenges (e.g., resistance to change, skills gaps)?

SECTION E: NATURE & CHALLENGES OF OUTDOOR EVENTS IN GHANA

(Objective 4)

1. Based on your experience, what are the main challenges of covering outdoor events in Ghana? Prompt: (weather, noise, crowd control, space limitations)
2. How do environmental and logistical factors affect your production process?
3. Can you describe a specific outdoor event that was particularly challenging and how you managed the situation?
4. What improvements would you recommend to enhance outdoor television production in Ghana?

SECTION F: CLOSING

1. Is there anything else you would like to add that you believe is important for this study?