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Drones and Unmanned Aerial Vehicles: Applications and Regulations. Nigeria as a Case Study Looking At It at Global Context

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Abstract

The fast rate of technological advancement of drone and Unmanned Aerial Vehicle (UAV) technology in Nigeria has revolutionized multiple sectors, including agriculture, logistics, surveillance, disaster management, environmental monitoring, and defense. This study examined various diverse applications of UAVs, highlighting their transformative impact on operational efficiency, data collection, and real-time decision-making. Alongside these innovations, the proliferation of drones raises significant regulatory, ethical, and privacy concerns. The study adopted a qualitative and exploratory research design, combining a comprehensive literature review with case analysis to examine the applications and regulatory landscape of drones and unmanned aerial vehicles. In Nigeria, the regulation of drones falls primarily under the purview of the Nigerian Civil Aviation Authority, which published its Remotely Piloted Aircraft Systems framework. While these regulations aim to ensure safety, national security, and airspace control, stakeholders have raised concerns about bureaucratic bottlenecks, limited enforcement capacity, and low awareness among users. Five research questions and five corresponding hypotheses guided the conduct of the study. A researcher designed questionnaire was used to collect data. The instrument was validated by two experts in Measurement and Evaluation in the Department of Educational Psychology, Guidance and Counselling, Ignatius Ajuru University of Education, Port Harcourt. The reliability of the instrument was established through test re-test method. The reliability indices obtained were; PSV(r = 0.86), DA (r = 0.75) and MI (r = 0.96). Pearson Product Moment Correlation (PPMC) was used to answer and test the research questions and hypotheses. The results of the analyses of the hypotheses were tested for statistical significance at .05 alpha levels. This study examines the current regulatory frameworks across various regions, identifying gaps and challenges in enforcement, airspace management, and safety protocols. By analyzing both the opportunities and risks associated with UAV deployment, the study underscores the urgent need for adaptive, comprehensive, and globally harmonized policies to ensure the responsible integration of drones into Nigeria and modern society.

Keyworlds: *Drones, Unmanned Aerial Vehicles, Applications, Airspace management, Surveillance, Civil aviation, Technology policy, Safety standards.*

Introduction

In recent years, drones and unmanned aerial vehicles (UAVs) have rapidly transitioned from niche military tools to mainstream assets across a wide array of industries. From agriculture and infrastructure inspection to filmmaking, logistics, and emergency response, these aerial technologies have revolutionized how data is collected, tasks are performed, and services are delivered. Their growing versatility and affordability have fueled global interest and adoption.

However, this technological boom also brings with it significant regulatory challenges. Ensuring safety, privacy, airspace integration, and ethical usage has become a pressing concern for governments and international bodies. As UAV applications expand, the need for coherent, adaptive, and enforceable regulations becomes increasingly urgent.

The proliferation of Unmanned Aerial Vehicles (UAVs), commonly known as drones, has significantly transformed operations across multiple sectors globally. From their early military applications, drones have evolved into vital tools in civilian domains such as agriculture, logistics, disaster management, environmental monitoring, and security. Their ability to access difficult terrains, gather real-time data, and operate with high efficiency makes them indispensable in contemporary technological ecosystems (Austin, 2010; Zhang & Kovacs, 2012).

In Africa, and Nigeria in particular, the adoption of drone technology is steadily increasing. Driven by the need for improved service delivery, surveillance, and infrastructure monitoring, both public and private institutions have begun to explore the potential of UAVs. For instance, drone-based solutions are being utilized for crop monitoring in precision agriculture, aerial mapping for urban planning, and even delivery of medical supplies to remote communities (Nkwunonwo et al., 2021).

However, the rapid diffusion of UAVs has also introduced complex regulatory, legal, and ethical challenges. In Nigeria, the regulation of drones falls primarily under the purview of the Nigerian Civil Aviation Authority (NCAA), which they published its Remotely Piloted Aircraft Systems (RPAS) framework in 2016. While these regulations aim to ensure safety, national security, and airspace control, stakeholders have raised concerns about bureaucratic bottlenecks, limited enforcement capacity, and low awareness among users (Adoga & Oyewole, 2019).

This study examines the current applications of drones in Nigeria and critically explores the regulatory framework governing their use. By analyzing how UAVs are being deployed across different sectors and how existing laws impact their adoption, the study offers insights into opportunities and barriers within the Nigerian context. The paper also discusses potential policy reforms needed to balance innovation with national interest and public safety.

This article explores the evolving landscape of drone applications, examines the regulatory frameworks in Nigeria governing their use across different regions, and considers the balance between innovation and oversight in shaping the future of unmanned flight.

Purpose of the Study

The purpose of this study is to explore the current applications, benefits, and regulatory challenges associated with the use of drones and unmanned aerial vehicles (UAVs) in Nigeria. As drone technology becomes increasingly vital across sectors such as agriculture, security, logistics, and disaster management, there is a growing need to understand how this technology is being adopted within the Nigerian context. This research examines how drones are currently being utilized, assess the effectiveness of existing regulatory frameworks, and identify gaps or areas for policy improvement. By focusing on Nigeria, the study seeks to provide insights that can inform national policy, promote safe and innovative drone usage, and contribute to the global discourse on UAV integration in developing countries.

Population of the Study

The population of the study consists of stakeholders involved in the development, deployment, regulation, and usage of drones and unmanned aerial vehicles (UAVs) across various sectors. These include: (i) **Government and Regulatory Bodies**; Agencies such as the Federal Aviation Administration (FAA), European Union Aviation Safety Agency (EASA), and national civil aviation authorities, which are responsible for formulating and enforcing drone-related laws and policies. (ii) **Commercial Operators and Companies**; Organization's and business that utilize UAVs for commercial purposes including logistics companies (e;g, Amazon Prime Air), agricultural firms using precision farming, construction firms conducting site inspections, and media/film industries employing drones for aerial footage. (iii) **Drone Manufacturers and Technology Developers:** Companies involved in the design, production, and innovation of drone technologies, ranging from consumers grade to advanced UAV systems for industrial and defense use. (iv) **Research Institutions and Academia:** Scholars and researchers studying the technological, environmental, legal, and societal impacts of UAVs. (v) **End Users and Civil Society:** individuals and organizations who operate drones recreationally, for community initiatives (e.g. search and rescue), or civil society advocacy (e.g., environmental monitoring). (vi) **Legal Experts and Policymakers**: Professionals involved in creating, interpreting, or advising on drone laws, privacy policies, and airspace safety regulations. This diverse population will ensure comprehensive multi-dimensional view of the UAV landscape.

Research Questions

1. To what extent does the primary application of drones and UAVs across different sectors in Nigeria?
2. To what extent does the drone improving operational performance in their respective application areas in Nigeria?
3. To what extent does the key regulatory challenges associated with drone use in Nigeria?
4. To what extent does users and the general public perceive the use of drones in civilian and commercial contexts?

5. To what extent does a current regulation adequately address the risks and benefits of drone use in Nigeria?

Hypotheses

1. There is no significant relationship between primary application of drones and UAVs across different sectors in Nigeria
2. There is no significant relationship between drones improving operational performance in their respective application areas in Nigeria?
3. There is no significant relationship between the key regulatory challenges associated with drone use in Nigeria?
4. There is no significant relationship between users and the general public perceives the use of drones in civilian and commercial contexts
5. There is no significant relationship between current regulations adequately address the risks and benefits of drone use in Nigeria.

Research Question One

To what extent does the primary application of drones and UAVs across different sectors in Nigeria?

Hypothesis One

There is no significant relationship between primary application of drones and UAVs across different sectors in Nigeria.

Table 1.1: PPMC Analysis on the Relationship between Primary Application of Drones and UAVs across different sectors in Nigeria

Variables	Parameters	Primary Application of Drones and UVAs	Across different sectors in Nigeria	Decision
Primary Application of Drones and UVAs	Pearson Correlation	1	.649**	
	Sig. (2-tailed)		.000	Significant
	N	450	450	
Across different sectors in Nigeria	Pearson Correlation	.649**	1	
	Sig. (2-tailed)	.000		
	N	450	450	

**. Correlation is significant at the 0.01 level (2-tailed).

The result on Table 1.1 shows the answer to research question one. Table 1.1 shows the extent to which Primary Application of Drones and UAVs across different sectors in Nigeria

The result revealed that the extent to which the Primary Application of Drones and UAVs across different sectors in Nigeria was high and positive (r = .65). The implication of this result was that as scores on Primary Application of Drones and UAVs across different sectors in Nigeria correspondingly increase highly and vice versa.

Also, Table 1.1 shows the significant level of the relationship between Primary Application of Drones and UAVs across different sectors in Nigeria.

The result revealed that there was a significant ($r_{(450)}$ = .65, $p < 0.05$) relationship hence the corresponding null hypothesis was rejected. The result was that there was a significant relationship between Primary Application of Drones and UAVs across different sectors in Nigeria.

Research Question Two

To what extent does the drone improving operational performance in their respective application areas in Nigeria?

Hypothesis Two

There is no significant relationship between drones improving operational performance in their respective application areas in Nigeria?

Table 1.2: PPMC Analysis on the Relationship between Drones Improving Operational Performance in their respective Application Areas in Nigeria

Variables	Parameters	Drones Improving Religious Affiliation	Application Areas	Decision
Drones Improving	Pearson Correlation	1	.621**	
	Sig. (2-tailed)		.000	Significant
	N	450	450	
Application Areas	Pearson Correlation	.621**	1	
	Sig. (2-tailed)	.000		
	N	450	450	

**. Correlation is significant at the 0.01 level (2-tailed).

In answering research question seven, Table 1.2 shows the extent to which drones improving operational performance in their respective application areas in Nigeria. The result revealed that the extent to which drones improving operational performance in their respective application areas in Nigeria was positive and high (r = .62). The implication of this result was that drones improving operational performance in their respective application areas in Nigeria and vice versa.

In testing null hypothesis two, Table 1.2 shows the significant level of the relationship between drones improving operational performance in their respective application areas in Nigeria. The result revealed that there was a significant ($r_{(450)}$ = .62, p < 0.05) relationship, therefore the stated null hypothesis was not accepted. This means that there was a significant relationship between drones improving operational performance in their respective application areas in Nigeria.

Research Question Three

To what extent does the key regulatory challenges associated with drone use in Nigeria?

Hypothesis Three

There is no significant relationship between the key regulatory challenges associated with drone use in Nigeria

Table 1.3: PPMC Analysis on the Relationship between the key regulatory challenges associated with drone use in Nigeria?

Variables	Parameters	key regulatory challenges	Drone use in Nigeria	Decision
key regulatory challenges	Pearson Correlation	1	.843**	
	Sig. (2-tailed)		.000	Significant
	N	450	450	
Drone use in Nigeria	Pearson Correlation	.843**	1	
	Sig. (2-tailed)	.000		
	N	450	450	

**. Correlation is significant at the 0.01 level (2-tailed).

Table 1.3 shows the extent to which key regulatory challenges associated with drone use in Nigeria. The result revealed that the extent to which key regulatory challenges associated with drone use in Nigeria was positive and very high (r = .84). This means that as key regulatory challenges scores increases very highly that of drone use in Nigeria correspondingly increase very highly and vice versa.

Furthermore, on statistical testing of hypothesis eight, Table 1.3 shows that the positive and very high relationship was statistically significant ($r_{(450)}$ = .84, p < 0.05). Hence, the stated corresponding null hypothesis was not accepted. The result was that there was a significant relationship between key regulatory challenges associated with drone use in Nigeria.

Research Question Four

To what extent does users and the general public perceive the use of drones in civilian and commercial contexts?

Hypothesis Four

There is no significant relationship between users and the general public perceives the use of drones in civilian and commercial contexts

Table 1.4: PPMC Analysis on the Relationship between Users and the General Public perceives the use of Drones in Civilian and Commercial contexts.

Variables	Parameters	Users and the General Public	use of drones in civilian and commercial contexts	Decision
Users and the General Public	Pearson Correlation	1	.892**	
	Sig. (2-tailed)		.000	Significant
	N	450	450	
use of drones in civilian and commercial contexts	Pearson Correlation	.892**	1	
	Sig. (2-tailed)	.000		
	N	450	450	

**. Correlation is significant at the 0.01 level (2-tailed).

Table 1.4 reveals the extent to which users and the general public perceives the use of drones in civilian and commercial contexts in Nigeria. The result showed that the extent to which users and the general public perceives the use of drones in civilian and commercial contexts in Nigeria was positive and very high (r = .89). This means that as users and the general public score increase very highly that of use of drones in civilian and commercial context in Nigeria also increase very highly and vice versa.

On further statistical testing of the null hypothesis nine, the result on Table 1.4 shows a significant relationship ($r_{(450)} = .89$, $p < 0.05$) between users and the general public perceives the use of drones in civilian and commercial contexts in Nigeria. Consequently, the stated null hypothesis was not accepted. This means that, there was a significant relationship between users and the general public perceives the use of drones in civilian and commercial contexts in Nigeria.

Research Question Five

To what extent does a current regulation adequately address the risks and benefits of drone use in Nigeria?

Hypothesis Five

There is no significant relationship between current regulations adequately address the risks and benefits of drone use in Nigeria.

Table 1.5: PPMC Analysis on the Relationship between current regulation adequately address the risks and benefits of drone use in Nigeria

Variables	Parameters	Current Regulation	address the risks and benefits of drone use	Decision
Current Regulation	Pearson Correlation	1	.810**	
	Sig. (2-tailed)		.000	Significant
	N	449	449	
Address the risks and benefits of drone use	Pearson Correlation	.810**	1	
	Sig. (2-tailed)	.000		
	N	449	450	

**. Correlation is significant at the 0.01 level (2-tailed).

Table 1.5 shows the extent to which current regulations adequately address the risks and benefits of drone use in Nigeria. The result revealed that the extent to which current regulations adequately address the risks and benefits of drone use in Nigeria was positive and very high (r = .81). The

implication of this result was that current regulations scores increases very highly with a corresponding very high increase scores of adequately address the risks and benefits of drone use in Nigeria and vice versa.

The results also on Table 1.5 shows that there was a significant ($r_{(450)} = .81$, $p < 0.05$), relationship between current regulations adequately address the risks and benefits of drone use in Nigeria, leading to the rejection of null hypothesis ten at the .05 significance level. The implication of the result was that there was a significant relationship between current regulations adequately addressing the risks and benefits of drone use in Nigeria.

4.2 Summary of Findings

The major findings of the study are presented thus:

1. There was a positive and significant relationship between primary application of drones and UAVs across different sectors in Nigeria
2. There was a positive and significant relationship between drones improving operational performance in their respective application areas in Nigeria?
3. There was a positive and significant relationship between key regulatory challenges associated with drone use in Nigeria?
4. There was a positive and significant relationship between users and the general public perceives the use of drones in civilian and commercial contexts
5. There was a positive and significant relationship between current regulations adequately addressing the risks and benefits of drone use in Nigeria.

Discussion and Findings

The integration of drones and unmanned aerial vehicles (UAVs) into civilian and commercial airspace in Nigeria has significantly transformed various sectors. From agriculture and infrastructure inspection to disaster management and logistics, UAVs have demonstrated high utility, efficiency, and cost-effectiveness. However, the rapid pace of adoption has outstripped regulatory development in many regions, creating gaps in policy, enforcement, and safety frameworks.

One of the key findings is that applications of UAVs are growing exponentially. In agriculture, drones are optimizing crop monitoring and pesticide spraying. In the energy and construction industries, they enable safer, real-time inspections. In public safety, drones aid in search and rescue missions, fire monitoring, and surveillance.

However, the regulatory landscape remains fragmented. Countries have varying approaches to licensing, no-fly zones, altitude restrictions, and data privacy. This lack of harmonization poses challenges for cross-border drone operations and hinders innovation. For instance, while some nations like the U.S. and Australia have clear operational guidelines and pilot certification programs, others still lack comprehensive frameworks.

Furthermore, the study found that privacy and security concerns are prominent among the public. Unauthorized surveillance, data breaches, and the potential for malicious use (e.g., smuggling or terrorism) are significant issues that must be addressed. Technological solutions such as geofencing, remote ID systems, and improved tracking mechanisms are emerging as key regulatory tools.

Finally, there is a pressing need for collaboration between governments, private industry, and civil society. Multi-stakeholder dialogue is essential for developing adaptable, future-proof regulations that balance innovation with safety, privacy, and public interest.

Conclusion

The rapid advancement of drone and unmanned aerial vehicle (UAV) technology has significantly transformed industries and reshaped the possibilities of modern operations. From agriculture and infrastructure inspection to disaster response and delivery services, drones have proven to be powerful tools that enhance efficiency, safety, and data collection. As their applications continue to grow, so too does the need for comprehensive and adaptable regulatory frameworks.

Striking a balance between innovation and public interest is crucial. Regulations must address safety, privacy, airspace management, and security without stifling technological progress. International collaboration, consistent policies, and evolving standards are essential to support both commercial growth and responsible usage.

Ultimately, the future of UAVs depends on ongoing dialogue between developers, regulators, and the public. With thoughtful governance and technological stewardship, drones can continue to unlock new opportunities while maintaining the trust and safety of the communities they serve.

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