Original Research Article

An Evaluation of Digital Addressing System Implementation in Ghana

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ABSTRACT

Purpose: The research reviews the implementation of Ghana's Digital Addressing System. Nearly six years into implementation and without an outward appearance of the meeting of the announced goals of the project, the research sets out to find out the likelihood of success or failure of the project and suggest remedial measures.
Relevance: The implementation of digital addressing in Ghana holds and demonstrates promise for benefits relative to transportation, courier services, taxation, property ownership and title, among others. For policy makers, the findings of this work give direct pointers to what needs to be done to keep the concept useful. For researchers, the work has only opened the doors for further academic and technical introspection into digital addressing and its nuances especially in Ghana.
Methods: Using a variety of quantitative and qualitative techniques the study assessed the implementation of the policy employing interviews, surveys, workshops and group discussion. It hinged on the Design-Reality Gap (DRG) model to identify the issues of interest with Ghana's digital addressing systems.
Findings: We found out that the attempts, although well intended, fall short in several best practice aspects. The research found it difficult to confidently showcase any immediate successes arising out of the implementation of the GhanaPostGPS App and System and proceeds to point out specific areas in need of attention if Ghana's Digital Addressing efforts are to meet the presumptive goals.
Conclusion: The Digital Addressing System might be a partial failure unless action is taken to close design-reality gaps.

Keywords: Design Reality Gap, digital addressing system, Ghana, developing country, GhanaPostGPS

1. INTRODUCTION

The traditional method of giving directions using prominent landmarks and physical features of a location has become outdated in modern times [1,2]. The development of various types of addressing systems has led to the use of digital addressing systems becoming the morecommon means for obtaining location data. The term "land address" refers to the positional information of a piece of land on a map, used to relate individuals and locations [2,3]. In modern societies, the digital address system has become more useful than other descriptive systems like personal identification numbers, house numbers, or telephone numbers. The need for improvement in location addressing systems is apparent due to constantly shifting landmarks and misunderstood instructions. Ghana has implemented a Digital Addressing System (DAS) in collaboration with various bodies; private and public, to digitize its addressing system [4, 5]. The deployedDigital Address System (DAS) uses a grid of 5m x 5m squares to assign each square a unique digital address comprising geographical identifiers and a numerical address generated at the backend [6]. The GhanaPostGPS mobile app serves as the user interface, and an open API provided by the DAS enables third-party developers to integrate with the system to facilitate transactions. [7]Emergency service providers like the National Ambulance Service benefit from the DAS, with plans to embed the digital addressing system in their ambulances to improve services. The DAS's

open API is a critical feature that Ghanaian businesses can use to integrate and utilize the digital addressing system [7].

This paper seeks to evaluate the implementation of the DAS, so far. The evaluation is intended to draw the attention of policy makers and implementers to the issues of survival and usability of the system with the view of making specific recommendations that would enhance the chances of success of the system. Following the recommendations will significantly reduce the actual outcomes of the design and the desired outcomes.

1.1 TheNeed to Evaluate Ghana's DAS

The Digital Addressing System in Ghana has potential benefits for property and location identification. However, users have not fully realized its benefits, and duty bearers have not announced concrete improvements or future plans [8]. The paper proposes using the Design Reality Gap framework to assess the gains and progress of GhanaPostGPS and DAS policy and estimate likely outcomes from the perspective of stakeholders.

1.2 Ghana's Addressing System and the Challenge

Spatial planning and official addressing in Ghana have a long history dating back to the 1940s when the Town and Country Planning Board (TCPB) was established to number houses and properties, mostly in resource and population-rich areas. However, vast areas of the country remained unidentified, leading to disjointed and counterproductive developments. Some development partners attempted to fill the gap, such as the Vitamin A Supplement Trials (VAST) project, which created a custom house numbering system in the Kassena Nankana District for research and intervention purposes. However, new structures that emerged after this exercise remained unidentified or numbered inconsistently [1, 13, 24, 30]. Special house numbering schemes were implemented in some towns for government housing schemes, such as the Junior Staff Quarters in Yendi, where structures were serially numbered JSQ 1, JSQ 2, etc., without separate numbering for semi-detached buildings. However, the identification numbering system has become disorderly due to the emergence of previously unidentified properties and structures. "I was directed to SAK 21 in Nayagnia in Navrongo, I could clearly see the house numbers on the walls and followed them serially but suddenly saw SAK 21 between SAK11 AND SAK12." Resp 2

In this instance, the entity of interest was built after the initial numbering of houses but numbered in an attempt to continue the serialisation.

To circumvent these, citizens would resort to the use of landmarks, shops, "containers" or any easily recognisable body as a point of reference. But this also is fraught with challenges especially when notable entities are movable.

1.3 The Proposed Solution: Digital Land-Addressing System

To improve the addressing system in Ghana, the government of Ghana opted in 2017, to go in search of a digital solution. The solution would map land and thus the structure, if any, on it. The decision led to the development of the GhanaPostGPS. The GhanaPostGPS is, on the surface, a proprietary user interface that depends almost solely on Google's freely available Google Maps engine making it dependent on data and infrastructure accessed through Google's API.

The Ghanaian app was co-developed by Vokakom, an IT firm, and Ghana Post, with Google's assistance in solving the challenge of satellite feed ownership [4]. This model has also been adopted by Navajo and Nepal, who utilized the Open Location Code by Google to provide a street-marking and property identification solution [12, 13]. In La Cote d'Ivoire, the government partnered with the UNDP to create the Système National d'Adressage, which aims to provide standardized addresses for every 3 meter x 3 meter square foot area [14]. This digital addressing system was launched in 2019.

The Système National d'Adressage (SNA) employs a combination of satellite imagery, GPS technology, and mapping software to generate a comprehensive database of addresses and

assigns a unique 16-digit code to each property. The code includes data on the location, building number, and street name, and is designed to assist emergency services, delivery firms, and other organizations in rapidly locating properties [15,16]. The SNA also incorporates What3words technology, which employs a combination of three words to identify precise locations worldwide. For example, the entrance to the St. Paul's Cathedral in Abidjan is designated as "splendide.manger.corniche" within the larger 16-digit code that includes location information, providing a standardized, precise, and easily memorable way of identifying locations, which can be especially useful in regions lacking conventional street addresses [11].

The Nigerian government launched the Nigeria Digital Addressing System (NDAS) in 2018, with the aim of covering every property in the country, both residential and commercial. The system is expected to improve service delivery, emergency response, and promote economic growth. However, adoption and usage by individuals and businesses remain low and require further awareness campaigns to encourage more people to use the system [17,18]. Like the Ivorian SNA, NDAS employs geospatial technology and imagery to assign a unique 10-digit code to each property. The code includes information on the property's location, street name, and building number. For instance, "1400010040" represents a property in the Garki district of Abuja, located in the FCT region of Nigeria. The first four digits correspond to the region, the next four digits correspond to the area or district within the region, and the final two digits represent the building or property number within the area or district.

1.4 **Evaluation of DAS Policy**

Numerous evaluation methods exist for assessing the effectiveness of government policies [4,11 ,19]. These evaluations can be prospective, carried out before policy implementation, or retrospective, conducted after policy implementation [1,9,20]. Prospective evaluations are based on estimations of outcomes and alignment of objectives, written goals, and action plans accompanying the policy. Retrospective evaluations, on the other hand, assess actual outcomes and propose further steps and recommendations towards the attainment of policy goals. The purpose of these evaluations is to determine what works and what does not in policy design and implementation. To reduce the possibility of subjectivity, it is crucial to ground evaluations in theory. However, some schools of thought caution that the perception of failure or success is subjective and reliant on the stance of the evaluator and timing of evaluations, particularly without using a theory [4,10]. This document performs an ex-post evaluation of the Ghana government's Digital Addressing System using the Design-Reality Gap (DRG) framework, which is considered fitting for purpose based on research goals [10,21,22,23,24]

1.5 **The Design-Reality Gap**

The DRG model is one of few well known and tested frameworks designed to empirically quantify the probability of success or failure of aninformation system or policy and is often used to evaluate public funded or initiated projects, including government interventions and policy documents [6,24,25,26,27].

Despite its usefulness, the Design-Reality Gap framework has been criticized for not paying enough attention to the root causes of gaps that lead to failure [22]. The framework places a high value on quantifying its findings, which may be the reason behind this issue. To mitigate this challenge, this research conducted interviews with stakeholders to gather qualitative data.The underlying principle of the DRG framework is that there is a gap between the design requirements and implementation for all ICT projects [23]. The gap's size determines project success or failure and is evaluated across seven dimensions (see Table 1) using a numerical rating scale from 0 to 10. The framework has been applied globally, and weights

can be assigned to dimensions to determine gap depth [7, 16, 24]. However, some critics argue that the framework does not address the reasons for gaps and puts too much emphasis on quantifying findings, which this research aims to mitigate by using qualitative data from stakeholder interviews.

Table 1: A description of the seven DRG dimensions

DRG Dimensions		Constituent Features
1	Information	Stakeholder Information needs, usage, sources, flow
2	Technology	ICT equipment: hardware, software databases and supporting infrastructure
3	Processes	Institutional processes necessary for the successful implementation of the project
4	Objectives and Values	What was the objective of establishing the Policy? What are the relevant political issues? The national context; Socio-cultural values of citizens
5	Staffing and Skills	Adequacy of personnel with technical and managerial skills
6	Management Systems and Structures	Policy document ownership and implementation, reporting structures
7	Other Resources: time and money	Availability of time, financial and other resources such as political will.

According to [21,22], the dimensions for evaluating design-reality gaps can be built in several ways which include:

- **Theoretically**, based on information systems literature.
- **Descriptively**, based on straightforward delineation of components of an information system and
- **Analytically**, based on case studies.

The DRG framework's flexibility and adaptability were appealing to the researchers. The framework enables the identification of dimensions of design and reality within a specific context by analyzing policy documents, publications, and statements of policymakers for the former and conducting interviews with beneficiaries and stakeholders for the latter. The discrepancies between design and reality are referred to as "performance gaps," which are associated with incomplete goal realization. While some duty bearers acknowledged deviations from planned elements, no remedial measures had been taken. This could be because the policy document's perspective differs from that of citizens. The DRG framework does not guide such possible mismatches. As a remedy, the study considered two options:

i) propose and test an extension to the framework and
ii) adapt an existing extension of the framework [20,25,28]

[13,14,19] extended the framework with two additional types of gaps which are dimensional and elemental gaps. Their extended framework adapted in this research.

Dimensional Gaps may be identified by sourcing the perspectives from relevant stakeholders;

- the dimensions of *design, in this case,* are derived from a study of the policy and related documents, supplemented by interviews with public officials
- the dimensions of *reality are* derived from interviews with citizens

Elemental Gaps may be identified by breaking down each dimension into measurable units. Since the elements of each dimension of *design* and *reality* are derived from two different perspectives, any differences in the elements of the *design* and *reality* dimension will depict elemental gaps.

2. Methodology

The study employed multiple tools in the form of interviews, surveys, and workshops using both quantitative and qualitative methods to obtain a combination of primary and secondary data.

2.1 Data Collection and Tools

In this study, primary data was collected from stakeholders who were purposefully sampled due to their information-rich status. The data collected was used to identify the gaps between reality and the ideal state. In addition to the stakeholder responses, publicly available documentary evidence from various sources was obtained to supplement the interview data. A workshop involving six academicians helped to assign weights to the dimensions and numerically describe perceived gaps in the subdimensions. Potential direct users were also interviewed, either purposefully targeted or randomly selected. Overall, 256 individuals were reached out to for their perspective during the 12-month study period. The 22 members of the public who were interviewed along the streets near their homes are referred to as Resp 1, Resp 2, and so on in the research. During the research period, a team member did a survey using 187 students from a public university. Table 2 shows the breakdown of the informants who helped to shape the outcome of the research with their feedback.

Table 2. Interviews and Role of Interviewees

Stakeholders Interviewed	Profile	Content of Interviews	Number Interviewed
Courier Delivery Service Workers	Potential Repeat User of DAS App	Application of DAS for locating clients	38
University Librarians	Potential users of the app with research thinking	Awareness of DAS, Use for DAS, Knowledge of technicalities, Hardcopy availability policy in libraries	2
University Lecturers	Potential users of the app with research thinking	Use for DAS, Knowledge of technicalities, Use for DAS, Assignment of weights to dimensions and subdimensions	4
Bank Staff	Potential Repeat User of DAS App	Use of DAS for KYC purposes	3

Stakeholders Interviewed	Profile	Content of Interviews	Number Interviewed
Chief's Secretary	Potential Repeat User of DAS App	Use for DAS for land leasing and registration purposes	1
DAS Developers	Persons with an in-depth understanding of inner workings of the app	To understand the technical thinking behind some components of the DAS	2
Ambulance Service	Potential Repeat User of DAS App	To gain an understanding of the use of the application for Emergency Services	3
Techpreneuers	Potential Repeat User of DAS App with understanding of technology in general	Use for DAS, Assignment of weights to dimensions and subdimensions	3
Students	Young adults with the propensity to explore digital tools such as the GhanaPostGPS app	Through surveys; Awareness of DAS, Use for everyday activities	187
Random Members of the Public	Tenants and landlords whose homes had been labelled by the DAS Project	Awareness of DAS, Use for everyday activities	22

2.2 Application of the Design Reality Gap Framework Using Weighted Averages

The DRG, as aforementioned, is used based on scores assigned to the various dimensions. It does not come with preformatted weights giving way for researchers independently assign weights based on context and environment. To assign weights and score dimensions, researchers, consulted with some key stakeholders; private sector ICT players

(techpreneurs), and academics to place weights of between ordinary (value of 1) and very important (value of 3) to the respective dimensions, following [24,29] recommendations. Table 3 shows the assigned weights obtained as a result of these steps. To help make findings and discussions more discreet, the research broke the DRG domains into subdomains. Given that each domain could potentially have an endless list of subdomains, the research, based on experience of the team, literature, and internal discussions, opted to break down each domain into the 'most relevant' 3 to 5 subdomains.

Table 3: Assigned Weights of Dimensions obtained from stakeholder engagement

	Dimension	Weight
1	Information	2
2	Technology	3
3	Process	2
4	Objectives and Values	1
5	Citizens and Skills	3
6	Management Systems and Structure	2
7	Other Resources	2

The same stakeholders identified above assessed each domain, subdomain by subdomain and assigned a score based on their experience and perception. The averages are used as the sub-dimension scores. The result is in Table 4 and Appendix, which also includes the assigned weights and gap scores of each subdomain.

3. Results and discussion

The DRG serves as a framework for the research, which made its findings from the ad hoc surveys, secondary research, interviews, and deductions.

3.1 Information

There was no policy document or parliamentary bill available on the Digital Addressing System in Ghana. The researchers found the GhanaPostGPS website to be the closest to a policy document, offering some insight into the intentions of the system. However, the website was not accessible to those with impairments and lacked an official translation into other languages. The researchers also examined public personalities' comments, particularly those made by Ghana's vice president, Dr. Mahamudu Bawumia, who championed the cause. To gauge the public's knowledge of the system, the team randomly surveyed 187 tertiary students, of whom only 17 (9%) had used GhanaPostGPS in the past month. The average gap score for the Information dimension, which included subdimensions such as Availability of Hardcopies and Availability in different formats for different audiences, was 7.17, with individual subdimension gap scores ranging from 3 to 10.

3.2 Technology

Ghana's Digital Address System has three technology sub-dimensions: Software, Hardware, and Networks. The user interface is based on Google Maps, accessible on Google Play and App Store. Hardware requirements are the same as internet access, which has a 53% penetration rate. However, interviewees identified an 11 gap score in the Hardware sub-

dimension, indicating a need for improvement. Networks sub-dimension scored 2.33 with a 3.0 gap score. The software sub-dimension scored an average gap score of 3.0 for the Technology dimension [5,7,30].

3.3Objectives and Values

As posited earlier, the research could not find any documented policy on the DAS in Ghana. Researchers will have to rely on text from the GhanaPostGPS website and the pronouncements made by the sector minister, vice president, and other public officials within the sector. We obtained a gap score of 3 for the **Citizen's awareness of the Policy** subdomain. The team proceeded to substitute the collection of statements and static content on the app's website with the absent policy. We, therefore, used the current rates of use complemented with the responses by some citizens who were interviewed to gauge the level of **Citizens' acceptance of the policy**, a score of 5.00 was awarded. One group of people expected to be active users of the GhanaPost GPS app would be delivery persons. Of the 38 delivery persons randomly interviewed in Bolga, Tamale, Ho, and Accra, only 4 (10%) said they actively used the GhanaPostGPS.

The last subdomain considered was **Citizen's involvement in the formulation of Policy**. Unlike previous digital strategy documents such as the ICT4AD policy [8,21,31] which involved ground up consultations and a series of iterations, the DAS was basically implemented by an announcement.

"The whole process has been shrouded in secrecy. There was no white paper laid, no consultations with industry players… we don't even know how the supplier was selected" - Resp 13

The research assigned an average score of 5.11 to the objectives and values dimension.

3.4Management Systems and Structure

The management Systems and Structure dimension was given a weight of 2 and holistically studied from the angles of its subdimensions:

- Policy adapted to Ghanaian context (1.33)
- Strong monitoring and evaluation of policy implementation (7.33)
- Monitoring and Evaluation lead to appropriate policy modifications (7.33)
- Availability of local content (2.33)
- Feasibility of timelines (5.33)

> The only challenge a few of us have with Ghana's current Digitisation Agenda is the consistent disconnect between the big picture and the path to getting us to it. Most of us can agree on how technology can transform this country. [1,4, 16, 19,32]

Whereas the paper cannot say the DAS policy was adapted to the Ghanaian context because there was no policy in the first place, we can say the developers of the system moderately took into consideration, the Ghanaian context by assigning unique labels to regions and districts thus making addresses somewhat easy to understand. Unfortunately, however, the application largely fails to take cognisance of existing street names and arbitrarily assigns new street names and nomenclature.

> "Here in Paga, virtually everybody's house is on Kajelo Street per your app. We don't see any of the accepted street names on any of their license plates[1]" Resp 2

Similar comments were observed across the country, for example, a respondent from Agordorme in Ho, Volta Region had this to say,

[1] Property Addresses generated from the DAS were printed on plates and affixed to some structures and properties across the country for use by citizens. The similarity with vehicle number plates got some citizens referring to them as such.

"See, I have always known the street in front of my home as Lolornyo Street, these people now say I am on Pineapple Street whereas the house directly opposite mine is on Maple Street. " Resp 3

Experiences and responses similar to Resp 2 and 3's were the commonest (15 out of 22) of all interviewed persons on the street naming part of the research. Response through any existing monitoring and evaluation mechanism seems weak, however. After a series of complaints to local authorities, some stickers were printed and pasted over the arbitrary street names assigned to properties in some towns. There is no evidence though that these names have been updated in the DAS user interface itself.

The average gap score under this dimension worked out to 9.47.

3.5Process

The process here focuses on the steps leading to the ideation, design, and implementation of the DAS in Ghana. Researchers concluded on a weight of 2 and studied the dimension based on its sub-dimensions of Internal Audit (gap score of 6.6), Monitoring (gap score of 7.33), Evaluation (gap score of 7), and General To ensure the success of a public sector project, the government should seek professional input, and engage in open and transparent debate to inform budget and value for money arguments, as encouraged by the Public Procurement Law [8, 27,33]. The UK's Open Banking initiative involves contributions from all stakeholders, similar to Ghana's Digital Addressing System (DAS) [7, 21]. The Bank of Ghana plans to launch a Central Bank Digital Currency, but no public whitepaper outlines essential details, such as node operator eligibility, membership criteria, and consensus protocol design [15,28,34]. The GhanaPostGPS app includes buttons to improve emergency services, in addition to property location. However, it is unclear if this feature ever worked, as an informant from the Ambulance Service confirmed that the app did not work for emergency services during the time of the research team's interview. Staff and Skills

The title of this Dimension is appropriately edited to Citizens and Skills. We study this dimension under the sub-dimensions of; ICT skills of citizens, Available avenues for ICT Capacity Building, and Willingness of citizens to accept.

Ghana has a high rate of smartphone usage giving a basis for this paper to posit that Ghana is a relatively mobile technology-savvy population. Thirteen of the 19 app users (17 students and 2 delivery persons) surveyed said they did not need any support from third parties during installation.

"Initially, I faced a few challenges because the OTP[2] was not coming. I knew it was network challenge so I just waited. The next day it worked on the first attempt" Resp 2

A majority of the surveyed respondents (69%) indicated willingness and interest in using the app but indicated that the presence of more convenient competing apps such as Google Maps which are also integrated into their smartphones made it a non-critical option. An overwhelming 75.82% [35] of Ghanaian smartphone users are android users and have free access to the more user-friendly google maps app. There are other users- -friendly apps such as Apple Maps which are installed by default on mobile devices. The GhanaPostGPS will need to be feature-rich to attract exponential growth in usage.

"If they consider adding more features that will bring us frequently to the app, maybe we will use it more. They have tried to include an emergency button butyou and I know we don't do emergencies every day. Two, it doesn't even work. What if they include a feature that alerts users of breaking news etc" Resp 5

"Me, like I will like to use that but all the customers are sending me their locations through WhatsApp. I can't force them to use the GhanaPost one" Resp 9

[2]OTP means One Time Password: a temporary, secure PIN-code sent to customers via SMS or e-mail usually valid only for one session.

"I tried using the GhanaPost app a few times, but it doesn't load fast like google maps" Resp 10

Another group of citizens whose work would have been made easier by the development of the app is the banks. As part of Know-Your-Customer (KYC), banks have traditionally asked for directions to people's homes (including landmarks) in addition to requesting utility bills for homes of prospective account owners. The vice president in launching the GhanaPostGPS app announced that "No more reliance on 'blue kiosk,' the 'waakye' seller, the 'Kofi brokeman' seller and 'that big tree at the junction,' as reference points for giving out locations." [36]. The indication was that the app would make directions precise and permanent. Bank relationship managers, however, still take utility bills and paper sketches of maps to customers' homes.

"It's difficult to rely on the GhanaPost GPS addresses for several reasons. Currently, it is impossible to verify the addresses given. There is nothing tying them to the addresses given like the way utility bills do. Also, it is possible for the same customer to give you multiple addresses in multiple documents, and they will all be correct. Ideally, we would want customers to have unique addresses as much as possible" Resp 12

Gap scores for the sub-dimensions of ICT skills of citizens, Available avenues for ICT Capacity Building and Willingness of citizens to accept were computed at 3.33, 6.33 and 4.00 with a dimensional average score of 4.55.

3.6Other Resources

The seventh dimension of the DRG model is the availability of other resources. The subdimensions used are Political willingness, Availability of funds and Socio-cultural dynamics.

One major challenge in Ghana's general development is the willingness of the political class to follow through with initiatives. Depending on which political party is in power, different projects may be emphasised. The DAS at the moment enjoys very positive political backing (gap score of 1.43). This has, directly or indirectly, led to the Availability of funds (gap score of 2.86) of over $2.5million. There is not guarantee that the political will and availability of funds will continue in the event of a change in national leadership. The society is also socio-culturally ready (gap score of 4.05) except for the infrastructural issues raised by some respondents and captured in this paper. The overall gaps score for the dimension worked out to 2.78.

3.7DRG Scores

Table 4summarises the individual responses and aggregates the gap scores for each of the seven dimensions of the DRG leading to an overall weighted rating for the GhanaPostGPS at **27.06.** The details are shown in Appendix. The overall gap score is interpreted using the Likely Outcomes Table [24, 29] as shown in Table 5. Heeks suggests that an overall rating between 15 and 28 should be a cause for some concern. In such a situation, Heeks suggests that **the DAS Policy might be a partial failure unless action is taken to close design-reality gaps**. Of the seven dimensions of the DAS policy, the most likely causes of failure are the Information, Process and Objectives and Values Dimensions

Table 4: Overall ratings for Dimensions

	Dimension	Weight	Gap Score
1	Information	2	7.17
2	Technology	3	3.00
3	Process	2	6.89
4	Objectives and Values	1	5.11
5	Citizens and Skills	3	4.55
6	Management Systems and Structure	2	4.73
7	Other Resources	2	2.78

Overall Rating	27.06

Table 5: Likely Outcomes table (adapted from Heeks, 2002)

Overall Rating	Likely Outcomes
57 - 70	DAS Policy will almost certainly fail unless action is taken to close design-reality gaps
43 - 56	DAS Policy may well fail unless action is taken to close design-reality gaps
29 - 42	DAS Policy might fail, or might well be a partial failure unless action is taken to close design-reality gaps
15 - 28	DAS Policy might be a partial failure unless action is taken to close design-reality gaps
0 – 14	DAS Policy may well succeed

3.8Summary Discussion

The GhanaPostGPSDAS performed best under the Other Resources dimension, and this is largely under the wing of the massive political will to ensure success under no less and office than the office of the Vice President. The availability of funds at the policy conception helped to push it through the project development life cycle. On the other hand, the Technology and Process dimensions scored the highest deviations or gap scores indicating the final product is not as close to the initial plans as ideally thought. This also reflects the finding of a lack of a written policy to guide the future. The research found no evidence of broad stakeholder engagements prior to the announcement and implementation of this novelty. This leaves the DAS at an elevated risk of being abandoned if key personalities in the government agencies trusted with the management of the system change. The GhanaPostGPS app, which even at this stage is struggling to gain widespread credibility, may suffer discontinuity and ultimate failure if urgent steps as outlined in the recommendations herein are not considered.

4.0 Recommendations

The study and its findings have both policy and practical implications. One major implication the fact that it is difficult to confidently showcase any immediate successes arising out of the implementation of the GhanaPostGPS App and System. To reverse this and based on the findings of this research, the following recommendations are made.

4. 1 Recommendations for Policy

We proceed to suggest the following measures for consideration as possible gap closure measures to steer the policy to success:

- Review the DAS so far with particular attention to the weakest dimensions identified; Information, Process and Objectives and Values Dimensions
- Move from vertical policy implementation to a collaborative and inclusive review and redesign involving stakeholders to ensure a comprehensive policy is drawn to make room for more sustainable implementation. This should culminate in the writing of a policy document owned by a permanent state actor such as the Ministry of Communications
- Include other features in the app that would make users return frequently. This should take into consideration user-friendliness and the latest developments in technology
- Make available, the policy document, when written, in other formats such as braille, for different audiences. This should translate into the accessibility of the application to multiple audiences.

4.2 Recommendations for Practice

Given that the ultimate aim of the GhanaPostGPS app is for it to become an everyday tool, other actors such as banks and emergency services who might rely on it are urged integrate the tool as a matter of urgency with their existing location information systems.

Technpreneurs should latch onto the app and build or integrate its abilities into Ghanaian products for local services such as the burgeoning delivery and gig job industry.
We acknowledge the limitations of our study since it looks only at implementation very broadly. We recommend future piece-meal and more detailed research into the various domains of the DAS.

4.3 Recommendations for Further Research

Based on the experience and outcomes of this research, the paper envisages future works in at least three major areas of interest and invites other researchers to consider exploring these domains through extensive research. The areas include;

I. User Behavior and Adoption Patterns
The study will involve longitudinal studies to track user behavior and adoption patterns over time exploring factors that influence user acceptance, frequency and persistence

II. Contextual Factors and Socio-cultural Influences
This proposed work will investigate the role of contextual factors and socio-cultural influences in shaping the adoption and usage of digital addressing systems. Phenomena worth exploring include cultural norms, social networks and community dynamics and their influence on perceptions and attitudes.

III. Developer Perspectives and Integration Challenges
This work will focus on the perspectives and experiences of third-party application developers regarding the integration of GhanaPostGPS functionalities into their apps. Extensive interviews and cases studies will help investigate the technical, logistical, legal and economic challenges faced by developers in incorporating addressing system APIs and plugins into their software.

5. Conclusion

The paper set out to review efforts at digitizing the national addressing system in Ghana to predict or determine its likelihood of success or failure. The results show that the well-intended policy falls short when evaluated using using the Design Reality Gap model. The gap score of 27 indicates a good chance of failure unless specific steps including those recommended in the paper, are taken.This study provides the reader and the policymaker with food for thought on what direct interventions may be required whilst it contributes to a broader understanding of Digital Addressing Systems. It shows where things may not be moving as desired and what needs to be done or resolved to ensure that the country is on track to achieving the assumed objectives.

6.0 References

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APPENDIX: DETAILED GAP SCORES FOR DIMENSIONS OF THE DAS

Information

Subdomain	Gap	Weight	Gap Score
Documentation Availability	5.67	2	11.33
Of Softcopy eg On Website Availability	3.00	2	6.00
Of Hardcopies E.G. In Public Libraries	10.00	2	20.00
Different Versions For Different Audiences Available	10.00	2	20.00
			7.17

Technology

Subdomain	Gap	Weight	Gap Score
Software	3.00	3	9.00
Hardware	3.67	3	11.00
Networks	2.33	3	7.00
			3.00

Process

Subdomain	Gap	Weight	Gap Score
Internal Audit	6.67	2	13.33
Monitoring	7.33	2	14.67
Evaluation	7.00	2	14.00
The Process Was Transparent And Predictable	6.33	2	12.67
			6.89

Objectives And Values

Subdomain	Gap	Weight	Gap Score
Citizens' Awareness Of Policy	3.00	1	3.00
Citizens' Acceptance Of Policy	5.00	1	5.00
Citizens' Involvement In Formulation Of Policy	7.33	1	7.33
			5.11

Citizens And Skills

Subdomain	Gap	Weight	Gap Score
Ict Skills Of Citizens	3.33	3	10.00
Available Avenues For Ict Capacity Building	6.33	3	19.00
Willingness Of Citizens To Accept	4.00	3	12.00
			4.55

Management Systems And Structure

Subdomain	Gap	Weight	Gap Score
Policy Adapted To Ghanaian Context	1.33	2	2.67
Strong Monitoring And Evaluation Of Policy Implementation	7.33	2	14.67
Monitoring And Evaluation Leads To Appropriate Policy Modifications	7.33	2	14.67
Availability Of Local Content	2.33	2	4.67
Feasibility Of Timelines	5.33	2	10.67
			4.73

Other Resources

Subdomain	Gap	Weight	Gap Score
Political Willingness	1.43	2	2.86
Availability Of Funds	2.86	2	5.72
Socio-Cultural Dynamics	4.05	2	8.10
			2.78