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ABSTRACT

Scholars of natural resource governance argue that national and local governments must engage ordinary community members. When ordinary community members access information about the utilization of natural resource revenue and get an opportunity to provide feedback, the revenue management improves. In this article, the authors engaged Ghanaians through a spatial crowdsourcing platform for their opinion about petroleum management revenue in Ghana. The participants accessed the platform via their mobile phones and completed a survey on their opinions about petroleum revenue management, the Free Senior High School program, and their priority areas for petroleum revenue funding in Ghana. The results suggest that ordinary community members, and particularly women, seemed less informed about the management of petroleum revenue in Ghana. Furthermore, Ghanaians' opinions regarding their prioritized projects for petroleum revenue funding vary geographically. The authors conclude that decision-makers can use spatial crowdsourcing to engage ordinary community members in natural resource revenue management.

1. Introduction

Scholars of natural resource governance argue for citizen engagement for better revenue management in resource-rich countries (Johannes et al., 2015; Lujala et al., 2020; Maconachie, 2016; Ogbe & Lujala, 2021). The overarching argument is that when ordinary community members, that is, inhabitants without any leadership or privileged position have access to information about the utilization of natural resource revenue and an opportunity to provide feedback, the revenue management improves. Moreover, since several scholars recognize spatial crowdsourcing as a tool for informing and collecting opinions from people at specific locations (Alonso, 2013; Howe, 2006; McCall & Minang, 2005; Ogbe & Lujala, 2021; Walden-Schreiner et al., 2018), we used it to engage Ghanaians on the management of the Annual Budget Funding Amount (ABFA) in Ghana.

The ABFA is the portion of petroleum revenue that finances community and national development projects in Ghana (T. K. Stephens, 2019). Ghana enacted the Petroleum Revenue Management Act (PRMA) in 2011 with institutions and mechanisms to manage the petroleum sector and its revenue. The PRMA requires the Ministry of Finance and the Public Interest and Accountability Committee (PIAC) to inform and collect opinions from Ghanaians on the management of the ABFA.

With almost a decade's existence of the PRMA and the PIAC, there is literature, for example, on the challenges of the PRMA (T. K. Stephens, 2019) and the promotion of accountability and transparency in the ABFA management (Sefa-Nyarko, Okafor-Yarwood, & Boadu, 2021). To the best of our knowledge, there is no previous research on the geography of Ghanaians' opinions regarding the ABFA management. Hence, we want to contribute to this knowledge gap. Identifying the geography of Ghanaians' opinions regarding the ABFA could help PIAC, for instance, to better engage Ghanaians across the country. As a case for this inquiry, we chose the Free Senior High School (SHS) program, which absorbs all fees for all senior high school students in Ghana and is fully financed from the ABFA for three reasons. First, the Free SHS is national. It covers all the fees (admission, tuition, accommodation, feeding, utility – electricity and water, and textbooks) for all senior high students across the country. Second, it is the government's most prioritized item with funding from the petroleum revenue. From 2017 to 2019, it had received about half (US$243 million) of the US$501 million utilized from the ABFA (PIAC, 2020). Third, it is widely advertised (through government communications, radio, television, newspapers, and social media) and debated in Ghana; so, we assume most Ghanaians will be aware of it and have an opinion about it.

We used Survey123 for ArcGIS from Esri to create a multimedia-based spatial crowdsourcing questionnaire survey and engaged Ghanaians across the country. The survey participants accessed the platform via their mobile phones and completed a survey that probed their level of information about the petroleum revenue spending and the Free SHS program, satisfaction with the Free SHS program, and their priority areas for petroleum revenue funding. We pursued three research questions (RQs):

RQ1: To what extent are Ghanaians informed about the management of petroleum revenue and the Free SHS program, and to what extent does their level of being informed vary geographically?

RQ2: To what extent are Ghanaians satisfied with the Free SHS program, and to what extent does their level of being satisfied vary geographically?

RQ3: What priority areas of ABFA funding are most important to Ghanaians, and to what extent do their prioritized areas vary geographically?

This article contributes to literature and practice in three ways: first, the results show that national and local governments as well as civil society organizations can use spatial crowdsourcing in engaging citizens to collect feedback on petroleum revenue utilization. For instance, in our case, spatial crowdsourcing helped us to identify what projects Ghanaians prioritize for petroleum revenue funding. Second, it makes a case for a broader consideration regarding citizen engagement in general and identifies which population groups' voices need inclusion in the management of natural resource revenue. Third, it adds to the existing literature on citizen engagement in natural resource governance by exploring the use of spatial crowdsourcing in the management of petroleum revenue.

The article proceeds as follows. Section 2 provides background for spatial crowdsourcing and the ABFA. Section 3 describes our method and data. Section 4 presents our analyses, results, and discussion. Section 5 concludes with a brief reflection on our methodology.

2. Background

2.1 Spatial crowdsourcing

Spatial crowdsourcing is the engagement of nonscientific community members in the collection, analysis, and dissemination of environmental, social, and other spatiotemporal information (To et al., 2014). According to Zhao and Han (2016), spatial crowdsourcing registers participants' precise

locations and lets them complete assigned tasks, such as sending text, pictures, audio, or other location-specific information. Hence, for any spatial crowdsourcing task, a device incorporating a positioning system to record locations is necessary (Miao et al., 2016). In the broader sense, spatial crowdsourcing is the combination of volunteered geographic information – using the Internet to create, assemble, and disseminate geographical information (Goodchild, 2007) and citizen science – the academic community engaging the public actively in academic work (Doyle, David, Li, Luczak-Roesch, Anderson, & Pierson, 2019).

The use of spatial crowdsourcing spans from natural resource management to non-resource-related issues. McCall and Minang (2005), Walden-Schreiner et al. (2018), and Jarvis et al. (2015) used spatial crowdsourcing to engage community members in forestry management, nature conservation, and marine spatial planning, respectively. These studies indicate two major points about spatial crowdsourcing: it can increase the degree of citizen engagement and improve governance of natural resources. Spatial crowdsourcing provides citizens with relevant information on important issues and can serve as a platform for citizens to provide input to public institutions. Thus, spatial crowdsourcing can enhance dialogue between citizens and public institutions. Some of the notable non-resource-related spatial crowdsourcing applications include *Ushahidi, iRain*, and *gMission*. Ushahidi is used to report crises and human rights abuse and to monitor elections in over 160 countries (Okolloh, 2009), iRain is used to report local precipitation conditions from anywhere in the world to the Center for Hydrometeorology and Remote Sensing at the University of California, Irvine (To et al., 2016), and gMission is a platform for conducting various location-based crowdsourcing tasks (Chen et al., 2014).

Spatial crowdsourcing can potentially engage a larger number of citizens otherwise under-represented in traditional engagement processes. For example, compared with town-hall meetings, media broadcasts, and offline surveys, spatial crowdsourcing can engage more citizens and provide a broader range of different feedbacks (Kytta et al., 2013). More so, it is faster and cheaper (Howe, 2006) and can produce data from diverse participants (Alonso, 2013). Yet, some scholars have questioned the quality of crowdsourced data (Basiri et al., 2019; Hecht & Stephens, 2014) because of required technology, technical skills, and voluntariness (e.g., unwillingness to volunteer due to lack of protection and privacy in participation), and biases in representation (e.g., more urban than rural participants). Related to biases, geotagged tweets and photos are biased toward wealthier and highly educated areas (Li et al., 2013). Wealthier areas have more mapped content in OpenStreetMap (OSM) than poorer areas (Mashhadi et al., 2013) and OSM editors are dominantly consisting of educated, young, white males (M. Stephens, 2013). To overcome these common biases, Ogbe and Lujala (2021) suggest that practitioners should maintain a balanced representation of the population, consider the expertise of the potential participants, and assure the participants of their anonymity.

Overall, spatial crowdsourcing can engage citizens in natural resource revenue management in four ways. First, to disclose information to citizens at specific locations (McKinley et al., 2017). Second, to collate location-specific information and opinions from citizens (Bott & Young, 2012). Third, as spatial crowdsourcing produces spatial data, it allows for a more effective response to citizens' concerns in specific places (Kurniawan & De Vries, 2015). Fourth, to serve as an easy and cost-effective way for dialogs between governments and/or other organizations and large sections of citizens. For instance, instead of spending time and money on expensive field visits, a few employees at an organization's headquarters can use spatial crowdsourcing to engage citizens across the country (To et al., 2016).

2.2 The annual budget funding amount

The Annual Budget Funding Amount (ABFA) refers to the share of petroleum revenue for developmental projects in Ghana. The Petroleum Revenue Management Act (PRMA, 2011) and its amendment (PRMAA, 2015) established the rules and regulations governing the collection,

allocation, and utilization of the petroleum revenue. The principal goal of the Act is to promote transparency, responsibility, and accountability in the management of the resources to benefit all Ghanaians (PRMA, 2011).

The PRMA assigns specific roles to two institutions – the Public Interest and Accountability Committee (PIAC) and the Ministry of Finance – regarding the ABFA. The PIAC is an independent body with 13 representatives from civil society, academia, religious and traditional authorities, media, organized professional groups, and the Ghana Extractive Industries Transparency Initiative. Its mandate is to monitor and evaluate the government's compliance with the Act, provide space and platforms for the public to increase its knowledge and awareness of petroleum revenue management, improve citizens' capability and willingness to hold the government accountable in managing petroleum revenue, and provide an independent assessment of the management and use of revenue (PRMA, 2011 Sections 51–57). On the other hand, the Ministry of Finance oversees the overall management of petroleum revenue, inclusive supervision of transfers into the ABFA, and disbursements from it. So far, PIAC's annual reports indicate that the government largely adheres to the PRMA with some shortcomings like failure to strictly adhere to allocating petroleum revenues between the current budget and future savings.

A major stipulation in the PRMA is that after a 30% disbursement to the national oil company for its operations, the ABFA should receive about 70% of the remaining petroleum revenue. In financing development projects across the country, the ABFA aims at maximizing economic growth, promoting economic equality, and enhancing balanced regional development (PRMA, 2011). The ABFA can fund projects from twelve priority areas[1] (including agriculture, education, health, and transportation). According to the Act, the Ministry of Finance selects the priority areas, and in consultation with the district assemblies (the second-level administrative subdivisions in Ghana, see Ayee (2013, p. 629) for more information). Furthermore, the ministry identifies the projects from a maximum of four of the twelve priority areas and reviews the selected priority areas every third year.

From 2017 to 2019, the selected priority areas were agriculture, roads, and other infrastructure, health, and education. In this period, the ABFA received about US$ 936 million and utilized about US$ 501 million on various projects in the country. The Ministry of Finance's reports (Ministry of Finance, 2018, 2019, 2020) on the petroleum revenue show that education was the most prioritized area (about 50% of all ABFA funding), followed by roads and other infrastructure (37%) and agriculture (11%). Health was the least prioritized area – receiving about 3% of the total utilized ABFA. Nonetheless, the amended PRMA instructs that the ABFA directly funds the PIAC. This is to enhance PIAC's financial capacity, especially in engaging Ghanaians. Accordingly, it received a total of US$ 1.6 million of ABFA funding in this period.

2.2.1 The Free Senior High School (SHS) program

The Free Senior High School program (henceforth, the Free SHS) is a national project that has removed all fees and expenses for upper secondary schools, including fees for boarding and meals. With the ABFA to finance it, President Akuffo-Addo of the New Patriotic Party (NPP) declared and launched it as a government program in September 2017 (Cudjoe, 2018; Mohammed, 2020).

At the end of 2019, the Free SHS had received 48% of the total utilized ABFA – about US $243 million (see Figure 1). In 2017, out of the US$47 million (61% of total utilized ABFA) for the education priority area, the government spent about US$45 million on the Free SHS. Thus, the program utilized about 97% of the entire allocation to the education sector. In 2018, the education priority area got almost twice its previous allocation and the program took almost all – US $87 million (97%). In 2019, all the allocation to the education sector (US$110 million) went into financing the program (see Figure 1).
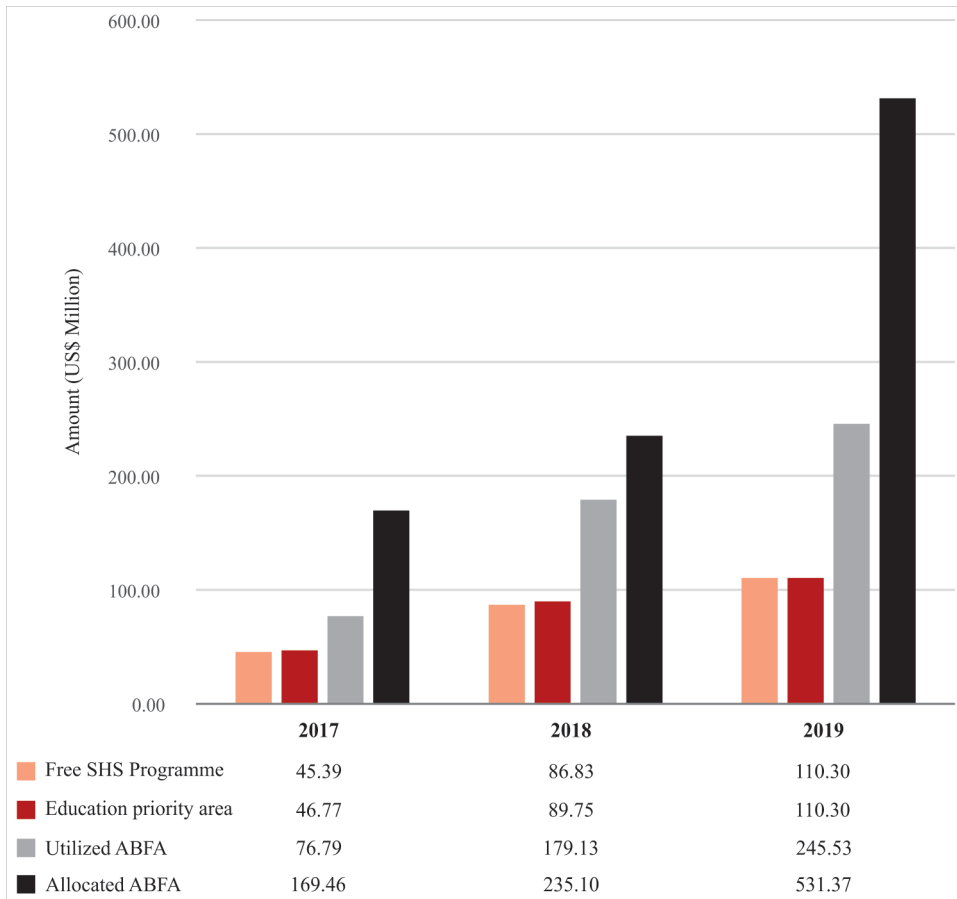
	2017	2018	2019
▧ Free SHS Programme	45.39	86.83	110.30
▧ Education priority area	46.77	89.75	110.30
▧ Utilized ABFA	76.79	179.13	245.53
▧ Allocated ABFA	169.46	235.10	531.37

Figure 1. ABFA allocation and utilization, education priority area, and the Free SHS (2017–2019). The data is from the Ministry of Finance (2020).

2.2.2 *Ghanaians and the ABFA*

Citizen engagement is crucial for better natural resource revenue management (Epremian et al., 2016; Maconachie, 2016). Accordingly, the PRMA mandates the PIAC to engage Ghanaians regarding the ABFA and demands Ghanaians to be an active and important voice in its management (PRMA, 2011). Thus far, the PIAC has held 16 regional and 123 district engagements[2] and produced 18 reports (PIAC, 2021). Additionally, researchers (Lujala et al., 2020; Mohammed & Kuyini, 2020; Ogbe & Lujala, 2021; Tamanja & Pajibo, 2019) have also engaged Ghanaians within natural resource revenue management.

Generally, these engagements indicate that most Ghanaians are not well informed about the management of the revenue. Those who are, have some reservations; especially, about the management of the ABFA (T. K. Stephens, 2019; PIAC, 2017). For example, they opine that the community-based ABFA-funded projects' implementation was without clear goals and objectives. Also, some of the projects were too small and thinly spread without a transformational impact on development, and the selection and implementation of the projects excluded community members. Thus, one cannot tell whether the projects met the needs of the people. Regarding the Free SHS, the concerns are mainly about the cost, sustainability, and politics (Mohammed & Kuyini, 2020). The program is too expensive and its reliance on the ABFA makes it unsustainable (Cudjoe, 2018), and it was politicized, rushed, and excluded consensus building in its implementation (Mohammed &

Kuyini, 2020). However, with the proportion of the ABFA going into this program, it is crucial to engage more Ghanaians regarding its management as it could lead to perceived fairness and trust in the revenue management (Schroeder & Fulton, 2017).

Nonetheless, Ghana's diversity could produce varied opinions regarding the management of petroleum revenue. Ghana is diverse geographically in terms of party politics and rural-urban dichotomies (Agyei-Mensah & Owusu, 2012; Churchill & Danquah, 2020). Concerning party politics, largely, the Ashanti and Eastern regions affiliate more to the governing NPP and the Volta, Oti, and the northern regions tilt toward the opposition National Democratic Congress (NDC) (Asante & Gyimah-Boadi, 2004; Kim, 2018; Osei, 2013). Moreover, regarding the rural-urban spatial dichotomies, mostly, the urban areas in Ghana have higher socio-economic amenities than the rural areas. The rural population is mostly dependent on subsistence agriculture whereas the urban folks' livelihood is diversified (Yeboah, Owusu, Arhin, & Kumi, 2015).

Due to the above geographic variation, Ghanaians could differ in opinion regarding the management of petroleum revenue. Engaging Ghanaians where they live as Fortin et al. (2016) suggest – in our case, using spatial crowdsourcing to identify geographic variations – could improve petroleum revenue allocation and utilization in the country. Finding the less informed communities regarding the management of the ABFA and engaging them or identifying the most needed project for each community and providing it, could be a better way to manage the ABFA. Nonetheless, regarding the management of the petroleum revenue, what are the factors that could determine the variations in Ghanaians' opinion?

2.3 Determining factors

We conceptualize Ghanaians' opinion concerning the petroleum revenue management generally, and the Free SHS particularly, to be influenced by two sets of factors: individual and geographical.

2.3.1 Individual factors

An 'individual' has both personal and social characteristics (Moon et al., 2012). Personal characteristics include variables such as gender, age, and education. Previous research has shown that, overall, men tend to be more informed on national issues than women; younger people use more information channels than the aged; majority groups tend to be more informed than the minority; and the highly educated are more informed than the less educated (Lujala et al., 2020; Nyamekye et al., 2020). English language and internet-savvy skills are potentially important determinants for information access (Ofori & Lujala, 2015) since, in Ghana, most information on petroleum resource revenue management is available mainly on the Internet and in English. Further, Lujala et al. (2020) reasoned that travelers are more likely to be exposed to information outside their areas. Hence, we expect that people who reside outside their home region (being possibly exposed to information available in their host- and home-regions) to be more informed about petroleum revenue management than those in situ.

Regarding social characteristics, as PIAC engages more local leaders, we assume that an individual with leadership or in a privileged position in her/his community will likely be more informed about petroleum revenue management than an ordinary community member.

2.3.2 Geographical factors

Geographical characteristics of the residence of a participant can affect the likelihood of being informed about resource revenue management. Literature indicates a strong divide between urban and rural dwellers: the former tends to have better access to varied information and thus more informed than the latter (Garcia-Cosavalente et al., 2010; Lujala et al., 2020), and the more remote one resides, the less informed one can be because the sources of information may be limited (Ofori & Lujala, 2015). Moreover, we expect people living close to an existing ABFA-funded project to be more informed compared with those living far away. Finally, we assume that the level of satisfaction with the Free SHS varies depending on the political dominance in the participant's location; the

strongholds of the governing party (NPP) will likely be more satisfied whereas those of the opposition (NDC) less satisfied; rural areas to prioritize roads or health-related projects for the funding from the ABFA.

2.3.3 Hypotheses

We summarize the determining factors as hypotheses and group them under each research question.

(1) Informed about the petroleum revenue management and the Free SHS in Ghana.

H1a: Ghanaian women are likely to be less informed about petroleum revenue management and the Free SHS in Ghana.

H1b: Ghanaian youth (18–35 years)[3] are likely to be more informed about petroleum revenue management and the Free SHS in Ghana.

H1c: Ghanaians living in their home regions are likely to be less informed about petroleum revenue management and the Free SHS in Ghana.

H1d: Ghanaians without leadership or privileged positions in their communities are likely to be less informed about petroleum revenue management and the Free SHS in Ghana.

H1e: Ghanaians who know about an existing ABFA-funded project are likely to be more informed about petroleum revenue management and the Free SHS in Ghana.

H1f: Rural Ghanaians are likely to be less informed about petroleum revenue management and the Free SHS in Ghana.

(1) Satisfaction with the Free SHS.

H2a: Ghanaians residing in the strongholds of the opposition political party (NDC) are likely to be less satisfied with the Free SHS in Ghana.

H2b: Rural Ghanaians are likely to be more satisfied with the Free SHS in Ghana.

(1) Preferred ABFA-funded project's Priority Area.

H3: Rural Ghanaians are likely to prioritize road- and health projects for ABFA funding.

3. Method, data, and analyses

3.1 Method

We conducted an online survey among Ghanaians above 18 years in Ghana between January and May 2020. We used Survey123 for ArcGIS (https://survey123.arcgis.com) as our spatial crowdsourcing platform. Survey123 aids in the creation, sharing, and analysis of online surveys. Furthermore, it can generate geographical coordinates for the devices' location and allows for the uploading of pictures, videos, and responses to questions. The survey questions focused on the following: the participants' biographic data (e.g., age, gender, and level of education), knowledge about petroleum revenue management in Ghana, knowledge about and satisfaction with the Free SHS, and

prioritized area for petroleum revenue's funding in Ghana (see Appendix for details). To ensure the quality of our data, we recruited participants from both rural and urban areas, limited the technology to smart-mobile phone usage, and assured the participants of their anonymity.

Our target population was the general adult Ghanaian public with input devices like mobile phones with GPS and Internet connection. Together with five research assistants, we circulated the survey link via social media (Facebook and WhatsApp) and e-mail. Compared with the rural dwellers, it was easier to engage the urban dwellers as they were often online. To navigate the challenge regarding the rural dwellers, we used people in the rural areas that we knew to circulate the link (mainly through WhatsApp) to their contacts who met our target population. Upon receipt of the link, the participants clicked it to access the survey, filled the questionnaire, and submitted their responses. We got responses from 806 participants (at least 20 per each of the 16 regions as shown in Figure 2) across Ghana. Table 1 gives the summary statistics of the data. We stored the responses in shapefile format, which we processed and analyzed using ArcGIS Pro 2.7 and StataMP 16.

3.2 Data

The participants were, on average, 30 years old. A large majority (720) had tertiary education. Most of them were men (468) and ordinary community members (484). Almost half (364) of them were not at all informed about the management of petroleum revenue in the country. Regarding the Free SHS, 48 of them were not at all informed while the rest 731 were fairly to very informed; and less than half of them were either satisfied (268) or very satisfied (34). (Table 1) indicates the summary statistics of the variables we used in our analyses.

3.2.1 Response and explanatory variables
We have four individual-level response variables (Table 1) and grouped our explanatory variables into two: demographic and geographic.

(a) Demographic: age (in numbers), gender (male or female), the highest level of education achieved (from none to tertiary), and position in the community (from an ordinary community member to a leader). We coded age, gender, education, and position in the community by dummies taking the values of 1 if the participant is a youth, female, tertiary educated, or an ordinary community member.[4] Further, we asked the participants whether they knew of any existing ABFA-funded project in their area.

(b) Geographic: home region (from a list of the 16 administrative regions, see Table 2). We coded their residing region as a dummy with the value of 1 for those staying in their home region. To operationalize a dummy variable for whether the participant was in a rural area (1) or urban (0), we used the 2019 global Climate Change Initiative Landcover from the European Space Agency dataset.[5] Further, from the administrative regional capital towns' point features and the urban area data, we calculated the distances from the participants' responding location to the nearest regional capital town and urban area. Finally, we created another dummy variable indicating whether the participant was within the stronghold of the opposition political party (1) or not.

3.2.2 Data representativeness
Spatial crowdsourcing projects that rely on access to a relatively expensive technology (e.g., smartphones and Internet access) are likely to be unrepresentative (Ogbe & Lujala, 2021) and could introduce biases in the sample (Bubalo et al., 2019). In our case, almost 90% of the survey participants had tertiary education, while only about 5% of Ghanaians had this level of education in 2017 (Ghana Statistical Service, 2019). Therefore, our survey participants were unrepresentative of
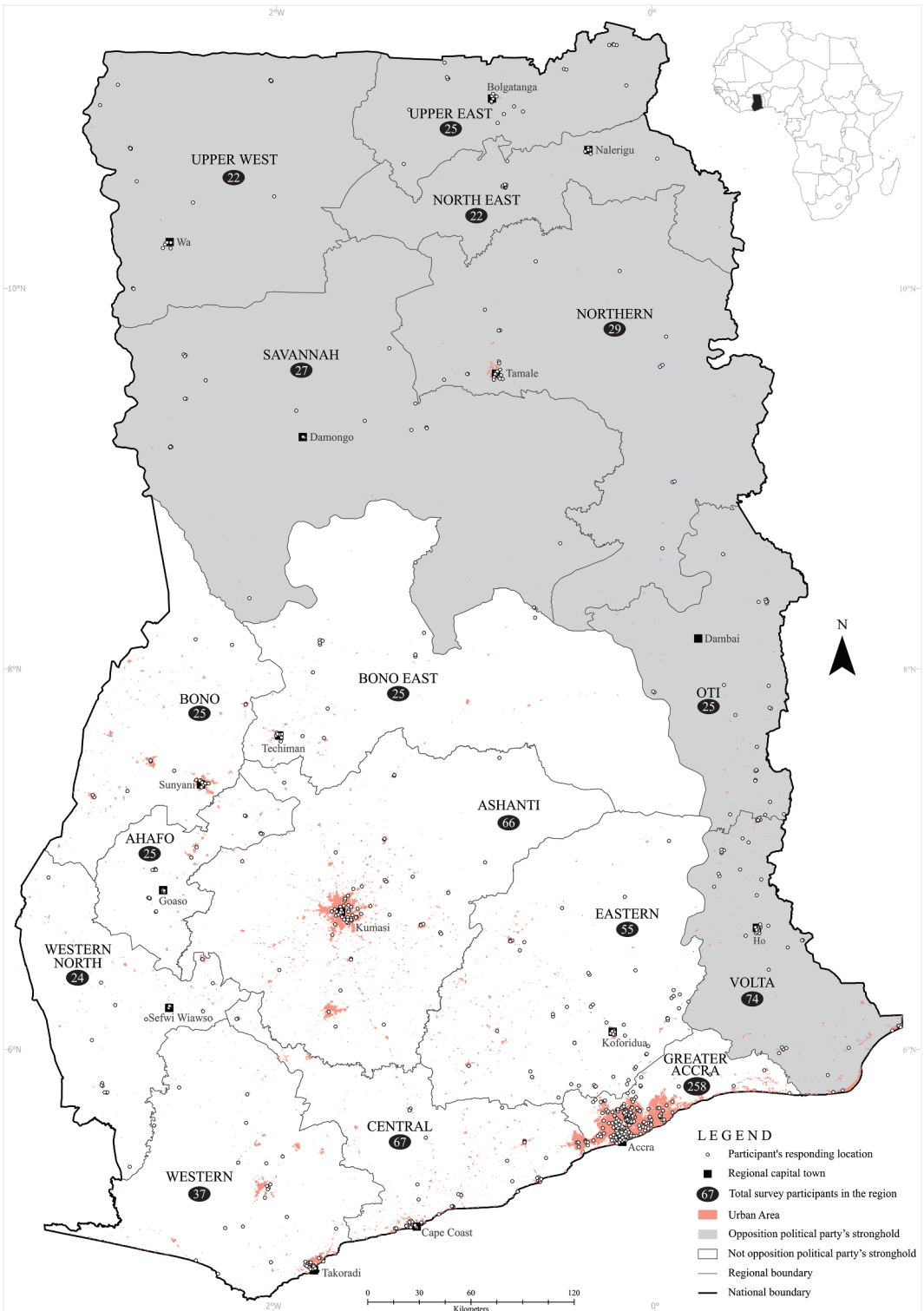
Figure 2. Survey participants' location (with 100 meters offset to secure privacy), the total number of participants per region, urban areas, and the opposition political party's strongholds in Ghana.

Table 1. Summary statistics for both response and explanatory variables.

Variable		Obs.	Median	Inter Quartile Range	Min.	Max.	Coding
Response	Level of information about the petroleum revenue management (RV1)	793	2	1	1	5	Likert-scale: 1 = Not at all informed 2 = Fairly informed 3 = Informed 4 = Well informed 5 = Very informed
	Level of information about the Free SHS (RV2)	779	2	1	1	5	Likert-scale: 1 = Not at all informed 2 = Fairly informed 3 = Informed 4 = Well informed 5 = Very informed
	Level of satisfaction with the Free SHS (RV3)	778	3	2	1	5	Likert-scale: 1 = Very dissatisfied 2 = Dissatisfied 3 = Neither dissatisfied nor satisfied 4 = Satisfied 5 = Very Satisfied
	Most prioritized area for funding from the ABFA (RV4)	786					1 = Agriculture (9%) 2 = Education (16%) 3 = Electricity (3%) 4 = Health (36%) 5 = Railway (1%) 6 = Road (35%)
Explanatory	Age	806					Dummy: 1 = youth participant (76%)
	Gender	806					Dummy: 1 = female (42%)
	Educational level	806					Dummy: 1 = at least tertiary education (89%)
	Position in the community	806					Dummy: 1 = leadership or privileged position in the community (60%)
	Existing ABFA project	806					Dummy: 1 = knowing of an existing ABFA-funded project in the community (17%)
	Home Region	806					Dummy: 1 = residing in the region s/he comes from (54%)
	Rural Area	806					Dummy: 1 = residing in a rural area (30%)
	Distance to nearest regional capital	806	18.4	41.7	0	122.98	Distance (km) from the participant's responding location to the nearest regional capital
	Distance to nearest urban area	806	0	0.1	0	63.12	Distance (km) from the participant's responding location to the nearest urban area
	Opposition stronghold	806					Dummy: 1 = residing in the stronghold of the opposition political party (28%)

We used the following sources: ESA (2020) for rural area data; Osei (2013) and Asante and Gyimah-Boadi (2004) for information about opposition stronghold. All dummy variables had zero for otherwise. The parenthesis indicates the corresponding percentage.

the Ghanaian populace in general. Our participants' presence on the Internet indicates that they might have been comparatively wealthier and more educated. Consequently, they possessed the required technology and skills (e.g., an ability to read and write in English), saw the survey, got interested, and participated more.

Table 2. Mean differences for the response variables (RV1 – RV3) and the most prioritized area for ABFA funding across the regions.

Region	RV1	RV2	RV3	RV4
Ahafo	0.254	0.442**	0.083	Health (52%)
Ashanti	0.129	0.143	−0.146	Health (46%)
Bono	0.295	0.281	−0.299	Health (48%)
Bono East	0.089	−0.116	−0.428*	Health (36%)
Central	0.409***	0.324**	−0.159	Health (68%)
Eastern	0.026	−0.246	−0.493***	Health (44%)
Greater Accra	−0.378***	−0.249***	0.089	Road (31%)
North East	0.221	0.621***	0.4*	Road (57%)
Northern	0.058	−0.008	−0.081	Road (39%)
Oti	0.336*	0.271	0.155	Road (60%)
Savannah	0.595***	0.314	−0.082	Road (58%)
Upper East	−0.114	−0.245	−0.17	Health (40%)
Upper West	0.268	0.527**	0.614***	Health (64%)
Volta	−0.333***	−0.296**	0.479***	Road (38%)
Western	−0.087	−0.016	−0.161	Road (51%)
Western North	0.401**	0.035	0.004	Road (63%)
Observations	793	779	778	786

Table shows the differences between the means of each region compared with the rest of the regions: *$p < 0.1$; **$p < 0.05$; and ***$p < 0.01$. The parenthesis indicates the corresponding percentage of the prioritized area for the region.

However, the objective(s) of a spatial crowdsourcing project determines whether the self-selection and the biases it introduces are an issue (Czepkiewicz et al., 2017). For example, within petroleum revenue management, representativeness may not be an issue if the objective is to monitor the progress of uncompleted revenue-funded projects or to report the statuses of completed ones. However, it can be of great importance if the objective is to decide future revenue-funded projects as the opinion of the poorer and less educated are more likely to be missing (Ogbe & Lujala, 2021). In our case, the objective was to engage Ghanaians to give their opinion about petroleum revenue management. Thus, we consider the unrepresentativeness of our sample not to be a major issue.

3.3 Analyses

To determine whether the regions differ significantly from each other regarding the response variables (RV1 – RV3), we used *t-test* inferential statistics (Table 2). We observed some significant variations, and in (Figure 3), we indicate the geography of these variations by adopting Tufte's (1983) classification.[6] Generally, at least 4 out of the 16 regions are significantly different concerning all the three variables. About the final response variable (RV4), majority of the participants (71%) would prefer the ABFA funding either health or road-project in their communities. A *Chi-squared test* for all the priority areas (6) together and the health and road-project priority areas individually across the 16 regions all indicate significant differences. Additionally, Table 2 shows the most prioritized area and its corresponding percentage across the regions.

The survey participants could indicate on a five-point scale, their level of either information (coded from not at all informed [1] to very informed [5]) or satisfaction (coded from very dissatisfied [1] to very satisfied [5]) about the petroleum revenue and the Free SHS management. So, we used Ordered Logistic Models (OLM) to analyze the response variables.

Following Gordon (2016) and Jiao et al. (2017), we employed four models to identify the factors determining the RV1, RV2, RV3, and RV4. Additionally, since the majority (71%) of the participants prioritized health and road areas for ABFA funding, we coded them as dummies to observe
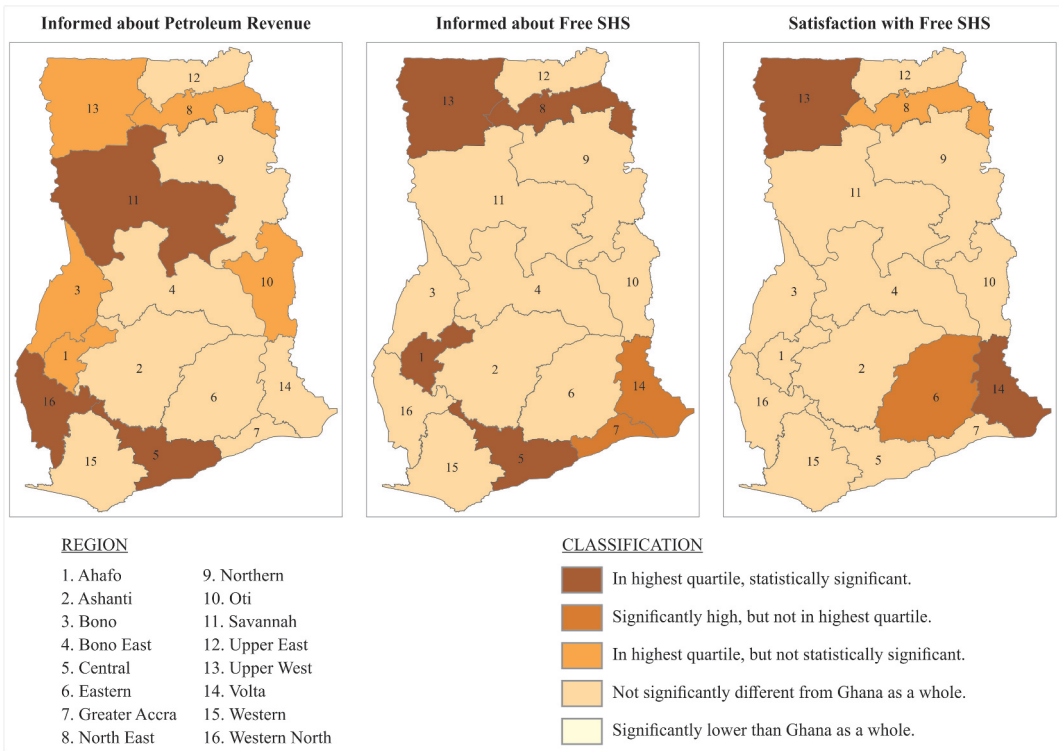
Figure 3. Geographic variation in the response variables (RV1 – RV3) at the regional level. Note: The maps show the combination of the differences between the means of each region compared with the rest of the regions (t-test in quartile) and their corresponding odds ratios. The classification is influenced by Tufte (1983). The darker shades indicate places with lower levels of being informed or satisfied.

how they relate to the explanatory variables. Thus, we divided our last response variable into two binaries (either the participant chose health or not, and either roads or not) and used multinomial regression to analyze them.

We anticipate that our results could be susceptible to heterogeneity due to unobserved influence from geographical factors like proximity between the participants. To account for such vulnerability, we included fixed effects on *region* in all models and cluster-adjusted *district*[7] for any within-cluster heteroscedasticity as Cameron and Miller (2015) suggest.

4. Results and discussion

Generally, our results show that Ghanaians have different opinions about the management of petroleum revenue. Specifically, most of the participants were less informed about the management of petroleum revenue and the Free SHS program, dissatisfied with the Free SHS program, and prioritized the health sector for petroleum revenue's funding. Regarding the level of information, we observed that women and participants without leadership or privileged position in their communities were less likely to be informed about the management of the petroleum revenue and the Free SHS. Further, participants in the strongholds of the opposition political party were dissatisfied with the Free SHS. Additionally, Table 1 indicates the top three most prioritized areas as health (36%), road (35%), and education (16%), respectively.

Table 3. Level of information about the petroleum revenue management and Free SHS, level of satisfaction about the Free SHS, and the two most prioritized areas for ABFA funding.

	RV1	RV2	RV3	RV4_health	RV4_road
Age	0.473***	0.69***	0.333*	−0.071	−0.564**
	(0.17)	(0.15)	(0.18)	(0.24)	(0.23)
Gender	−0.542***	−0.653***	−0.156	0.4***	−0.019
	(0.16)	(0.13)	(0.13)	(0.14)	(0.18)
Educational level	0.902***	1.421***	0.107	0.229	−0.625**
	(0.26)	(0.29)	(0.17)	(0.28)	(0.31)
Position in the community	−0.862***	−0.822***	0.031	0.413**	0.164
	(0.23)	(0.21)	(0.14)	(0.2)	(0.17)
Existing ABFA project	1.939***	1.29***	0.547**	0.148	−0.953***
	(0.19)	(0.19)	(0.21)	(0.17)	(0.21)
Opposition stronghold	0.824***	1.094***	−0.793***	−1.356***	0.384
	(0.3)	(0.31)	(0.18)	(0.33)	(0.32)
Home Region	−0.6***	−0.609***	0.226	0.323**	0.087
	(0.16)	(0.17)	(0.15)	(0.16)	(0.16)
Rural Area	0.374*	0.044	0.167	−0.462**	0.422**
	(0.22)	(0.23)	(0.15)	(0.21)	(0.2)
Distance to nearest regional capital	−0.005	−0.003	−0.002	0.001	0.003
	(0)	(0)	(0)	(0)	(0)
Distance to nearest urban area	0.027***	0.028***	−0.002	−0.006	−0.009
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observations	793	779	778	806	806

Ordered Logistic Regression models with Robust Standard Errors in parentheses. Table shows the odds ratio for the coefficient: *p < 0.1; **p < 0.05; and ***p < 0.01.

4.1 Petroleum revenue management

First, we analyzed how informed the participants were about the management of the petroleum revenue in Ghana. Table 3 (model RV1) shows the odds ratios for ordered logistic regression: positive values indicate an increase in the participants' likelihood of being informed, and negative ones indicate a decreased likelihood. The odds ratios provide an intuitive interpretation for discrete variables such as gender or age and our response variables. For example, in model RV1, gender has the odds ratio of −0.542, which means being a woman, decreases the likelihood of a participant being informed about the management of the petroleum revenue by about 0.5 units (see Table 1 for the scale).

From the model, we observe that Ghanaians who are young, tertiary educated, know about an existing ABFA-funded project, residing in the stronghold of the opposition political party, and closer to an urban area (in distances) are more likely to be informed about the management of the petroleum revenue. Contrarily, women, ordinary community members, and people residing in their home region are more likely not to be informed. Besides, from a simple crosstabulation, the Central, Savannah, and Western North were the significantly least informed regions with 78%, 77%, and 71% of their participants, respectively (see Figure 3).

We hypothesized that Ghanaians who are young and know about an existing ABFA-funded project are likely to be informed about the management of petroleum revenue, while those who are women, ordinary community members, living in rural areas, and their home regions are less likely to be. Our results confirm all these hypotheses except that of rural Ghanaians. Although uncertain, we observe that out of the 244 rural dwellers in our survey, 190 of them were youthful, and since being young positively influences the likelihood of being informed, it could have been a contributing factor.

These results align well with available research already mentioned (see Section 2.3) that men, the young, and the more educated tend to be more informed on issues than their counterparts. Access to information sources and the ability to assess information all favor men, the young, and the educated (Lujala et al., 2020; Nyamekye et al., 2020; Ofori & Lujala, 2015). Generally, these results

suggest that the PIAC needs to reconsider its scope of citizen engagement in Ghana. For example, they need to engage women and the less educated more regarding the management of the petroleum revenue.

4.2 The free SHS

Further, in model RV2 (Table 3), we have significant observations regarding the level of information with the Free SHS. Age, education, knowledge of an existing ABFA-funded project, living in the opposition stronghold, and being closer to an urban area all increase a participant's likelihood of being informed. However, gender, position in the community, and residing in one's home region reduce a participant's likelihood. Comparing the regions, and from Figure 3, we realize that the significantly least informed were North East, Upper West, Ahafo, and Central representing 90%, 86%, and 83% of their participants, respectively.

Concerning how satisfied the participants were with this program, we observe in model RV3 (Table 3) that only the youth and those who know about an existing ABFA-funded project are likely to be satisfied. However, those in the stronghold of the opposition party are very likely to be dissatisfied. This is apparent in Figure 3 as the two most dissatisfied regions – Upper West (95%) and Volta (77%) – are all within the opposition strongholds (see Figure 2).

Regarding the level of satisfaction with the Free SHS, the results did not confirm our hypothesis that rural Ghanaians are likely to be satisfied with the program. Chanimbe and Dankwah (2021) and Matey (2020) observed that the Free SHS, in doubling student enrollment in the rural areas, has left the rural schools with inadequate teaching staff (shortage of qualified teachers), learning materials (e.g., textbooks, science, and allied laboratory equipment), and infrastructure (classrooms, dormitories, and dining halls). Chanimbe and Dankwah (2021) assert that these challenges contribute to low academic performance by rural students, making some rural Ghanaians disliking the program. However, our results confirm our hypothesis that Ghanaians in the opposition's strongholds are likely to be unsatisfied with the program. Though we need further studies to explain this observation, some scholars indicate that the government did consult other stakeholders (Salifu & Ayamba, 2018; Tamanja & Pajibo, 2019) especially, minority political parties (Cudjoe, 2018; Edwards & Amoah, 2020; Mohammed & Kuyini, 2020) in implementing the program. In the future, we suggest that such development programs need more consensus-building between all concerned stakeholders.

4.3 ABFA priority areas

We concentrated on the two most prioritized areas – health and road – for ABFA funding in our final analyses. From Table 2, we observe that half of the regions prioritized the health area most while the remaining half prioritized roads and other infrastructure. Our control variables indicate in Table 3 (model RV4a) that while women, ordinary community members, and those in their home region are likely to prioritize health, those in the opposition strongholds and rural areas are likely not to. Besides, rural dwellers are likely to prioritize roads than the young, tertiary educated, and those who know about an existing ABFA-funded project (Table 3, model RV4b). More so, a simple tabulation of the most prioritized area by the rural-urban dichotomy likewise indicates that health and road are the most prioritized areas. Urban dwellers prioritize health (38%) more than roads (32%). The reverse is the case for the rural folks; road (42%) and then health (32%).

Our results show that rural areas are likely to prioritize road projects and not health projects refuting our last hypothesis. Most deplorable roads are in rural Ghana (Acheampong & Gyasi, 2019; Peprah et al., 2020), hence a possible explanatory factor. In essence, as various factors influence the priority areas for Ghanaians, the Ministry of Finance needs to consider engaging the locals to identify their priorities better.

5. Conclusion

Natural resource governance scholars justify citizen engagement for better revenue management in resource-rich countries. When ordinary community members have access to information about the utilization of natural resource revenue and opportunities to provide feedback, the revenue management improves. We used a spatial crowdsourcing platform to engage Ghanaians to express their opinion about petroleum revenue management in Ghana. Our results suggest that decision-makers can use spatial crowdsourcing to collect opinions from citizens at specific locations for natural resource revenue management. For instance, to identify what projects Ghanaians prioritize for petroleum revenue funding. The participants in our sample accessed the platform via their mobile phones and completed a survey on their opinions about petroleum revenue management in general, the Free Senior High School program, and their priority areas for petroleum revenue funding in Ghana.

Our results suggest that Ghanaians' opinions about the management of petroleum revenue vary geographically. Regarding the Free SHS, Ghanaians in the stronghold of the opposition political party appear to be dissatisfied. While urban Ghanaians prioritize health projects, the rural ones prioritize road projects for petroleum revenue funding. We need further research to investigate these geographical variations as they could be essential to the PIAC in its citizen engagement strategies regarding petroleum revenue in the country. Additionally, we need further research on the possible biases from spatial crowdsourced data and how we can mitigate them. For example, ensuring a balanced representation of the population, considering the technological expertise of the potential participants, and assuring the participants of their anonymity. In our case, we recruited participants from rural and urban areas, limited the technology to smart-mobile phone usage, and assured the participants of their anonymity.

Notes

1. See Ogbe and Lujala (2021) for the list of all the twelve priority areas.
2. The engagements occur at the administrative capital towns and are open to traditional and political leaders, the media, and all community members.
3. As defined in the Ghana Youth Policy by the Ministry of Youth and Sports (2010).
4. An ordinary community member is a citizen without any leadership or privileged position.
5. We used the 2019 dataset because it was the most current at the time. For more information about the dataset, see ESA (2020).
6. Instead of deciles as Tufte did, we used quartiles as we had 16 regions.
7. Ghana has 260 districts (the second-level administrative area).

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References

Acheampong, P., & Gyasi, J. F. (2019). Teacher retention: A review of policies for motivating rural basic school teachers in Ghana. *Asian Journal of Education and Training*, *5*(1), 86–92. https://doi.org/10.20448/journal.522.2019.51.86.92

Agyei-Mensah, S., & Owusu, G. (2012). Ethnic residential clusters in Nima, Ghana. *Urban Forum, 23*(1), 133–149. https://doi.org/10.1007/s12132-011-9127-8

Alonso, O. (2013). Implementing crowdsourcing-based relevance experimentation: An industrial perspective. *Information Retrieval*, *16*(2), 101–120. https://doi.org/10.1007/s10791-012-9204-1

Asante, R., & Gyimah-Boadi, E. (2004). *Ethnic structure, inequality and governance of the public sector in Ghana*. United Nations Research Institute for Social Development.

Ayee, J. R. (2013). The political economy of the creation of districts in Ghana. *Journal of Asian and African Studies*, *48*(5), 623–645. https://doi.org/10.1177/0021909612464334

Basiri, A., Haklay, M., Foody, G., & Mooney, P. (2019). Crowdsourced geospatial data quality: Challenges and future directions. *International Journal of Geographical Information Science*, *33*(8), 1588–1593. https://doi.org/10.1080/13658816.2019.1593422

Bott, M., & Young, G. (2012). The role of crowdsourcing for better governance in international development. *Praxis: The Fletcher Journal of Human Security*, *27*(1), 47–70. Retrieved https://pdfs.semanticscholar.org/2b4b/9e693aa12ecf66635bd2c7b080d340d90513.pdf

Bubalo, M., Van Zanten, B. T., & Verburg, P. H. (2019). Crowdsourcing geo-information on landscape perceptions and preferences: A review. *Landscape and Urban Planning*, *184*, 101–111. https://doi.org/10.1016/j.landurbplan.2019.01.001

Cameron, A. C., & Miller, D. L. (2015). A practitioner's guide to cluster-robust inference. *Journal of Human Resources*, *50*(2), 317–372. https://doi.org/10.3368/jhr.50.2.317

Chanimbe, T., & Dankwah, K. O. (2021). The 'new' Free Senior High School policy in Ghana: Emergent issues and challenges of implementation in schools. *Interchange*, *52*, 599–630. https://doi.org/10.1007/s10780-021-09440-6

Chen, Z., Fu, R., Zhao, Z., Liu, Z., Xia, L., Chen, L., Cheng, P., Cao, C. C., Tong, Y., & Zhang, C. J. (2014). gMission. *Proceedings of the VLDB Endowment*, *7*(13), 1629–1632. https://doi.org/10.14778/2733004.2733047

Cudjoe, F. (2018). *Speaking notes on "Free Senior High School education in Ghana: Prospects, challenges and recommendations*. Imani Africa. Retrieved from https://imaniafrica.org/2018/11/26/speaking-notes-on-free-senior-high-school-education-in-ghana-prospects-challenges-and-recommendations

Czepkiewicz, M., Jankowski, P., & Mlodkowski, M. (2017). Geo-questionnaires in urban planning: Recruitment methods, participant engagement, and data quality. *Cartography and Geographic Information Science*, *44*(6), 551–567. https://doi.org/10.1080/15230406.2016.1230520

Doyle, C., David, R., Li, J., Luczak-Roesch, M., Anderson, D., & Pierson, C. M. (2019). Using the web for science in the classroom: Online citizen science participation in teaching and learning. *Proceedings of the 10th ACM Conference on Web Science*, 71–80.

Edwards, A. K., & Amoah, S. A. (2020). Original paper deontological perspective of the free secondary education policy in Ghana. *World*, *7*(1), 16–31. https://doi.org/10.22158/wjer.v7n1p16

Epremian, L., Lujala, P., & Bruch, C. (2016). High-value natural resources and transparency: Accounting for revenues and governance. *Oxford Research Encyclopedia of Politics*. https://doi.org/10.1093/acrefore/9780190228637.013.21

ESA. (2020). *Land cover CCI product user guide version 2.0*. Retrieved https://maps.elie.ucl.ac.be/CCI/viewer/download/ESACCI-LC-Ph2-PUGv2_2.0.pdf

Fortin, S., Kameli, Y., Ouattara, A., Castan, F., Perenze, M. L., Kankouan, J., Traore, A., Kouanda, S., Conte, A., & Martin-Prével, Y. (2016). Targeting vulnerable households in urban Burkina Faso: Effectiveness of geographical criteria but not of proxy-means testing. *Health Policy and Planning*, *31*(5), 573–581. https://doi.org/10.1093/heapol/czv104

Garcia-Cosavalente, P. H., Wood, L. E., & Obregon, R. (2010). Health information seeking behavior among rural and urban Peruvians: Variations in information resource access and preferences. *Information Development*, *26*(1), 37–45. https://doi.org/10.1177/0266666909358640

Ghana Statistical Service. (2019). *Ghana living standards survey round seven (GLSS) 7*. Retrieved https://open.africa/organization/about/ghana-statistical-service

Goodchild, M. F. (2007). Citizens as sensors: The world of volunteered geography. *GeoJournal*, *69*(4), 211–221. https://doi.org/10.1007/s10708-007-9111-y

Gordon, S. L. (2016). Welcoming refugees in the rainbow nation: Contemporary attitudes towards refugees in South Africa. *African Geographical Review*, *35*(1), 1–17. https://doi.org/10.1080/19376812.2014.933705

Hecht, B., & Stephens, M. (2014). A tale of cities: Urban biases in volunteered geographic information. In *Paper presented at the proceedings of the international AAAI conference on web and social media*. Michigan, USA: University of Michigan.

Howe, J. (2006). The rise of crowdsourcing. *Wired Magazine*, *14*(6), 1–4. Retrieved https://sistemas-humano-computacionais.wdfiles.com/local–files/capitulo%3Aredes-sociais/Howe_The_Rise_of_Crowdsourcing.pdf

Jarvis, R. M., Breen, B. B., Krageloh, C. U., & Billington, D. R. (2015). Citizen science and the power of public participation in marine spatial planning. *Marine Policy*, *57*, 21–26. https://doi.org/10.1016/j.marpol.2015.03.011

Jiao, X., Pouliot, M., & Walelign, S. Z. (2017). Livelihood strategies and dynamics in rural Cambodia. *World Development*, *97*, 266–278. https://doi.org/10.1016/j.worlddev.2017.04.019

Johannes, E. M., Zulu, L. C., & Kalipeni, E. (2015). Oil discovery in Turkana County, Kenya: A source of conflict or development?. *African Geographical Review*, *34*(2), 142–164. https://doi.org/10.1080/19376812.2014.884466

Kim, E. K. (2018). Sector-based vote choice: A new approach to explaining core and swing voters in Africa. *International Area Studies Review*, *21*(1), 28–50. https://doi.org/10.1177/2233865917742066

Kurniawan, M., & De Vries, W. T. (2015). The contradictory effects in efficiency and citizens' participation when employing Geo-ICT apps within local government. *Local Government Studies*, *41*(1), 119–136. https://doi.org/10.1080/03003930.2014.937001

Kytta, M., Broberg, A., Tzoulas, T., & Snabb, K. (2013). Towards contextually sensitive urban densification: Location-based softGIS knowledge revealing perceived residential environmental quality. *Landscape and Urban Planning*, *113*, 30–46. https://doi.org/10.1016/j.landurbplan.2013.01.008

Li, L., Goodchild, M. F., & Xu, B. (2013). Spatial, temporal, and socioeconomic patterns in the use of Twitter and Flickr. *Cartography and Geographic Information Science*, *40*(2), 61–77. https://doi.org/10.1080/15230406.2013.777139

Lujala, P., Brunnschweiler, C., & Edjekumhene, I. (2020). Transparent for whom? Dissemination of information on Ghana's petroleum and mining revenue management. *The Journal of Development Studies*, *56*(12), 2135–2153. https://doi.org/10.1080/00220388.2020.1746276

Maconachie, R. (2016). The extractive industries, mineral sector reform and post-conflict reconstruction in developing countries. *The Extractive Industries and Society*, *3*(2), 313–315. https://doi.org/10.1016/j.exis.2016.03.004

Mashhadi, A., Quattrone, G., & Capra, L. (2013). Putting ubiquitous crowd-sourcing into context. *Paper presented at the Proceedings of the 2013 conference on Computer supported cooperative work*. New York, NY: Association for Computing Machinery.

Matey, J. (2020). The effect of Free Senior High School policy on the lives of parents and wards in Ghana. *International Research Journal of Multidisciplinary Scope (IRJMS)*, *1*(SI–2), 27–36. https://doi.org/10.47857/irjms.2020.v01si02.038

McCall, M. K., & Minang, P. A. (2005). Assessing participatory GIS for community-based natural resource management: Claiming community forests in Cameroon. *Geographical Journal*, *171*(4), 340–356. https://doi.org/10.1111/j.1475-4959.2005.00173.x

McKinley, D. C., Miller-Rushing, A. J., Ballard, H. L., Bonney, R., Brown, H., Cook-Patton, S. C., Evans, D. M., French, R. A., Parrish, J. K., Phillips, T. B., Ryan, S. F., Shanley, L. A., Shirk, J. L., Stepenuck, K. F., Weltzin, J. F., Wiggins, A., Boyle, O. D., Briggs, R. D., Chapin, S. F., Preuss, P. W., & Soukup, M. A. (2017). Citizen science can improve conservation science, natural resource management, and environmental protection. *Biological Conservation*, *208*, 15–28. https://doi.org/10.1016/j.biocon.2016.05.015

Miao, C. Y., Yu, H., Shen, Z. Q., & Leung, C. (2016). Balancing quality and budget considerations in mobile crowdsourcing. *Decision Support Systems*, *90*, 56–64. https://doi.org/10.1016/j.dss.2016.06.019

Ministry of Finance. (2018). *2017 reconciliation report on the petroleum holding fund submitted to Parliament*. Retrieved https://www.mofep.gov.gh/index.php/publications/petroleum-reports?page=1

Ministry of Finance. (2019). *2018 reconciliation report on the petroleum holding fund submitted to Parliament*. Retrieved https://www.mofep.gov.gh/index.php/publications/petroleum-reports?page=1

Ministry of Finance. (2020). *2019 Reconciliation report on the petroleum holding fund submitted to Parliament*. Retrieved https://www.mofep.gov.gh/index.php/publications/petroleum-reports?page=1

Ministry of Youth and Sports. (2010). *National youth policy of Ghana*. Retrieved http://www.ilo.org/dyn/natlex/docs/ELECTRONIC/92297/107410/F-387470778/GHA92297.pdf

Mohammed, A. K. (2020). Does the policy cycle reflect the policymaking approach in Ghana?. *Journal of Public Affairs*, *20*(3), e2078. https://doi.org/10.1002/pa.2078

Mohammed, A. K., & Kuyini, A. B. (2020). An evaluation of the Free Senior High School policy in Ghana. *Cambridge Journal of Education*, *51*(2), 143–172. https://doi.org/10.1080/0305764x.2020.1789066

Moon, K., Marshall, N., & Cocklin, C. (2012). Personal circumstances and social characteristics as determinants of landholder participation in biodiversity conservation programs. *Journal of Environmental Management*, *113*, 292–300. https://doi.org/10.1016/j.jenvman.2012.09.003

Nyamekye, A. B., Dewulf, A., Van Slobbe, E., & Termeer, K. (2020). Information systems and actionable knowledge creation in rice-farming systems in Northern Ghana. *African Geographical Review*, *39*(2), 144–161. https://doi.org/10.1080/19376812.2019.1659153

Ofori, J. J. Y., & Lujala, P. (2015). Illusionary transparency? Oil revenues, information disclosure, and transparency. *Society & Natural Resources*, *28*(11), 1187–1202. https://doi.org/10.1080/08941920.2015.1024806

Ogbe, M., & Lujala, P. (2021). Spatial crowdsourcing in natural resource revenue management. *Resources Policy*, *72*, 102082. https://doi.org/10.1016/j.resourpol.2021.102082

Okolloh, O. (2009). Ushahidi, or 'testimony': Web 2.0 tools for crowdsourcing crisis information. *Participatory Learning and Action*, *59*(1), 65–70. Retrieved https://pubs.iied.org/pdfs/14563IIED.pdf#page=67

Osei, A. (2013). Party system institutionalization in Ghana and Senegal. *Journal of Asian and African Studies*, *48*(5), 577–593. https://doi.org/10.1177/0021909612465720

Peprah, P., Budu, H. I., Agyemang-Duah, W., Abalo, E. M., & Gyimah, A. A. (2020). Why does inaccessibility widely exist in healthcare in Ghana? Understanding the reasons from past to present. *Journal of Public Health*, *28*(1), 1–10. https://doi.org/10.1007/s10389-019-01019-x

PIAC. (2017). *Composite report – PIAC's 2017 district engagements & project inspections*. Retrieved https://www.piacghana.org/portal/files/downloads/secretary_reports/composite_report_of_2017_abfa_project_inspections.pdf

PIAC. (2020). *PIAC 2019 annual report*. Author. https://www.piacghana.org/portal/files/downloads/piac_reports/piac_2019_annual__report.pdf

PIAC. (2021). *Our History*. Retrieved https://www.piacghana.org/portal/2/3/history

PRMA. (2011). *Petroleum revenue management act*. Retrieved https://www.mofep.gov.gh/sites/default/files/acts/Petroleum-Revenue-Management-ACT-815.pdf

PRMAA. (2015). *Petroleum revenue management (amendment) act, 2015. Ghana* Retrieved https://www.mofep.gov.gh/sites/default/files/reports/petroleum/PRMA-Amendment-2015.pdf

Salifu, A., & Ayamba, A. (2018). Assessing the Free Senior High School education on science learning in Ghana. *ADRRI Journal of Arts and Social Sciences*, *15*(6), 1–11. Retrieved from https://journals.adrri.org/index.php/adrrijass/article/view/409

Schroeder, S. A., & Fulton, D. C. (2017). Voice, perceived fairness, agency trust, and acceptance of management decisions among Minnesota anglers. *Society & Natural Resources*, *30*(5), 569–584. https://doi.org/10.1080/08941920.2016.1238987

Sefa-Nyarko, C., Okafor-Yarwood, I., & Boadu, E. S. (2021). Petroleum revenue management in Ghana: How does the right to information law promote transparency, accountability and monitoring of the annual budget funding amount? *The Extractive Industries and Society, 8*(3), 100957. https://doi.org/10.1016/j.exis.2021.100957

Stephens, M. (2013). Gender and the GeoWeb: Divisions in the production of user-generated cartographic information. *GeoJournal*, *78*(6), 981–996. https://doi.org/10.1007/s10708-013-9492-z

Stephens, T. K. (2019). Framework for petroleum revenue management in Ghana: Current problems and challenges. *Journal of Energy & Natural Resources Law*, *37*(1), 119–143. https://doi.org/10.1080/02646811.2018.1485269

Tamanja, E. M. J., & Pajibo, E. D. (2019, July 3). Ghana's Free Senior High School policy: Evidence and insight from data. In *Paper presented at the EDULEARN19 conference.* Palma, Mallorca, Spain: IATED Academy.

To, H., Fan, L., Tran, L., & Shahabi, C. (2016, April 21). Real-time task assignment in hyperlocal spatial crowdsourcing under budget constraints. In *Paper presented at the 2016 IEEE international conference on Pervasive Computing and Communications (PerCom).* NSW, Sydney: IEEE.

To, H., Ghinita, G., & Shahabi, C. (2014). A framework for protecting worker location privacy in spatial crowdsourcing. *Proceedings of the VLDB Endowment*, *7*(10), 919–930. https://doi.org/10.14778/2732951.2732966

Tufte, E. R. (1983). *The visual display of quantitative information* (16, illustrated, reprint ed. Vol. Second ed.). Graphics Press.

Walden-Schreiner, C., Leung, Y. F., & Tateosian, L. (2018). Digital footprints: Incorporating crowdsourced geographic information for protected area management. *Applied Geography*, *90*, 44–54. https://doi.org/10.1016/j.apgeog.2017.11.004

Yeboah, T., Owusu, L., Arhin, A. A., & Kumi, E. (2015). Fighting poverty from the street: Perspectives of some female informal sector workers on gendered poverty and livelihood portfolios in Southern Ghana. *Journal of Economic and Social Studies, 5*(1), 239. https://doi.org/10.14706/JECOSS11511

Zhao, Y. J., & Han, Q. (2016). Spatial crowdsourcing: Current state and future directions. *IEEE Communications Magazine*, *54*(7), 102–107. https://doi.org/10.1109/MCOM.2016.7509386