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Mobile Spamming in Nigeria: An Empirical Survey

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Abstract—Spamming has attained a global dimension and continued to maintain an upward trend, both in sophistication and frequency. And, so far, it has defied every effort, including technical and non-technical proposals, to curb it. This study seeks to investigate the prevalence of spam SMS, with focus on Nigeria. To quantify the prevalence, primary data was collected using questionnaire. Out of 270 surveyed, the responses of 191 mobile users were valid and analyzed. The study revealed that all mobile subscribers receive spam SMS, receiving an average of 2.45 spam SMS daily. This implies an average of 334,857,685 spam SMS received daily in Nigeria. However, most are for commercial purposes. Few mobile users report cases of fraudulent spam SMS, including those with SMSing intent, to network providers or security agencies. Most believe customers of mobile networks should reserve the right to determine the type of unsolicited SMS to be received, and unsolicited advertorial/promotional SMS should be regulated. Current guidelines and regulations need to be reviewed, to effectively manage spamming activities in Nigeria

Keywords—Spam, SMS, Unsolicited, Mobile, Telecommunication, Spam Detection

I. INTRODUCTION

Since the turn of the century, there has been a drastic growth in the wireless communication industry, as there is a clear shift from the fixed telephone system to the more flexible but robust wireless mobile communication. An announcement made by the International Telecommunications Union (ITU) opined that the number of active cell phones would reach 7 billion by 2014 [1]. Nigeria, a developing country, has witnessed a much more agile development in the mobile industry. By 2012, it had over 110 million subscribers, and was ranked as the tenth country with the highest number of mobile telephony subscribers [2].

GSM growth in Nigeria has continued to maintain an upward trend. The number of subscribers, from 2007, just within a 7 year span, more than tripled [3]. Corresponding to the increase in mobile users in the country is increment in mobile users' activities which include, but not limited to, sending and receiving messages, making calls, sending and receiving emails, accessing the internet, and download applications. Because of its robustness, flexibility, and affordability, mobile communication in the country has attracted a whole lot of benefits. However, the country has had

her share of setbacks associated with mobile telecommunication. One of these is sending unsolicited short messages (SMS) in bulk quantity to many mobile users, also known as SMS spamming.

There are varying definitions of spamming, with no one definition generally acceptable. As a result, definitions applicable in Australia differ from that of the European Union and United States. According to [4], spamming is an unsolicited electronic message which includes, but is not limited to emails, short messaging service (SMS), Voice over IP (VoIP), instant messages from chats. Usually, spam is sent in bulk for commercial or other purposes, and indiscriminately. Also, the messages sent are often identical.

Spamming has become a gigantic problem to almost all sectors of the economy, causing loss of revenue to internet service providers (ISP), and users of these facilities generally. Due to its anonymous nature, spammers are often protected from being held responsible for their actions, as it is always difficult to identify them [5].

Many studies have been devoted to different aspects of mobile spamming, including detection and filtering [6], [7], [8], [9]; mitigation [10]; and spam laws and regulations [11], [12], [13]. Only very few have focused on quantitative and/or qualitative assessment of the state of mobile spamming [14]. As far as we know, only two studies have provided sparse information on the state of mobile spamming in Nigeria: [3] and [15]. In both surveys, spamming was not the primary focus. We therefore pose the following questions: how prevalent is SMS spam in Nigeria's mobile telecommunication sector? What categories of SMS spam are most prevalent? Have mobile users been experiencing SMS spam with fraudulent intentions? What are mobile users' perceptions on regulation of the sector?

The aim of this study is to investigate the prevalence and nature of SMS spam in Nigeria's mobile telecommunication sector. Khong [13] highlighted the fact that the issue of spam is not all about contents. The fact that spam is undesirable to its recipients, and could constitute considerable overheads for service providers, necessitates relevant studies to measure its prevalence. This could aid relevant regulatory bodies in developing appropriate containment measures.

Other sections of this paper are organized as follows: In section 2, we present a review of related literatures. In section 3, we describe the research methodology. The results are presented in section 4. In section 5, the results are discussed, and finally, the study is concluded in section 6.

II. LITERATURE REVIEW

A. Short Message Service (SMS)

Short Message Service (SMS) is a type of mobile communication system that utilizes the use of standardized protocols for exchange of text messages between mobile devices [16]. SMS is usually a maximum of 160 characters and is sent wirelessly to another mobile device user.

When a user sends a mobile SMS from his device, the message goes to the Short Message Service Centers (SMSC) [17]. The SMSC is usually maintained by the mobile network operator, and sends a message of maximum payload of 140 octet, thereby making the SMS maximum number of characters to be 160. Email-based SMS are directed to the SMS-gateway, otherwise known as the SMSG. The SMSG on receiving the email-based SMS, routes it to the SMSC, which then sends it to the receiver device.

The SMSC operates either through a store and forward or a forward and forget method. It also utilizes Home Location Registry (HLR) to retrieve information about the receiving device Message Service Centre (MSC), through which it delivers the message to the recipient.

Texting, otherwise known as Short message service (SMS), has become a popular means of mobile communication. Mobile subscribers send in excess of 200,000 SMS text messages every second [18]. For example, over 500 million SMS were sent to celebrate the New Year in France [19].

An increasing bandwidth for communication and a relatively low cost of sending SMS has been one of the major factors for its popularity [20]. According to Portio research, SMS usage was worth 200 billion dollars as at year 2011, and is estimated to surpass \$300 billion at the end of 2014 [16].

Another factor that has helped to increase SMS adoption is the relative level of trust and acceptance around the world that sending of SMS via mobile phones engenders. For instance, some financial institutions adopt its use even for payment authorization [21]. Many organizations have adopted using SMS for mobile advertising to inform its consumers of products and services appropriately. Unfortunately, spammers have been leveraging on these factors to exploit mobile users.

B. SMS Spam

Aside from being sent from mobile devices, spam short messages have similar features with spam emails: they are unsolicited for by the receiver, sent for commercial or financial purposes, and are sent indiscriminately in bulk form [17]. They could also be utilized for malicious purpose [10]. Due to the personal nature of mobile devices, SMS spam messages coming in will always draw the attention of the user, who is forced to open such messages, thereby intruding into

such user's privacy. And the fact that some mobile telephone operators charge users for receiving messages only helps to compound the frustration experienced by users.

Generally, spam messages users receive on their mobile devices can be said to emanate from three major sources, viz. mobile network operators and groups that have paid the mobile network operator, groups that do not pay the mobile network operator yet send spam SMS, and user-originated messages that are inconvenient to the receiver [20].

According to [21], depending on the intention of the spammer, mobile messaging attack can be said to be of three major types: SMS spam, premium rate fraud, and SMShing.

- SMS spam is such that unsolicited messages are indiscriminately sent to mobile subscribers for advertising hoax. In Nigeria, such SMS's encourage one to forward a message to all of his contacts, in order to get some airtime. For example, "MTN national protocol is celebrating his birthday today. Send this message to 15 people and get N750 recharge card.sms is free." Messages similar to this have also become very common on social media sites.
- Premium rate frauds are spam messages that trick mobile network users to call some certain numbers where they could be defrauded, or are made to make expensive subscriptions that are billed from their account. An example of such fraudulent SMS received from an MTN Nigeria line reads:

LACASERA DRINK:congrats!you emerged winner of #300,000 from our 10th annual promotion code No 🍀(MTN3).Call MR LARRY ON 08131921656 FOR CLAIMS.

- SMShing is the mobile form of phishing where baits are embedded in text messages to extract mobile users' personal information. This personal information is then used for purposes ranging from adverts to fraudulent activities. An example of a smishing SMS: "MASTERCARD ALERT: Your CARD starting with 5110 has been DEACTIVATED. Please contact us at 361-400-xxxx." A mobile device user that calls the number in the SMS is answered by an automated machine, which then extracts information from the user. Other types include links that directs the user to a website where personal information is requested.

C. SMS Spam in Nigerian and Other Countries

Cheaper SMS cost and increasing profit on spam messages have led to high rise in spam messages emanating from the United States. A research by [22] reports that 79% of Americans with a mobile phone send and receive SMS on their phones, and 69% of all mobile text senders claim that they receive unsolicited and unwanted messages on their mobile device. An analysis of all the types of spam sent in the United States and United Kingdom is shown in Fig. 1 [23].

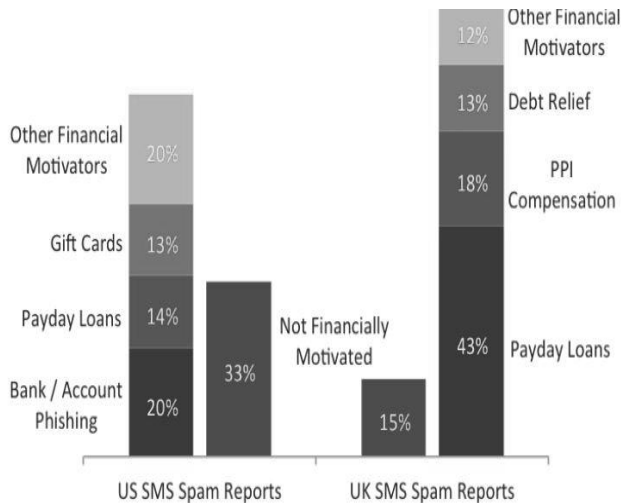


Fig. 1. Categories of Spam Messages received in the UK and USA in 2013

About 67% of the spam messages received in the United States used money as their pitch, with only 33% not financially motivated. Phishing forms the most observed motivation of attackers. On the other hand, in the UK, it was payday loans. Payday loans only accounted for 14% of SMS spam in the US.

A survey conducted on behalf of the Direct Marketing Association (DMA) in 2012 reported that about 9 million spam mobile messages are received every day in the UK [24], [25]. This implies that over 3.29 billion spam messages were sent in the year 2012 in the UK alone. The increasing nature of spam in the UK has reduced users' trust in the security of their mobile devices. At least 19.1% of respondents in a survey admitted that SMS is less secure; a phenomenon attributed to the increase in SMS spam [26]. In most western countries, mobile subscribers view SMS spam as an intrusion to their privacy, thereby causing them to call the network operators for complaints.

The menace of SMS spam is becoming increasingly prevalent also in east countries, including China, Korea, and Japan. A Chinese mobile user, it was reported, experienced more than 8.3 SMS spam weekly [27]. Up to 30% of daily SMS received in Asia are spam [19].

With subscribers running over 120 million, spammers have been able to identify that they could reach more mobile targets in Nigeria. The rate at which Nigerian mobile subscribers have been receiving spam messages are on the increase. A consumer satisfaction survey suggests that 94% of mobile users use SMS in Nigeria, and 77% of the respondents claim to have been receiving SMS spam [28]. Mobile Subscribers in the country have been receiving barrage of different type of unsolicited SMS ranging from network operators' promotions adverts to unsolicited messages urging subscribers to subscribe to a particular type of service. A recent survey by the security firm Gemalto suggests that up to 80% of Nigerians are annoyed when they receive SMS spam on their mobile device [15]. Many Nigerian telecoms consumers have

expressed discontent over the absence, in most of the spam messages, of option to opt out.

D. Guidelines, Regulations, and Legislations on Mobile Spamming

The incessant spam SMS received by mobile network subscribers had led to the Nigerian Communication commission (NCC), the communication regulatory body of the country, to direct that all mobile network operators will have to comply with the commission's guidelines on bulk messaging. It warned it would not hesitate to wield the big stick on any erring mobile network provider [29]. Currently, there are no comprehensive guidelines or legislations solely developed for regulating spamming activities in Nigeria. However, there are guidelines and regulations, by Nigeria Communications Commission, that indirectly affect these activities. Examples include Guidelines on Advertisements and Promotions [30]; Competition Practices Regulations, 2007 [31]; Consumer Code of Practice Regulations, 2007 [32]; Guidelines on Short Code Operation in Nigeria [33]; and Quality of Service Regulations, 2012 [34]. Others include bills being drafted by the National Assembly, including Cyber Security and Data Protection Agency Bill, 2008 [35], and Cybersecurity Bill, 2011 [36].

A critical analysis of the documents reveals guidelines, regulations, and legislations that address aspects of mobile spamming, including identification of message sender, purpose of communication, pricing and charges, and penalties for offenders. For instance, the Guidelines on Short Code Operation in Nigeria [33] mandate that, for all advertisements, content provider must provide information displaying its name, telephone numbers and contact details. In addition, all terms and conditions, including pricing information; and whether service is or is not a subscription, must be clearly displayed. The Consumer Code of Practice Regulations [32] emphasizes that the purpose of the communication must equally be added at the beginning of the communication. The Guidelines on Advertisements and Promotions [30] emphasized the aspect of pricing and charges more clearly. This document, which specifies minimum standards and requirements for advertisements and applications for promotions stipulates an unambiguous communication of prices and financial implications, and "no hidden or disguised price adjustments, discounts, unrealistic price comparisons or exaggerated claims as to worth or value." In addition, as contained in Part II of the Consumer Code of Practice Regulations, 2007 [32], the service provider is expected to provide information regarding frequency of charges, and the subjectivity of such charges to change from time to time.

In recognition of mobile users' rights, the Commission mandates service providers to provide mechanisms for users to subscribe or discontinue subscription to their services. This regulation is contained in two of the documents. In [33], service providers are required to display consumer right to 'opt in' or 'opt out' of service, promotion, or programme regardless of whether such is subscription based or not. The equivalent regulation in [34] specifically addresses unsolicited

messages. Service providers are mandated to provide option to recipients to ‘opt out’ of receiving unsolicited messages.

While the existing documents clearly relate to service providers within the country, it is not impossible for spammers to use external sources – means and providers outside the country. To mitigate spamming via external sources, NCC requires service providers to “make reasonable effort to identify and block or filter bulk, unsolicited and offensive messages from other sources” [34].

As a way of deterrent to potential offenders, some documents include penalties for erring service providers or communication sources. For instance, for advertisements, according to [30], non-provision of required information or provision of false or misleading information attracts a fine of ₦1,000,000 per violation. A fine of not less than ₦500,000 or imprisonment of not less than 3 years or both, for any person sending spam electronic mail messages to recipients with whom there is no prior commercial or transactional relationship is proposed in [35]. On the other hand, [36] recommends a minimum fine of ₦10,000,000 or a term of 5 years in prison or both fine and imprisonment, if the message is fraudulent.

Unfortunately, the level of compliance with these existing regulatory guidelines has been very low; senders of unsolicited SMS have continued to flout the provisions. For instance, NCC declared early in 2014 that mobile network operators should restrict sending of unsolicited messages on the networks to between 8.00 am and 8.00 pm [37]. However, this has not proved effective as mobile subscribers still receive unsolicited SMS even during these restricted periods. On June 8, 2015, one of the authors received a message from MTN (with the sender code ‘MTNN’):

*Hello, Oluwafemi, Esther has sent you a message on Facebook. Dial *510*55# to check Facebook messages without internet charges*

The first impression of the recipient, as a result of the clause “without internet charges,” was that the service was free. However, upon dialing the supplied number, the network responded with the message:

*Yello! You have successfully subscribed to Facebook Weekly. You have been charged N25.00 for 7 Days. To use the service dial *510#.*

The first message, obviously, falls short of the minimum standard set by most of the guidelines and regulations. Whilst displaying the purpose of communication, the message did not disclose, in clear terms, information on terms and conditions, including charges, frequency of charges; and did not provide any option for the recipient to ‘opt out.’

The above scenario is an example of what has become typical of network operators and other service providers in Nigeria. They are generally indifferent to consumers’ rights, and not much is being done to correct the menace. There have been instances where advertisers used flash SMS [10]. Once a recipient presses any key on the mobile device, such mobile

user is automatically subscribed to the service being advertised.

From the foregoing, it is evident that relevant regulating agency must awaken to their enforcement responsibility. Part of the recommendations contained in the Nigeria Consumer Satisfaction Survey Final Report (Part 1) [28] was directed to the NCC. The recommendations include encouraging operators to provide options to opt out from receiving SMS spam, and clearly publicize the procedures for opting out; showing efforts being made to identify, block and filter spam messages; providing a platform for receiving unsolicited messages forwarded by mobile users; collaborating with each other to share best practices; and putting mechanism in place to analyze the unwanted messages received, making every effort to identify the senders, and taking appropriate action.

E. Theoretical Framework

This study is located around two inter-twined theoretical concepts: privacy and personal information as commodity. Privacy has been defined informally as the ‘right to be let alone’ [38]. Jerry [39] described privacy from the perspective of space, decision, and information. Leppaniemi & Karjaluoto [40] highlighted some six C’s of privacy that every user should be entitled to: choice, control, constraint, customization, consideration, and confidentiality.

While some view privacy as a right, it is seen as commodity by others. Personal information privacy has even been viewed as a property right [41], [42]. For the privacy-as-commodity group, privacy is not the absolute right of anyone, but dependent on cost-benefit analysis and compromise [43]. For instance, while some countries view privacy as fundamental individual right, information privacy within the context of business to consumers was not captured under this fundamentality [44]. With advancements in information technology capabilities, information privacy right is deemed by some to already have vanished [45].

Applying the perspective of [39] in the study’s context, in respect of space, privacy refers to a mobile user’s cyber-domain, including the mobile device and all its resources, harbored from invasions by unwanted externalities. Viewed from a decision point of view, it connotes a user’s individual right or freedom to make decision in the absence of encumbrances. The last concerns the right to mobile information privacy. This form of privacy puts the use of a mobile user’s information, say, the mobile number, under the full control of the user. Extending privacy-as-a-property-right model to decision privacy, a proprietor should have the exclusive right to exercise control over the use of the property; for example, determining the quantity and type of commercial messages that he wants to receive.

Some have argued spam as a violation of privacy rights [46]. It violates those entitlements described by [40]. Considering the fact that every mobile user has a right to his/her cyber-domain, spam can also be deemed to invade privacy. For instance, whenever a mobile user receives a spam SMS, such user is expected to open the SMS, with the expectation that it came from a sender acquainted with, and in

many cases, read the message. Even if, upon discovering the content to be spam the user deletes immediately the SMS, some significant amount of time had already been expended.

Within the confines of legal norms of the community, spamming is unjustifiable [46]. The mere fact that it is unsolicited makes it unacceptable. Spamming is coercive. It breaks users' autonomy over their personal cyberspace and cyber-possession, making them "captive audience to another's communication" [46]. Spammers invariably metamorphose mobile users' personal information into currency. In other words, spamming turns privacy into commodity [38].

III. METHODOLOGY

A. Participant

To obtain first hand information on mobile user's experience with spam SMS in Nigeria, primary data were collated. In order to collate data that are more representative of the country, it was necessary to consider population in multiple locations. Stratified cluster sampling was used. This method combines elements of stratification and clustering, combining the cost-saving benefit of clustering with the error reduction of stratification. The basis of clustering was the major geographical divisions of the country: north and south. This was necessitated due to the fact that the country is majorly classified along these two regions, with each, in many ways, distinct from the other. Six strata of clusters were then formed based on six geopolitical zones in the country, with three in each of the two main clusters. The clusters in each stratum were states of the federation belonging to each geopolitical zone. Two of the strata were selected for the study, with one selected from each of the two main clusters. From each stratum, two states were picked. This gives a total of four states surveyed.

The research instrument used was questionnaire. 270 questionnaires were distributed. 265 were returned. Out of these, 191 were found to be valid. The invalid ones were due to respondents choosing multiple options where the questions required one option, or not responding appropriately to questions which depended on one or more preceding questions. Those who were not conversant with the term bulk or spam SMS were likewise considered invalid. A mobile user who does not understand what spam SMS is would not be able to complete appropriately the requested information in the questionnaire.

B. Measures

The questionnaire was divided into three parts. The first part covered demographic information, and networks subscribed to. The study essentially focused on users of the four major GSM operators in the country. The second part focuses on analyzing the prevalence and nature of mobile spamming. The last part deals with mobile users' expectations on determining the type of unsolicited advertorial/promotional SMS to be received, and regulation of these categories of SMS.

For the purpose of analysis, both descriptive and inferential statistics were applied on gathered data. The latter

was used to identify relationships among the variables. Essentially, only those relationships with statistical significance are reported.

IV. RESULTS

A. Demographic of Mobile Users

From Table I, 62.3% of respondents were male, while the remaining 37.7% were female. Students accounted for more than half of the respondents, with only 7.9% unemployed.

MTN is the most subscribed to network. Average number of network subscription is 2.04 (SD = 0.9). 24.6% maintain subscription to a minimum of three network operators. 16 of the respondents (0.8%), presented in Fig. 2, were found to be subscribed to all the four GSM operators in the country. 27.9% of respondents are subscribed to only one of the four networks.

B. Mobile Users' Experiences with Spam SMS

All respondents reported they use their phones for sending or receiving text messages, and have also received at one time or the other spam SMS. The average amount of spam SMS received daily was found to be 2.45 (SD = 1.3). Most spam SMS are sent on MTN networks, as presented in Table II, with Airtel as the least used by spammers.

TABLE I. RESPONDENTS' SEX, OCCUPATION, AND SUBSCRIBED NETWORKS COMPOSITION

	Frequency	Percent
Sex		
Male	119	62.3
Female	72	37.7
Total	191	100.0
Occupation		
Student	114	59.7
Employed	62	32.5
Unemployed	15	7.9
Total	191	100.0
Subscribed Mobile Networks		
MTN	145	97.3
Glo	85	57.0
Airtel	90	60.4
Etisalat	70	47.0

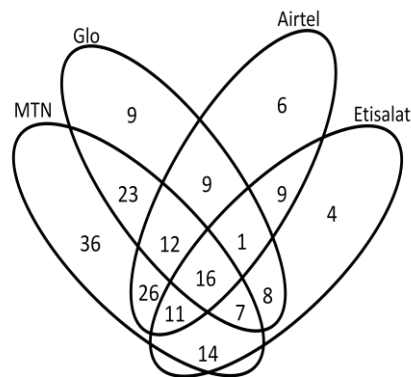


Fig. 2. Venn diagram showing network subscriptions

TABLE II. EXPERIENCE OF MOBILE USERS WITH SPAM SMS

Experience	Frequency	Percent
Number of bulk SMS received on average daily		
1	54	28.3
2	55	28.8
3	45	23.6
4	19	9.9
5	15	7.9
6	3	1.6
Total	191	100.0
Network on which spam SMS is most received		
MTN	109	57.1
Glo	33	17.3
Etisalat	30	15.7
Airtel	19	9.9
Total	191	100.0
Content of spam SMS most received		
Advertorial	74	38.7
Promotional	74	38.7
Invitational	17	8.9
Congratulatory	24	12.6
Fraudulent	2	1.0
Total	191	100.0
Respondents sending spam SMS		
Yes	83	43.5
No	108	56.5
Total	191	100.0

Spam SMS in Nigeria is mostly used for commercial purpose. Most respondents reported unsolicited mobile messages received are mostly either advertorial or promotional. Only 1% indicated the most dominant were fraudulent messages.

Most mobile users do not engage in sending spam SMS. The study found out being a spammer increases the likelihood of receiving a minimum of three spam SMS daily by 92.8% ($\chi^2(1) = 18.394$, $p = 0.002$). Specifically, 59% of mobile users who send spam SMS receive on average a minimum of three spam SMS daily. Only 30.6% of those who have never sent spam SMS reported getting this minimum daily.

From Table III, the study reveals that most mobile users seem to receive unsolicited advertorial and promotional messages more from their network providers than other sources..

Being unemployed was found to significantly increase the likelihood of receiving unsolicited advertorial/promotional SMS from other sources than network providers ($\chi^2(1) = 6.563$, $p = 0.038$). Specifically, all the unemployed mobile users were found to have received this type of spam SMS, compared to 71.1% of those who were students, and 79.0% of employed mobile users.

Even though most respondents receive spam SMS on their MTN network, the study found out that the percentage of those who receive spam advertorial/promotional SMS from sources other than their network providers is most on Etisalat network ($\chi^2(1) = 9.549$, $p = 0.023$).

TABLE III. EXPERIENCE WITH ADVERTORIAL AND PROMOTIONAL SPAM SMS

Experience	Frequency	Percent
Unsolicited advertorial/promotional SMS from network provider		
Yes	175	91.6
No	16	8.4
Total	191	100.0
Unsolicited advertorial/promotional SMS from other sources		
Yes	145	75.9
No	46	24.1
Total	191	100.0

C. Mobile Users' Experiences with Spam SMS with Fraudulent Contents

Despite the fact that spam SMS are predominantly used for commercial purpose in Nigeria, most mobile users receive fraudulent messages. As presented in Table IV, 78% reported they have received messages that were fraudulent. Among these, 69.1% disclosed the fraudulent messages requested for their personal details. Those involved in sending spam SMS were more likely to receive fraudulent messages by 16.8% ($\chi^2(1) = 4.112$, $p = 0.043$).

Surprisingly, only 20.8% of those who received fraudulent message did make effort to report to network provider ($\chi^2(1) = 0.02$, $p < 0.001$). However, a little higher, 25.2%, of those whose received fraudulent message requested for their personal details, actually reported to network provider ($\chi^2(1) = 0.02$, $p < 0.001$).

While few users report fraudulent messages received on their mobile phones to their network provider, fewer users made effort to report to security agency.

D. Mobile Users' Expectations

Majority of users believe mobile subscribers should be given the right to determine the type of unsolicited SMS they wish to receive. Almost the same percentage of respondents

TABLE IV. EXPERIENCE WITH FRAUDULENT SPAM SMS

Experience	Frequency	Percent
Received fraudulent SMS		
Yes	149	78.0
No	41	21.5
No response	1	0.5
Total	191	100.0
Fraudulent message requiring sending of personal details		
Yes	103	69.1
No	46	30.9
Total	149	100.0
Reported fraudulent message to network provider		
Yes	31	20.8
No	118	79.2
Total	149	100.0
Reported fraudulent message to security agency		
Yes	4	2.7
No	145	97.3
Total	149	100.0

TABLE V. USERS' EXPECTATIONS

Expectation	Frequency	Percent
Need for customers' right to determine unsolicited SMS to be received		
Yes	170	89.0
No	21	11.0
Total	191	100.0
Need for regulation of unsolicited advertorial/promotional SMS		
Yes	169	88.5
No	21	11.0
No response	1	0.5
Total	191	100.0
Need for regulation to be undertaken by a monitoring body		
Yes	161	84.3
No	30	15.7
Total	191	100.0

agrees on the need for regulation of unsolicited advertorial and promotional SMS, and that the regulation should be undertaken by a monitoring body.

V. DISCUSSION

This study sought to investigate the prevalence and nature of SMS spam in Nigeria's mobile telecommunication sector. From the study, an average mobile user is subscribed to a minimum of 2 networks. And most respondents use MTN network.

A crucial finding of this study is that all mobile subscribers in Nigeria receive SMS spam, either from network providers or other sources. This implies an increase of 29.9% compared to data obtained in 2012. As at 2012, only 77% were receiving the unsolicited mobile messages [28]. Most receive between one to three unsolicited SMS daily; the average number of spam SMS received daily by mobile users from both network providers and other sources was found to be 2.45. The total number of subscribers on the four main GSM networks as at December 2014 was 136,676,606 [47]. Using this average per mobile user, the average number of spam SMS received daily in Nigeria is 334,857,685. This is higher than the average in UK [24], [25].

The study also reveals that MTN network is mostly used by spammers. Specifically, 57.1% of all spam SMS traverses this network. This is not surprising, considering the fact that the network remains the most subscribed to in Nigeria. According to [47], as at December 2014, MTN has 59,893,093 subscribers. The other network operators, Glo, Etisalat, and Airtel, have 28,219,089; 21,103,749; and 27,556,544 respectively.

SMS spam is still mostly utilized for commercial purpose, specifically for advertorial and promotional purposes. Out of every ten spam SMS sent in Nigeria, approximately eight of them are either advertorial or promotional. Surprisingly, these categories of spam SMS come more from network providers than other sources. One possible reason for this development is the competition among the mobile network operators, to increase their subscriber base, and consequently their revenue. Two factors contribute to this completion. The first is decline in revenue. In Nigeria, the telecom industry Average Revenue

Per User (ARPU) has been significantly declining [48]. For instance, from 2000 to 2012, there has been 44.4% drop, from ₦1,800 to ₦1,000 [49]. The other factor is the introduction of number portability in April, 2013. The effects of these are more products and services being developed by MNOs, to improve their revenues. Thus, subscribers' mobile devices are continuously barged with tons of information regarding existing and new products and services. These are in addition to those from other sources, including telemarketers and value-added service providers (VASPs). From observations, there are instances where a mobile user receives in quick succession two or more unsolicited SMS with exactly the same contents from a single source. Unfortunately, mobile users hardly have interest in these messages. Gonzalez [15] reported 65% of mobile users in Nigeria, in a survey, indicated they received promotional messages of no personal interest.

While all mobile users in Nigeria receive unsolicited SMS, most do not send spam. Only 43.5% indicated they send unsolicited messages. One interesting discovery in the study is the increase in likelihood by 92.8% of a mobile user receiving spam SMS if the user is a spammer, compared to when he is not. 59% of mobile users who send spam SMS receive daily more than the average spam SMS received in Nigeria. Only 30.6% who do not send spam fall into this category. While there are no studies that established the fact that sending spam increases the likelihood of receiving more spam, one possible explanation is that this type of occurrence could be location-specific. A cluster of population that sends spam SMS can be expected to receive more than those outside the cluster.

Compared to those who are students and employed, the study also reveals that unemployed mobile users receive advertorial and promotional spam SMS most. This can be added to the fact that most unemployed users, in search of jobs, usually submit their profiles, including phone numbers, to different job sites, recruitment agencies, and online fora. Based on the high availability of these mobile numbers online, spammers would easily harvest them.

It is evident that malicious spammers, though still in the minority, are also taking advantage of the growing mobile user base in the country. More than three-quarter, 78% to be precise, reported they have received fraudulent spam SMS. On March 4, 2015, one of the authors received an unsolicited SMS on his MTN network, purportedly sent from +2348110232119, with the content:

Congratulations!!! Your number is among the 15 lucky winners that won N500,000 from the ongoing GUNNESS CHOOSING NAIRA BET. Your Winning ticket number is (0103) Call Mr johnpaul on 08063999018 for claims....

In 2014, the average percentage subscriber growth for the four main GSM operators was 3.06 [47]. The implication of this is that fraudulent spam SMS are bound to become more prevalent, as are the cases already in US and UK [23].

Unfortunately, less people are reporting cases of fraudulent messages to either network providers or security agencies. 79.2% did not report to their network providers, and almost

all, 97.3%, to the security agencies. The study found out users were slightly more interested in reporting fraudulent messages with SMSing intent. Most mobile users are reluctant to report fraudulent messages to either network provider or security agencies, due to perceived waste of time and effort of such venture. For instance, in the 2012 Nigeria Consumer Satisfaction Survey Final Report (Part 2) [50], 64.0% reported they never made any complaint in the preceding year. 14.5% made complaint only once. When asked about the nature of last complaint, SMS-related complaints accounted for only 5.7% of total complaints. In Nigeria, consumer protection index is very low. When reports are made, most often, investigation by the agency concerned is never initiated. In cases where investigation is launched, they are hardly completed.

On the expectations of mobile users in respect of rights to determine type of spam SMS to be received and need for regulation of the sector, most agreed they should be given the right to determine the type of spam SMS they would love to receive. This is consistent with the finding of [15], in which 86% of mobile users in Nigeria expect messages should be based on their interests and tastes.

Equally, most mobile users expressed the belief that unsolicited advertorial/promotional SMS should be regulated. Most indicated this should be done by a monitoring body apart from the mobile network operators. Current regulations and guidelines have not been adequately effective at regulating service providers who send spam SMS for commercial purpose. In addition, compliance with the guidelines and regulations has been very low. This low compliance with regulations is also experienced in Saudi Arabia [14]. One country, however, which has succeeded in this area of regulation, is India. There, the Telecom Commercial Communications Customer Preference Regulations helps in the regulation of commercial mobile communications [51]. While the regulation permits for sending of transactional messages, receiving of promotional messages are determined by the mobile users. The promotional messages are categorized, and customers can register or deregister their preferences, via SMS or voice call. The regulation also specifies penalties that defaulters are liable to pay.

VI. CONCLUSION

SMS spam has attained a global dimension. And Nigeria is not left out of this reality. The issue of spam had been identified as one of the aspects of services requiring most attention from NCC [28]. Unfortunately, the county is yet to have a legislation or regulation that comprehensively addresses mobile spamming. This study is one of the first studies to provide some insight into the state of SMS spamming in Nigeria. The study revealed that all mobile users in Nigeria have received at one time or the other unsolicited mobile messages, receiving an average of 2.45 daily. In the country, spamming is utilized majorly for commercial purpose: advertorial and promotional messages accounting for most spam messages that traverse the national cyberspace. However, the study also found out that malicious spammers are also leveraging on the continual increase in mobile

adoption in the country. Most mobile users, unfortunately, do not report receiving spam SMS to either network operators or security agencies. Most, however, indicated they should hold the right to decide on the type of spam SMS they want to receive, and agreed on the need for more effective regulation of mobile messaging for marketing purpose. Current recommendations by the government are very limited in scope and potency. There are no guidelines on enforcement. Until more stringent regulations are put in place, MNOs, value added service providers, telemarketers, and other SMS spammers will continue to abuse mobile bulk messaging.

One major limitation of this study is the number of locations covered. In reality, stratified clustering sampling requires sampling from all the strata. However, the study considered only two of the six strata. Due to the fact that rate of spamming could differ from one location to another, sampling from the entire geopolitical zones would have portended higher representativeness of the country.

Providing a comprehensive framework for effectively managing mobile spamming is one research area that could be considered in future studies. There are other areas in respect of mobile spam experience that could further be investigated. It is necessary to know whether senders of spam SMS comply with guidelines set by NCC on actually providing options to opt out of receiving mobile messages, and the level of compliance with the directive to not send message before 8am and after 8pm. Another area worth exploring is mobile users' disposition to spam SMS.

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