Spatial Analysis of Digital Technologies and Impact on Socio – cultural Values in Selected Communities in Nigeria

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Abstract

The objective of this study was to determine the spatial distribution of digital technologies and ascertain whether digital technologies have significant impact on socio - cultural values or not. Moran's index and Getis and Ord's statistic were used for cluster and hotspots analysis. The unique locations of digital technologies were investigated through standard deviational ellipse and standard distance deviation, while, the Chi-square statistic was used for test of significance. The Nigerian 2008 Demographic Household Survey report on counts of households with television and land phone was used. Through systematic sampling, 200 households were investigated within 10 wards in Mopamuro Local Government Area (LGA) of Kogi State, Nigeria. Questionnaires were administered to identify households with television and mobile phone and the impact on socio - cultural values: communal gatherings/meetings, local songs and farming. For television, there was 5-10 % likelihood that the clustered pattern could be a result of random chance. No apparent clustering was detected at this scale for land phone. The concentration of televisions and mobile phones across all communities in Mopamuro LGA was high. At 5% level of significance, results showed that the advent of digital technologies have significant impact on socio - cultural values. The study reveals strong spatial dependence of households with television and mobile phone in Nigeria. The findings should enable the orientation of social transformation

programmes geared towards preserving socio - cultural values through digital technologies.

Keywords: Digital technology, hypotheses tests, impact, socio - cultural values, spatial analysis

Introduction

Digital technologies have brought new approaches to human activities and engagements. Digital technologies have implications on the media, motion picture industry, role of writing and reading in culture, internet ownership, distribution and consumption of cultural and expressive goods namely, literature, music, visual and performing arts, libraries and archives, teaching and learning, users' perceptions and beliefs, level of modernization and everyday life.

For example, the emergence of digital widescreen television represents an exciting and dynamic development. The cultural history of the movie theatre reveals that both cultural forces and industrial imperatives are likely to preserve the theatre. This is despite the threat that it will be substituted for by digital television, with its promise of film like screen size and picture/sound quality. However, instead of digital television emerging as a substitute for the movie theatre, it is much more likely that the motion picture theatre, the movie theatre and computer technologies will interact and transform each other (Corbett, 2001).

The computer is another form of digital technology that has transformed the publishing industry. Kevin (1999) observed profound implications for the role of writing at the simplest level. The deliverable of the author from unwieldy raw material into a form that can, although depending on the skills of the author be a template for the design of a book is greatly affected by digital technology. Such that, the author can now function as a partner further downstream in the entire publishing process, usurping several of the traditional functions of the publisher and changing the dynamics of the publishing relationship. Apparently, digital technology have an immediate and deep impact on how people write, read, listen, view, learn, teach and how art and culture are consumed (John, 1997; John, 2002; Healy, 2002; Tracey et al, 2002; Denzel et al, 2002; Galician, 2004; Clotilde and Maria, 2011; Martine, 2013).

Little is known about how perceptions and beliefs are affected after adopting information technology. Lee et al, (2007) constructed and verified a research model, based on interaction theory and the cultural lens model that focuses on the relationship between users' cultural profiles and post-adoption beliefs in the context of the mobile internet. The results of large scale on-line surveys in Korea, Hong-Kong and Taiwan indicated that four cultural factors namely, uncertainty avoidance, individualism, contextuality and time perception have a significant influence on users' post-adoption perceptions of mobile internet services. Also, Natascha et al, (2009) observed that a country's level of modernization is affected when digital applications are available at the family home. While, Nigel (2011) and Kaul (2012) observed that electronic technologies are reshaping everyday life dramatically.

In the western world, digital revolution is seeping through daily lives, reaching into office spaces by means of telecommunications, email communications, e-books and Skype, into homes via consumer and social websites and computer games and into pockets through credit cards, i-Pods and i-Phones. Therefore, digital technology have brought changes to approaches to communal gatherings and meetings, local songs, businesses, research, social institutions, media literacy movements, instructional processes, production of knowledge and attitude to farming amongst several other societal values in communities and across the globe.

The focus of this study is on the advent of television, land phone and mobile phone in Nigeria. There is a transition from analogue to digital technology and corresponding increase in capacity impacted on diffusion of digital technology since the early nineties (Abid et al, 2001). Thus, the objective of this study is to determine the spatial distribution of digital technologies and ascertain whether digital technologies have a significant impact on socio - cultural values or not. The socio - cultural values to be investigated include communal gatherings/meetings, local songs and farming.

The research questions include: Is the spatial distribution of digital technologies in Nigeria clustered or random? In other words, is there spatial dependence (spill over effects) in the distribution of digital technologies in Nigeria? Is there any significant impact of digital technologies on socio - cultural values? The null hypothesis for the spatial analysis states that the pattern of the spatial distribution of digital

technologies is random. For the test of significance, the null hypothesis states that there is no significant impact of digital technologies on socio - cultural values. The findings should enable the orientation of social transformation programs geared towards preserving socio - cultural values through digital technologies.

Methodology

Research design

The Nigerian 2008 Demographic Household Survey (DHS) report on counts of households with television and land phone was obtained for the 36 states and the Federal Capital Territory. The data consists of counts of households that had or had no digital electronics. The 2008 DHS survey report is available at www.measuredhs.org. Through systematic sampling, 200 households were investigated within 10 wards in Mopamuro Local Government Area (LGA) of Kogi State, Nigeria. Questionnaires were administered using systematic sampling procedure across the 10 wards within the study area. Respondents were interviewed to ascertain whether the advent of digital technologies had any significant impact on socio cultural values: communal gatherings/meetings, local songs and farming. The global positioning system was used to obtain the longitude and latitude of every household that was interviewed on the world geographic coordinate system. The conduct of the 2008 DHS is in furtherance of the National Population Commission's responsibility of collecting, collating, analysing, and disseminating population census and survey data at all levels that contribute to policy formulation and coordination of population activities in the country. Also, the sample survey was conducted by trained enumerators that understood the language of the community. Thus, the data used for this study is reliable.

Methods of data analysis

Moran's index

This global measure of spatial dependence was developed by (Moran 1948). The index measures spatial dependence based on feature locations and attribute values. The measure evaluates whether the pattern is clustered, dispersed or random. When the z - score or p-value indicates statistical significance, a positive Moran's I index value indicates tendency

towards clustering while a negative Moran's I index value indicates tendency toward dispersion.

The Moran's I statistic is structured as a Pearson product moment correlation coefficient, plus W, the contiguity weights matrix. Y is a covariance matrix, that is, the relation between the spatial units is calculated as $(y_i - \bar{y})(y_j - \bar{y})$. The obtained measure is scaled by $\frac{n}{\sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}}\left[\sum_{i=1}^{n}(y_i - \bar{y})^2\right]$.

By convention, $i \neq j$ .As a result, $I = \frac{n}{\sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}} \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}(y_i - \bar{y})(y_j - \bar{y})}{\sum_{i=1}^{n}(y_i - \bar{y})^2}$, $i \neq j$,

where y_i = the value of variable y on segment i, $\bar{y}$ = the mean of variable y, n = the number of segments, w_{ij} = a weight indicating if segment i is connected to segment j (e.g. 1) or if it is not (e.g.0).

Getis and ord's statistic

This statistic developed by (Getis and Ord, 1992) measures the degree of association that results from the concentration of weighted points (or area represented by a weighted point) and all other weighted points included within a radius of distance d from the original weighted point. The basis is now $\Gamma_i = \sum_j W_{ij} Y_{ij}$, $i \neq j$. We assumed an area subdivided into n regions, $i = 1,2,...,n,$ where each region is identified with a point whose cartesian coordinates are known. Each i has associated with it a value y (a weight) taken from variable Y. The variable has a natural origin and is positive.

The statistic is, $G_i(d) = \frac{\sum_{j=1}^{n} w_{ij}(d)\, y_j}{\sum_{j=1}^{n} y_j}$, j not equal to i, where (w_{ij}) is a symmetric one/zero spatial weight matrix with ones for all links defined as

being within distance d of a given i; all other links are zero including the link of point i to itself. The numerator is the sum of all y_j within d of i but not including y_i.The denominator is the sum of all y_j not including y_i.

Standard distance deviation and standard deviational ellipse

The list of latitudes and longitudes produced three measures of concentration for the point distribution which are relevant for the description of unique locations. These measures allow for a description of the spatial variations in the existence of digital technologies, particularly the degree of concentration the mean center, often called the center of gravity; the standard distance deviation, based on the great circle, distance of each point from the mean center and the standard deviational ellipse, which calculates two standard deviations – one along a transformed axis of maximum concentration and one along an axis which is orthogonal.

Chi - square statistic

The Chi - Square statistic compares the tallies or counts of categorical responses between two (or more) independent groups.

$$\chi^2 = \sum \frac{(observedvdue - \exp ectedvalue)^2}{\exp ectedvalue}$$

The chi-square significance test measures the likelihood that the observed association between the independent variable and the dependent variable is caused by chance. In practical terms, a chi - square with low P-value indicates statistical significance, in which case the null hypothesis is rejected.

Results and Discussion

Spatial distribution of television in households across the 36 states and the federal capital territory in Nigeria

Generally, Figure 1 shows that the number of households across the 36 states and the Federal Capital Territory (FCT) of Nigeria that have no television (blue bars) is higher than the number of households that have television (yellow bars). In the South West region: Lagos, Ogun, Oyo, Ondo, Osun states and FCT, Abuja; South South region: Delta and Edo states and South East region: Anambra, Imo and Abia states, the number of

households that own television are greater than the households that do not own television. In the whole of the North East and North West regions, the number of households that do not own television is greater than those that own television. One unique feature about the pattern of distribution of television across the country is the availability in the 36 states and the FCT (see Figure 1).

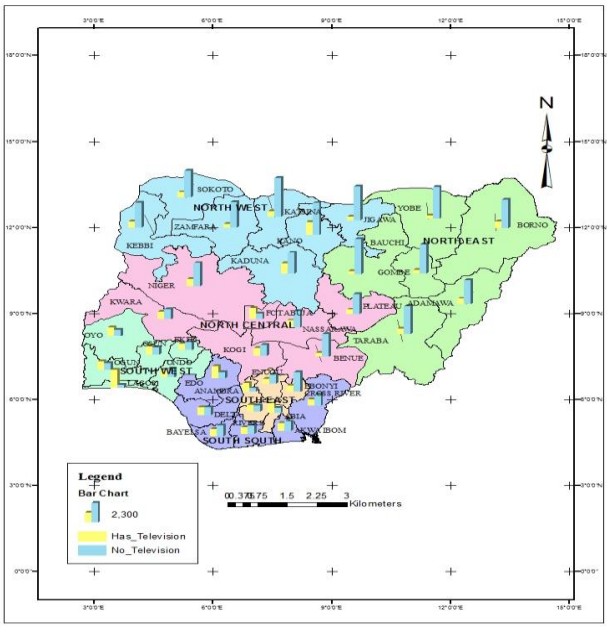

Figure 1: Bar chart displaying distribution of television across Nigeria

Figure 2 shows that most households in all the states (blue bars), including the FCT do not own land phones. This is an indication that the use of land phones is fast being substituted for mobile phones in Nigeria.

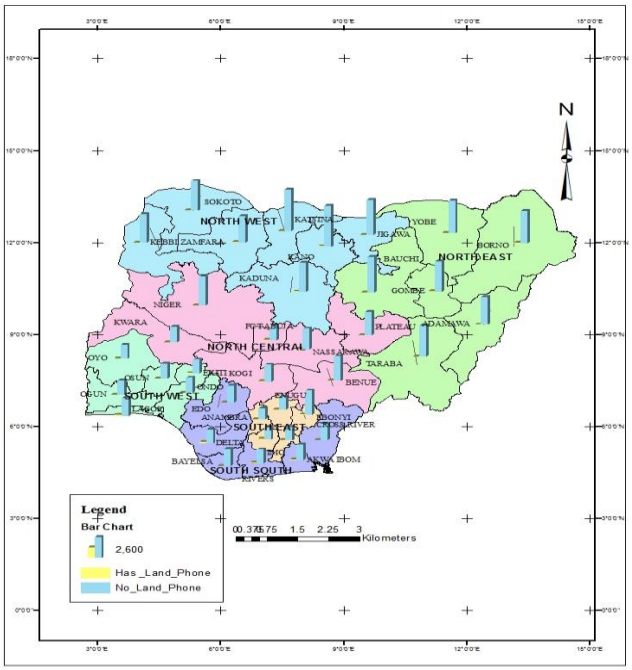

Figure 2: Bar chart displaying distribution of land phone across Nigeria

Spatial dependence of television in households across the 36 states and the federal capital territory in Nigeria

The Moran's I Index, Z score and P value equal 0.14, 1.79 and 0.10 respectively (Figure 3). The G Index, Z score and P value equal 0.12, 1.76 and 0.10 respectively (Figure 4).

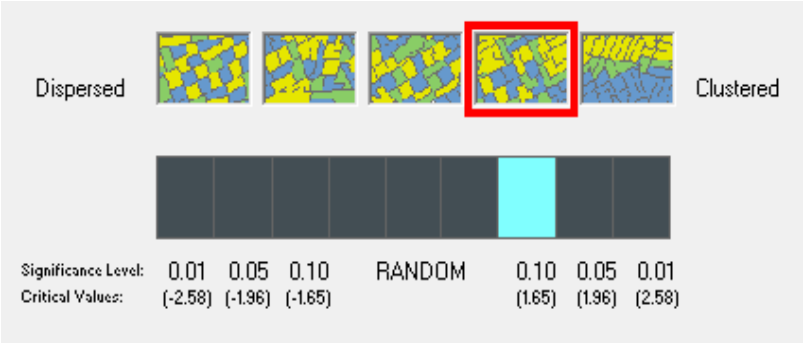

Figure 3: Television Spatial pattern (Global Moran's I)

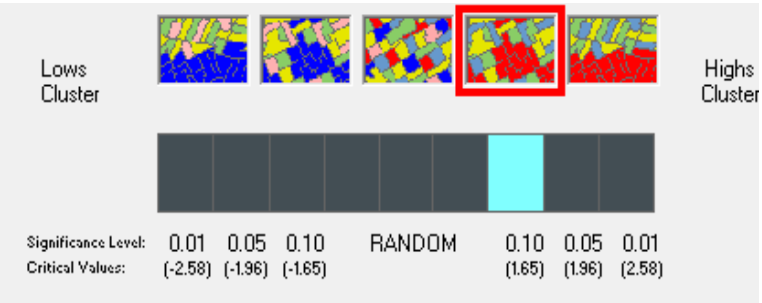

Figure 4: Television spatial pattern (Getis-Ord General G)

There is 5-10% likelihood that this clustered pattern could be a result of random chance. The null hypothesis of randomness was rejected. Therefore, we conclude that the spatial pattern is clustered; there is strong spatial dependence (spill over effects) across the states in Nigeria. This shows that the probability that a household with a television will have a neighbour that also owns a television is high.

Hotspots for television in households across the 36 states and the federal capital territory in Nigeria

Tables 1 and 2 represent the Moran and Getis and Ord concentrations of television respectively. The geographical representations of the hotspots are displayed in Figures 5 and 6. The least concentrations were observed within three geopolitical regions: North East (Gombe, Bauchi and Adamawa States); North West (Zamfara and Sokoto States) and North Central (Plateau and Benue states). These states had fewer households that own televisions when compared to other states in the country.

Table 1: Moran's spatial dependence for television among 36 states and the federal capital territory in Nigeria

Geopolitical Region	State	LMiIndex	LMiZScore	LMi Pvalue	Concentration
South West	Lagos	4.34	3.27	0.001	HH
North West	Kaduna	1.94	2.41	0.016	HH

Key: HH =High High

Table 2: Getis and ord spatial dependence for television among 36 states and the federal capital territory in Nigeria

Geopolitical Region	State	G_i Z Score	G_i P value
South West	Osun	2.70	0.006
South West	Ondo	2.64	0.008
South West	Ogun, Lagos	2.52	0.010
South West	Oyo	2.18	0.030
North West	Kaduna	2.46	0.010

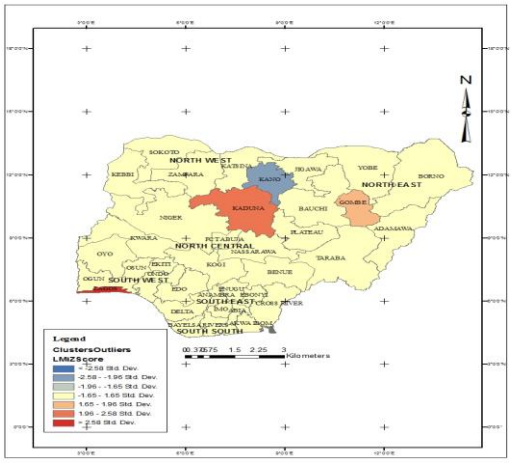

Figure 5: Television hotspots analysis (local moran's I)

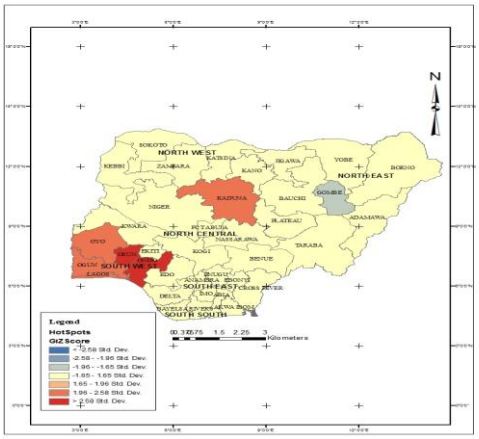

Figure 6: Television Hotspots Analysis (Getis-Ord)

Spatial dependence of land phone in households across the 36 states and the federal capital territory in Nigeria

The Moran's I Index and Z score equal -0.13 and -1.09 respectively (Figure 7). G Index and Z score equal 0.09 and -0.51 respectively (Figure 8). No apparent clustering is detected at this scale. The null hypothesis of randomness is thus not rejected. Therefore, we conclude that the spatial pattern is not clustered. The probability of households having land phones is low.

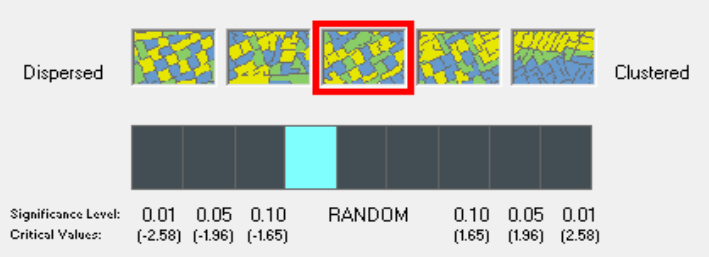

Figure 7: Land phone Spatial pattern (Global Moran's I)

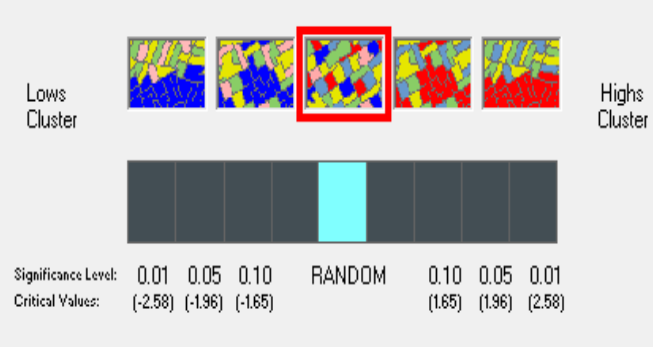

Figure 8: Land phone Spatial pattern (Getis-Ord General G)

Hotspots of land phone in households across the 36 states and the federal capital territory in Nigeria

Tables 3 and 4 represent the Moran and Getis and Ord concentrations of land phone respectively. The geographical representations of the hotspots are displayed in Figures 9 and 10. Low concentration was observed only in North Central region, the FCT – Abuja. There was no concentration for all the 36 states. This provides evidence that

the use of land phone is fast being over taken by mobile phone across the country especially in North Central, South West, North East, South East and South South geopolitical regions.

Table 3: Moran's spatial dependence for land phone among 36 states and the federal capital territory in Nigeria

Geopolitical Region	State	LMiIndex	LMiZScore	LMi Pvalue	Concentration
South West	Lagos	-5.60	-4.06	0.000	HL
North South	Delta	-7.63	-3.77	0.000	HL

Key : HL= High Low

Table 4: Getis and ord spatial dependence for land phone among 36 states and the federal capital territory in Nigeria

Geopolitical Region	State	G_i Z Score	G_i P value
North Central	Abuja	1.68	0.09
South West	Ondo	1.49	0.13
North West	Kaduna	1.19	0.23
North West	Katsina	0.86	0.39

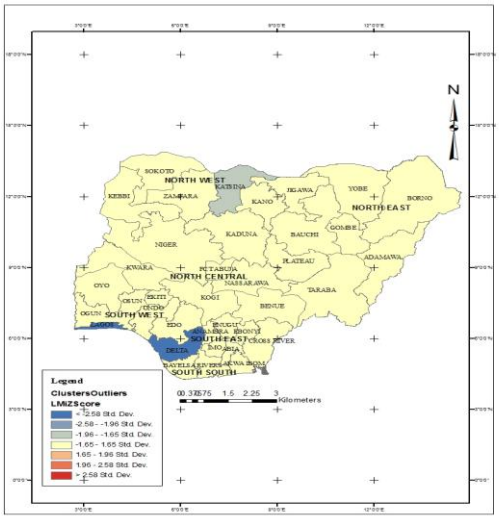

Figure 10: Land phone hotspots analysis (getis-ord G*)

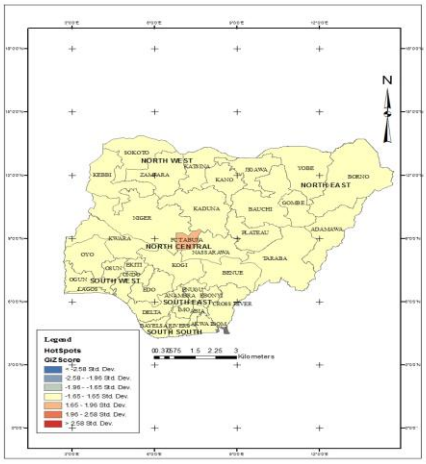

Figure 9: Land phone hotspots analysis (local moran's I)

Unique locations with mobile phone within 10 wards in Mopamuro local government area of Kogi state, Nigeria

The study sample area is shown in Figure 11, Mopamuro LGA in Kogi State within the North Central geopolitical region of Nigeria. Figure 12, shows the unique locations for the households that have television. The mean center is Mopa. The highest concentration of households that have television is within Mopa, Agbele, Amuro, Ilai, Irunda, Okeagi, Takete Ide, Bajogun and Ijagbe.

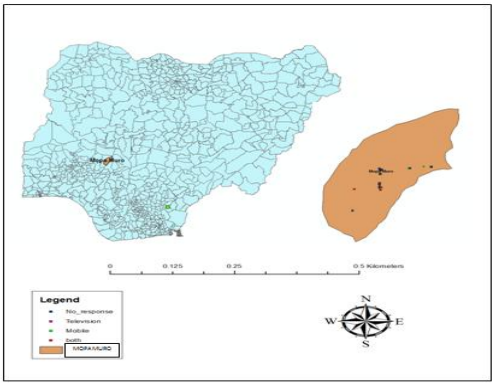

Figure 11: Map of Nigeria indicating the location of Mopamuro Local Government area in Kogi state

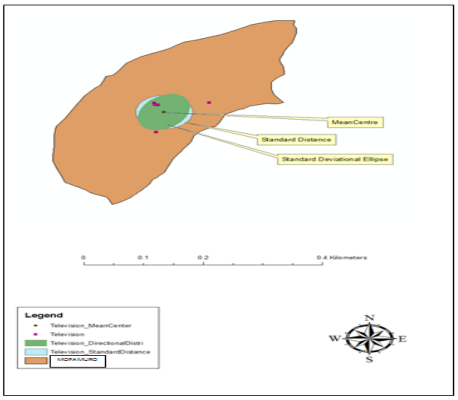

Figure 12: Map of Mopamuro indicating unique locations for households with television

The standard deviational ellipse is a more elegant measure of spatial concentration than the standard distance deviation. The standard distance deviation covers more areas than the standard deviational ellipse. Although, it covers more localities, this measure extends to areas outside the state where the survey was not carried out. The use of mobile phones appears to have totally taken the place of land phones in these communities.

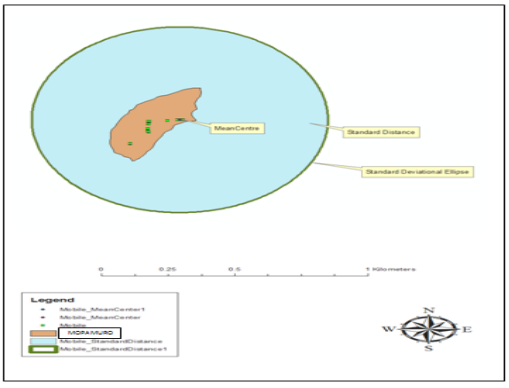

Figure 13: Map of Mopamuro indicating unique locations for households with mobile phones

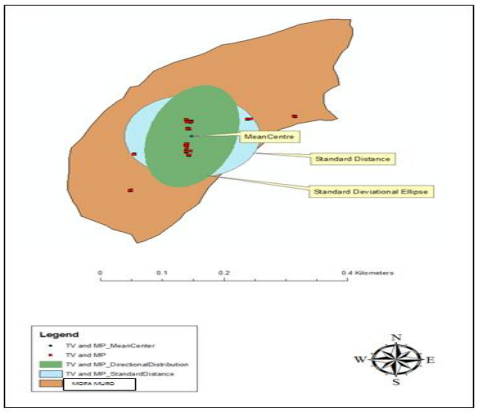

Figure 14: Mopamuro indicating unique locations for households with television and mobile phones

A close look at the standard deviational ellipse and the standard distance deviation in Figure 13 shows a high concentration of mobile phones across all communities in Mopamuro LGA, while, Figure 14 shows the unique locations for households that have both television and mobile phones. The concentration is highest in the following communities Mopa, Amuro, Okeagi, Orokere, Aiyede, Agbele and Ijagbe.

Test of significance on the impact of digital technology on communal gatherings/meetings within 10 wards in Mopamuro local government area of Kogi state, Nigeria

The Chi-square statistic 204.687 had a P-value of 0.000. At 5 percent level of significance the null hypothesis of no significant impact of digital technologies on socio - cultural values was rejected. Therefore, we conclude that the advent of digital technologies have significant impact on communal gatherings/meetings. The use of text messages and phone calls for invitation was observed to have a positive impact on the attendance at communal gathering/meetings. However, findings show that the mobile phones have substituted for family physical contacts. Individuals communicate through mobile phones and the need for visitation was observed to be negatively affected.

Test of significance on the impact of digital technology on local songs within 10 wards in Mopamuro LGA of Kogi state, Nigeria

The Chi-square statistic 22.115 had a P-value of 0.009. At 5 percent level of significance the null hypothesis of no significant impact of digital technologies on socio - cultural values was rejected. Therefore, we conclude that the advent of digital technologies have significant impact on local songs. The television drama/film is gradually taking the place of entertainment through local songs. It was observed that 86.6% of the respondents got entertained through digital technology rather than gather at any place within the community to enjoy local songs.

Test of significance on the impact of digital technology on farming within 10 wards in Mopamuro LGA of Kogi state, Nigeria

The Chi-square statistic 61.481 had a P-value of 0.000. At 5 percent level of significance the null hypothesis of no significant impact of digital technologies on socio - cultural values was rejected. Therefore, we conclude that the advent of digital technologies have significant impact on farming. It was observed that young adults found it more interesting to stay under shades selling recharge cards rather than being actively involved in one of the communities' form of productive employment which is farming. Farming activities do not interest majority of the respondents. This has a negative impact on the populace and may lead to low agricultural outputs from these communities.

Conclusion

The distribution of television in households is across all the 36 states and the Federal Capital Territory in Nigeria, although, the number of households in some states that do not have this digital electronic is generally higher. The spatial pattern is clustered, as a result of the spill over effects; availability of television in households within states across the country depends on the geographical location of the household. The hotspots include households in states in the South West region (Lagos, Osun, Ondo, Ogun and Oyo) and a state in the North West region (Kaduna). Low concentration was prevalent in the North East (Gombe, Bauchi and Adamawa), North West (Zamfara, Sokoto) and North Central (Benue, Plateau). On the contrary, the availability of land phones in households is sparse across all the 36 states and the Federal Capital Territory in Nigeria. The spatial pattern is not clustered. There are no hot

spots. The concentration is tending from high to low in the South West and South South geopolitical regions. For all the other geopolitical regions the concentration of land phone in households is low.

The results from the sample survey suggest high concentration of television and mobile phones in some parts of the communities (Mopa, Amuro, Okeagi, Orokere, Aiyede, Agbele and Ijagbe) within Mopamuro Local Government Area of Kogi State. Not a single household interviewed had a land phone. Ultimately, the advent of these digital technologies has significant impact on socio-cultural values, namely, communal gatherings/meetings, local songs and farming within the sample area.

Invariably, how individuals and communities think about themselves have been greatly influenced and their activities are being reconfigured since the advent of digital technologies. Similar to the works of Kevin (1999), Healy (2002), Lee et al. (2007) and Nigel (2011) association between digital technologies and socio - cultural values was established. Additionally, this study supports the findings of (Healy 2002), (Galician 2004), (Lee et al. 2007) and Martine (2013) and submits that we can successfully determine how to engage our communities in the advent of digital technology. Strategic measures that can preserve our socio-cultural values with an immediate and deep impact while simultaneously taking advantage of this exciting and dynamic media development should be the focus of stakeholders and policy makers. Future studies should examine the impact of digital technologies on more communities across the country.

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