



DISSEMINATION AND VISUALIZATION OF AGRICULTURAL STATISTICS IN MALAWI: UNRAVELLING THE POTENTIAL ROLE OF THE MEDIA COMMUNITY

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1. ABSTRACT

In this paper, we examined approaches of disseminating agricultural statistics in Malawi. We used a desk research as well as secondary data from the National Statistics Office to review other ways through agricultural data could be disseminated to the public in Malawi. We found that agricultural data is disseminated through two main approaches that is through hard copy publications and website. However, we find that these approaches are traditional and do not meet the needs of the 21 first century era. In current circulations, there is a lack of display of simplified versions of statistical graphs, namely, pie charts, histograms, time-series plots, contour plots, scatterplots, and many more. The focus has largely been on standard line and tabular forms. On the other hand, we find that there are several means through which statistics in agriculture could be made available to the public, namely, radio broadcasting, mobile phones, televisions and social platforms. However, we also identify some interesting limitations that such approaches could have on agricultural data. We lastly combine these approaches with data visualization that could be easily implemented by journalists, spokesperson and other media community. This paper investigate that these other approaches would be easily combine with visual data. In addition, they could likely allow dissemination of technologies that could be transferred to the rural population of which 90% are farmers. In spite of the limitations that the other approaches to data visualization could have in Malawi, this paper suggests that the NSO has to swiftly move into social media as well other formal media dissemination models of agricultural statistics.

Key words: Agricultural statistics, data visualization, technologies, website

1 INTRODUCTION

1. Study Context and the Problem

High quality statistics are essential for designing and targeting policies to reduce hunger, malnutrition, rural poverty, and to promote the sustainable use of natural resources (<http://www.fao.org/3/a-mk541e/mk541e03.pdf>). Statistics provide the foundation for evidence-based decision-making and play a critical role in measuring and monitoring progress towards national and international development goals and targets. Improving country capacity for the collection, dissemination and analysis of basic agricultural data is essential. A coordinated approach to statistical capacity development, aligned to country strategies and priorities is crucial. In addition, this has to catch up with modern means of disseminating statistics.

In Malawi, agriculture is rural and cornerstone of the economy. It contributes about 40% of total Gross Domestic Product and provides above 80% of employment (NSO, 2016). The agricultural sector could only achieve its intended purpose only if it is disseminated to profit policy making frontier. Besides, technologies in agriculture could be beneficial if its related statistics can be made available to rural farmers. In our rural farmers will require technologies that is able to produce results on the ground.

Dissemination of agricultural statistics is increasing becoming a cost for most developing countries' central statistical systems. In Malawi, the agricultural statistical forum fails to meet annually because of lack of funds (MoA, 2015). This is despite its critical role in sharing successes that are generated in agricultural technology generation and dissemination value chain. Although the Central Statistical Office and the Ministry of Agriculture have attempted to disseminate agricultural data, their focus has been marginal. It has targeted government and donor community members only. The big question has always been do actual farmers know how the technology is fairing when compared within themselves and across communities.

World Bank, through paper written by Boyko and Hill (2009), isolated data as an input into knowledge and wisdom. If this is the case then data generated in Malawi does not result into knowledge and wisdom of farmers that are supposed to implement various technologies on the ground. If farmers are not aware of the modern ways of farming, how are they going to improve on the old tradition methods of farming practices for the better? It should be noted that many national statistical agencies disseminate microdata for public use. Reiter (2004) discussed two data dissemination strategies. The first is remote access computer servers, to which users submit requests for analyses and, in return, receive only the results of statistical analyses, such as estimated model parameters and standard errors. Confidentiality is protected, because the remote server never allows users to see the genuine data. The second is to release synthetic, possibly simulated, data that mimic the relationships in the real data. This approach has low disclosure risks since the released values are not the genuine data. Discussion of these approaches is framed by two key questions. First, to what degree can these approaches protect data confidentiality? Second, how do these approaches affect the accuracy and types of analyses users can undertake? These two questions are relevant for any method of data dissemination, including disclosure limitation techniques used currently by many agencies and organizations. To provide context and motivation, we begin by examining some of these current approaches.

Statistical Offices such as Malawi National Statistical Office cannot be blamed in its totality as dissemination demands kwachas. However, it can be argued that dissemination of agricultural statistics is becoming costly because of use of traditional approaches to data sharing. On a good note, in the twenty first century, several global organizations such as the World Bank, Food and Agricultural Organization, UN Statistics Division, Organization for Economic Cooperation and Development (OECD) Global Strategy and others are developing technologies that can enhance dissemination of statistics at a very much reduced cost (<http://www2.stat.duke.edu/~jerry/Papers/dissemination.pdf>). For example, FAO induced development of CountrySTAT with financial support from Bill and Melinda Gate Foundation. It provides decision-makers with a one-stop Centre for easy access to statistics across thematic areas such as production, prices, trade and consumption (FAO, 2013). However, in most countries, the Country STAT is still idle as data is not regularly updated by the Central Statistical Offices and Ministries of Agriculture, Forestry and Energy. In this paper, we explore approaches that can be affordably used to cut costs on disseminating agricultural statistics. This is based on the call by Reiter (2004) that wide access to public use microdata has undeniable societal benefits

2. Research Methodology

In this paper, we first adopt a meta-analysis, which is a desk based research exploration, of tools of disseminating agricultural statistics. In other words, we adopted a revelatory case study approach following Fitzgerald and Fitzgibbon (2014). We basically review publishable articles of the Food and Agricultural Organization publications, World Bank technical papers, and World Class Universities that have provided a thorough discourse on data dissemination approaches. We have reviewed data disseminated through the following reports: Integrated Household Survey and Agricultural Production Estimate Surveys. Second, we combined desk research with secondary household survey data from National Statistical Office (NSO), phone and face to face key interviews with agricultural data custodians and media houses in Malawi. Lastly, this study had a discussion with statisticians at the NSO and Ministry of Agricultural on how the media could be partnered for easy publication of agricultural statistics.

2 DISCUSSIONS

Agricultural Statistics Stakeholder Analysis

Statistical Office and the Ministry of Agriculture are the major custodian of agricultural statistics in Malawi. These providers of agricultural statistics have varied policies on the dissemination of statistics (Kambewe and Banda, 2011). While some tend to be more comprehensive policies, other providers have simple policies. For example, NSO is governed by Statistics Act and detailed dissemination policy macro and microdata (NSO, 2013; 2014). NSO disseminates through two major methods, website and hard copy publications. Only basic tables without a link to micro-data set are disseminated by the Office. The reports are distributed for free to selected stakeholders. This in itself introduce bias and discrimination of who to access data from the data mother body. The following are the publications that the National Statistics Office provides a link on its website or in hard copy report forms (see Table 1):-

Table 1: Data Publications from the National Statistical Office

Publication	Outputs	Mode
Monthly Statistical Bulletin	Prices, agriculture, finance, industrial, production, transport, and external trade	Report
Quarterly Statistics	External trade, agriculture, industrial, production, transport, finance and prices	Report
Malawi in Figures	Short summary of available statistics	Report
Statistical Yearbook	Annual summary of all available statistics covering all economic and social sectors	Report
Statistical Data Bank	Databank of statistics for the country (monthly, quarterly and annual series)	Website
Malawi Socio-Economic Database	Presentation of Socio-Economic Indicators including agricultural data	Website
African Statistics Day	Presentation, Dissemination	Report
Agriculture Inputs Subsidy Survey	Recipients of subsidized agricultural inputs and the impact on the economy	Survey Report
National Census of Agriculture & Livestock	Crop production, acreage, yield, livestock and land tenure	Report

Furthermore, the NSO promotes dialogue with data users through what is termed the National Statistical System. It regularly meets with sectoral officials and with members of the media. In agriculture, the NSO has developed and supported statistical user-producer technical working groups in the areas of agriculture through Agricultural Statistical Forum and Quarterly Agricultural Production Estimate Survey Meetings.

The Department of Climate Change and Meteorological Services considers data it produces as a public good which can be given free of charge. Summarized data can be accessed while access to raw data e.g. daily data is limited and access depends on how it will be used. Data can be sold to profit making organization such as contractors and insurance companies. The pricing is on cost recovery basis. For other organizations, the Director of the Department of Climate Change and Meteorological Services can give a waiver. Data given by the Department cannot be shared with other users.

The Department of Forestry does not have a policy regarding data dissemination. It normally releases its data through annual reports which are submitted to its parent Ministry, the Ministry of Natural Resources and Environment around June every year so that it is in time for the planning of the new government financial year. Agriculture and Fisheries data of the Ministry of Agriculture is for public use although there is no clear policy on that. Various reports (annual and quarterly) are prepared and meetings are held to disseminate the information. Annual meetings for the Ministry are held and progress of the previous year and plans for the following year are disseminated.

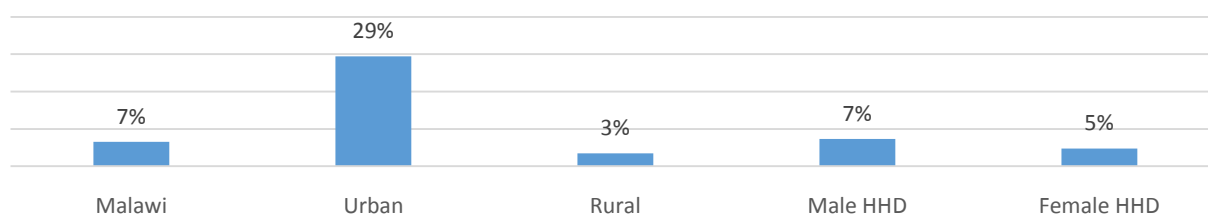
Statistical Database Platforms in Malawi

Malawi has various online databases for disseminating official statistics, namely, MASEDA, CountrySTAT, Data Portal, MDGs; Trade Portal and others. The NSO has a web-page <http://www.nso.malawi.net>. It is linked to the Malawi Socio-economic database (MASEDA) <http://www.maseda.mw/> and the CountrySTAT website <http://www.countrystat.org/mwi>. The website has latest reports on National Census of Agriculture and Livestock (2006/07), Integrated Household Survey, Micro, Small and Medium Enterprise Report, Welfare Monitoring Surveys (Annual), latest statistical flashes (food crop prices) and Statistical Bulletins.

As regards to the data storage, most raw data is stored in SPSS or Stata format. Recent data is now being archived through the International Household Survey Network toolkit like the National Census of Agriculture and Livestock and the Population and Housing Census data sets. It can be indicated that only 7% of

Malawians have access to internet (NSO, 2015) which means that the internet is only accessed by few individuals that are likely to be non-farming households. As shown by figure 1 below, only in the urban area are households able to access internet.

Figure 1-Proportion of household with access to internet in Malawi



The Ministry of Agriculture and Food Security also has a website, <http://www.moafsmw.org/>. This website is linked to the National Statistical Office website and a number of other government websites. The site has data on livestock census, farmers clubs, fertilizer consumption, fish statistics, rainfall, tobacco sales, farm gate price data and crop production data. However, the data on the website has not been updated in recent years. The Ministry disseminates its statistics through meetings, bulletins, leaflets and E-mail. The main products from the Ministry of Agriculture & Food Security are the Annual Agriculture Production Estimates which are disseminated at various for a (see Table 2).

Table 2-Types of disseminating agricultural statistics in Malawi

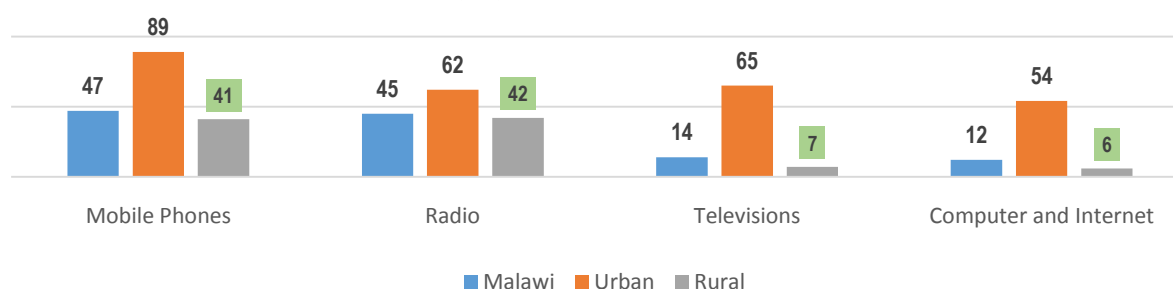
Data Type	Data Dissemination Methods
Crop estimates (Crop production, acreage, yield)	Publication
Tobacco Statistics	Annual reports, media and press releases and Website: www.tccmw.com/
Sugar Statistics	Press Release and Annual Reports
Smallholder Coffee Statistics	Annual Reports
ADMARC Purchases	Annual Reports
Livestock Census	Annual Reports
Horticultural Commodity Prices	Biweekly E-mail reports and through the Annual Agricultural Statistical Bulletin
Retail prices	Biweekly E-mail reports and through the Annual Agricultural Statistical Bulletin
Farm gate prices	Biweekly E-mail reports and through the Annual Agricultural Statistical Bulletin
Fishery statistics	Annual Agricultural Statistical Bulletin
Consumer Price Index	Stat flashes, Press Releases and Monthly, Quarterly and Annual Report
Trees planted	Annual Reports
Wood removals	Annual Reports
Daily weather forecasts	E-mail, on the web and the media
Malawi 10-day Rainfall and Agromet Bulletin	E-mail, on the web and the media
Seasonal Forecasts	E-mail, on the web and the media

National Statistical Office (2015) reported that above half of household in Malawi cannot afford internet services and 31% of households are reported that they do not know how to use internet. This implies that use of website in Malawi is challenged by barriers such as affordability, availability as well as technological know-how. Nevertheless, about 77% of individuals in Malawi are able to access social platforms such as Facebook and WhatsApp that do not require heavy tech-know (MACRA, 2016).

Data Visualization

Organizations of all types and sizes generate data each minute, hour and day. Everyone from decision makers to call center workers and employees on production lines hopes to learn things from collected data that can help them make better decisions, take smarter actions and operate more efficiently. Regardless of how much data you have, one of the best ways to discern important relationships is through advanced analysis and high-performance data visualization. If sophisticated analyses can be performed quickly, even immediately, and results presented in ways that showcase patterns and allow querying and exploration, people across all levels in organizations can make faster and more effective decisions.

Figure 2-Proportion Distribution of Households' Access of ICT equipments in Malawi



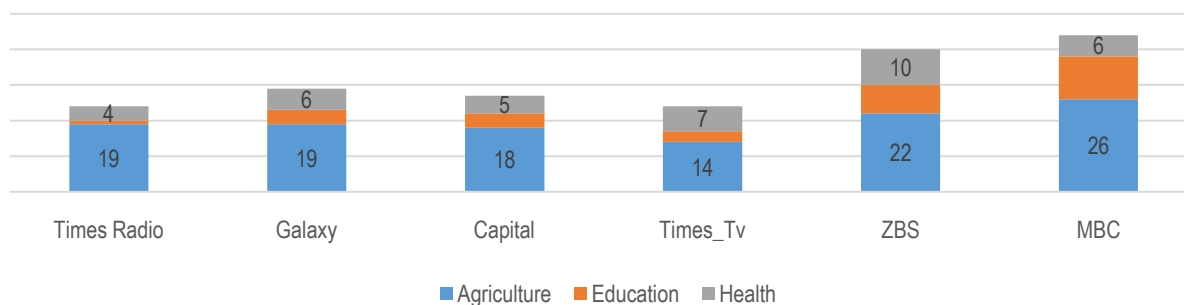
In today's on-the-go society, you may also need to make the results available quickly via mobile devices, and provide users with the ability to easily explore data on their own in real time (SAS, 2014; See Figure 2).

The Media Community

In collaboration with Malawi's National Statistical Office, media personnel, spokespersons from the national statistical system line ministries and sectoral statisticians from various Ministries were brought together to participate in the workshop titled 'Communicating Data through Visualization'. Some of the Ministries that were invited included Agriculture, Trade and Industry, Environmental Affairs, Energy, Mining, Forestry and Fisheries. The workshop aimed at promoting statistical literacy, ensure statistical materials target the right audience, foster networking amongst journalists and government spokespersons and ensure citizens understand better on the statistical information. Some participants highlighted how the workshop demystified data for them and taught them how to use official data sources and present information in a visual way.

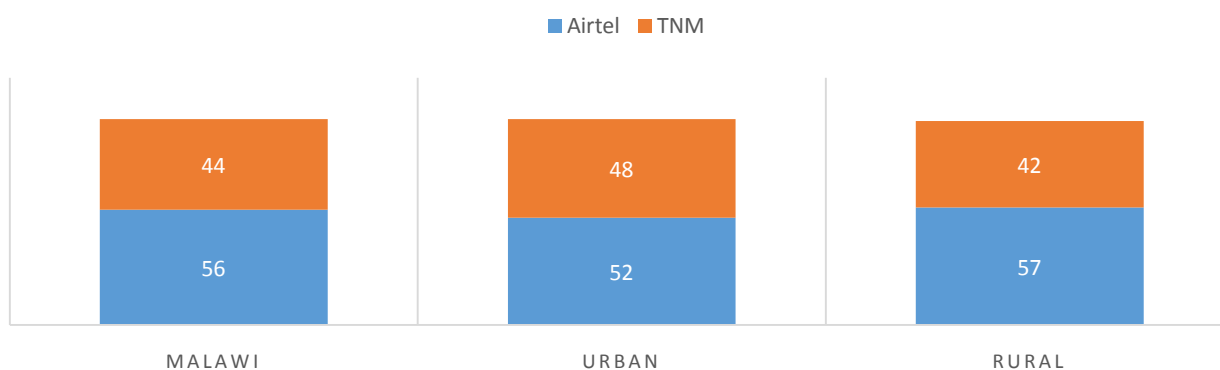
In terms of coverage of issues by the media, it is noted that out of main thematic areas of government, agriculture top the airtime given to broadcasting. This is a space that the Malawi statistical System can take in disseminating agricultural data and technology transfer. Figure 3 depicts issues that are broadcasted by Radio Stations in Malawi.

Figure 3-Issue based programme by Radio stations



In terms of mobile service provider, we only find two providers that is Airtel and TNM (see Figure 4). This means dissemination of data can be channeled through any of these to households as well as individuals. MACRA (2015) found that about half of the population that owns mobile phones use dual sim which means they have access to both Airtel and TNM line. The growing popularity and global reach of Social Media like Facebook and Twitter presents an interesting new data source for social and economic research. Social Media and related methods and technologies, for example crowd sourcing and social collaboration, can also serve as a new data collection approach (Jug, 2014)¹.

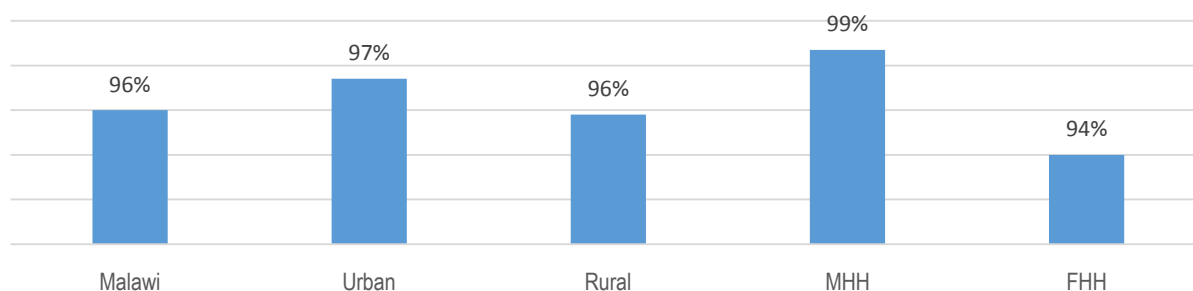
Figure 4-Proportion Of Individuals By Phone Service Providers



It is indeed imperative for the Malawi Central Statistical System to train the media community because of its coverage with the public. For example, Figure 5 shows that above 40% of the population in Malawi, urban and rural areas have a radio. This can imply that households listen to news that can be broadcasted on the radio. Assuming radio stations broadcast messages about agricultural technologies, almost 90% of the population in urban and rural areas listen to radio programmes (NSO, 2015).

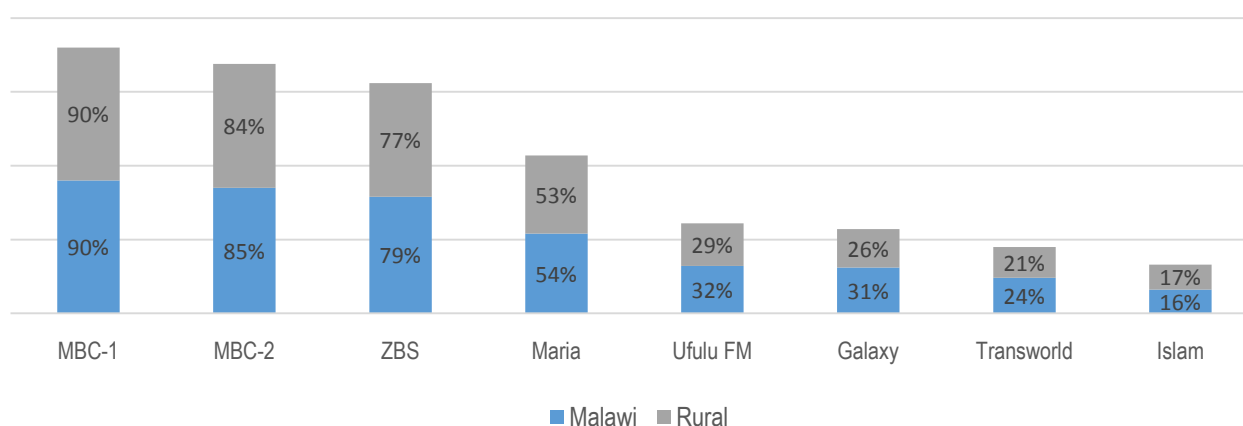
¹Jug M. (2014). Information revolution: from data to policy action in low income countries: how can innovation help? PARIS21. France.

Figure 5-Proportion of households that listen to radio



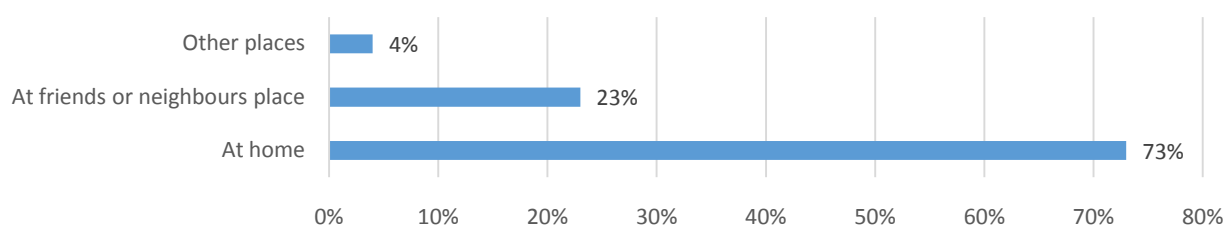
This is also vindicated by radio stations that reach out to households with new agricultural technologies. Nevertheless, among radio stations, Malawi Broadcasting Corporations (MBC) Radio 1 and 2 reach to most households in Malawi than other radio stations (see Figure 6).

Figure 6-Proportion of households that are reached by national radio stations



We however observed the multiplier effects that are generated when having or listening to the radio stations. Figure 7 shows that 73% of households listen from radio at home. This can be implied that about 4.6 people (NSO, 2008) at household level benefit from a single radio broadcasting. What is very interesting is that almost one in four households in Malawi listen from radio at neighbors or friend place. This also increases the multiplier effects from 4.6 people within a household to more than 9 individuals among households that may likely be reached out by national radio stations.

Figure 7-Proportion of households' multiplier Effects due to listening to radio with others



In terms of newspaper, in Malawi, we have only two major Prints, namely, National Newspapers and Blantyre Daily Times. These newspaper circulate about 36000 prints in a day. They reach out to about 262000 households in a week that is on accumulative basis (see Table 3). However, most newspaper, do not include modern forms of statistical graphs, namely, pie charts, histograms, time-series plots, contour plots, scatterplots, and many more. And these could display an array of economic, social, medical, and physical data (Friendly, 2005). The focus has largely been on standard line, bar, and tabular forms over other types of data visualizations (Strecker, 2012)².

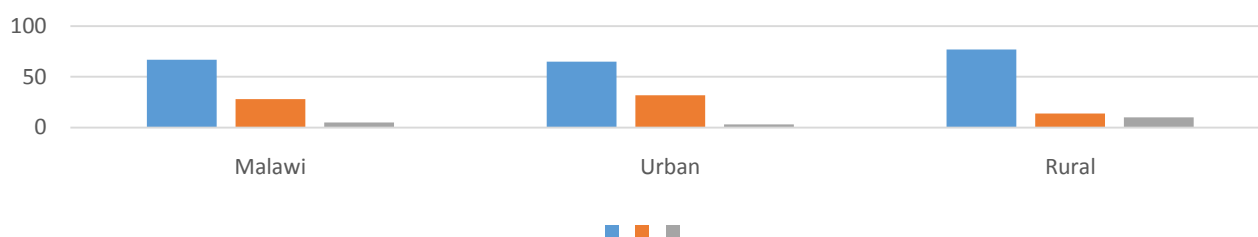
Table 3-Circulations by National and Daily Times newspapers in Malawi

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
National Newspaper	16,000	16,000.00	16,000.00	16,000.00	16,000.00	25,000.00	12,000.00
Daily Times Newspaper	20,000	20,000.00	20,000.00	20,000.00	20,000.00	30,000.00	15,000.00
Total Circulation	36,000	36,000.00	36,000.00	36,000.00	36,000.00	55,000.00	27,000.00
Households Reached	36,000	36,000.00	36,000.00	36,000.00	36,000.00	55,000.00	27,000.00
Individuals Reached	180,000.00	180,000.00	180,000.00	180,000.00	180,000.00	275,000.00	135,000.00

Figure 8 shows households that subscribe to pay tv by location. It can be observed that 67% of households in Malawi subscribe with DSTv while only 5% subscribe with Zuku tv. In rural areas, we find a higher proportion of households subscribing to DSTv while only 10% subscribe to Zuku Tv. This may imply that dissemination of agricultural statistics through Televisions should be able to target pay tv that most households subscribed to.

²Strecker J. (2012). Data Visualization in Review: Summary. IDRC

Figure 8-Proportion of households with access to Televisions that subscribe to pay Tv by location



3 LIMITATION

Strecker (2012) highlighted that data visualizations in practice in most designs remain generally clear, but are generic. She stressed that there appears to be a lack of understanding about how to tailor design choices to ensure that visualizations are communicating a more focused and compelling message. In other words, most data visualization are generally at a novice level. More attention should be paid to the following three areas to help improve the effectiveness of the data visualizations currently being created:

- Document consistency: coherent color schemes and chart graphics should be selected and remain through the entire document.
- Titles and decks: supporting text should be used to draw attention to the main message or take-away of the visualization.
- Design choices: colours, positioning, and size should to be carefully incorporated into designs to help draw the reader's attention to the most important data points.

Refinements in these three areas would significantly strengthen the data visualizations and would help improve their ability to communicate effectively. For example, most participants at the training organized by NSO spotted that they had a limited understanding of data visualization principles, but demonstrated strong enthusiasm for its potential and a willingness to learn and further engage with these tools. Therefore, they requested further knowledge and skills development around how to strategically use data visualizations (Strecker, 2012).

Brescian and Eppler (2008) results of field studies confirm and substantiate most of the concepts already collected from the literature. They have also surfaced a few new relevant issues on limitation of visualization, such as:

- the potentially misleading perception of reliability of a visualization (visualizations may appear more convincing and sound than they really are),
- the (multiple) implicit meanings inherent in visualizations (leading to ambiguous interpretations),
- the high prerequisites for diagram interpretation (a visualization's efficacy depends on the user's previous experience and visual literacy).

- The cause of a visualization disadvantage can be twofold: the designer(s) or the user(s) (that is, their interpretation) (Tufte, 1986). The designer can intentionally or unintentionally introduce mistakes or drawbacks in a visualization.
- Previous studies have demonstrated that visualization is costly to produce in terms of time and other economic resources (money, equipment, know-how, etc.). In this context, various authors emphasize the need for quantifiable measures of the quality of a visualization in order to determine whether it is fit for use (van Vijk 2006).
- The interpretation of a visual form can depend on the familiarity of the observer and on his or her previous experience with it.
- Visualization is actually one of the biggest barriers to insight because it places the burden of discovery on the user, hence any tool that places burden on the analyst is a game-stopper.
- Data visualization is defined as the study of the visual representation of data, meaning information that has been abstracted in some schematic form, including attributes or variables for the units of information. "Humans are better equipped to consume visual data than text.
- Given today's explosion of big data, Statistical Offices need more advanced methods for leveraging data methods that don't rely solely on tribal knowledge, personal experience or best guesses.

4 CONCLUSION AND POLICY RECOMMENDATIONS

In this paper, we examined approaches of disseminating agricultural statistics in Malawi. We used a desk research as well as secondary data from the National Statistics Office to review other ways through which agricultural data could be disseminated to the public in Malawi. We found that agricultural data is disseminated through two main approaches that is through hard copy publications and website. However, we find that these approaches are traditional and do not meet the needs of the 21st century era. On the other hand, we find that there are several means through which statistics in agriculture could be made available to the public, namely, radio broadcasting, mobile phones, televisions and social platforms. However, we also identify some interesting limitations that such approaches could have on agricultural data. We lastly combine these approaches with data visualization that could be easily implemented by journalists, spokespersons and other media community. In current circulations, there is a lack of display of simplified versions of statistical graphs, namely, pie charts, histograms, time-series plots, contour plots, scatterplots, and many more. The focus has largely been on standard line and tabular forms over other types of data visualizations. This paper notes that other approaches would be easily combined with visual data. In addition, they could likely allow dissemination of technologies that could be transferred to the rural population of which 90% are farmers. In spite of the limitations that the other approaches to data visualization could have, this paper suggests that the NSO has to swiftly move into social media as well as other formal media dissemination models of agricultural statistics.

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