Journal of Agricultural Extension and Rural Development

Volume 8 Number 11 November 2016

ISSN 2141-2170

Academic Journals

ABOUT JAERD

The Journal of Agricultural Extension and Rural Development (JAERD) is published monthly (one volume per year) by Academic Journals.

Journal of Agricultural Extension and Rural Development (JAERD) is an open access journal that provides rapid publication (monthly) of articles in all areas of the subject such as Impact monitoring and evaluation system for farmer field schools, Metals in bio solids-amended soils, Nitrogenous fertilizer influence on quantity and quality values of balm, Effect of irrigation on consumptive use, water use efficiency and crop coefficient of sesame etc.

The Journal welcomes the submission of manuscripts that meet the general criteria of significance and scientific excellence. Papers will be published shortly after acceptance. All articles published in JAERD are peer-reviewed.

Contact Us

Editorial Office: jaerd@academicjournals.org

Help Desk: helpdesk@academicjournals.org

Website: http://www.academicjournals.org/journal/JAERD

Submit manuscript online http://ms.academicjournals.me/

Editors

Journal of Agricultural Extension and Rural Development

Table of Contents: Volume 8 Number 11 November 2016

ARTICLES

academicJournals

Vol.8(11), pp. 224-231, November 2016
DOI: 10.5897/JAERD2016.0806
Articles Number: 06BEF6C61226
ISSN 2141-2170

http://www.academicjournals.org/JAERD

Journal of Agricultural Extension and Rural Development

Full Length Research Paper

Trust, perception and effectiveness of extension services in Uganda: A case of National Agricultural Advisory Services (NAADS)

Willy Turyahikayo[1]* and Edson Kamagara[2]

[1]Department of Finance, Makerere University Business School, P. O. Box 1337, Kampala, Uganda.
[2]Uganda Management Institute, P. O. Box 20131, Kampala K.A.R. Rd, Kampala, Uganda.

Received 2 August, 2016; Accepted 5 October, 2016

In order to increase the effectiveness of extension services, the government of Uganda adopted a farmer driven extension approach in 2001. In this approach, the government contracts out the extension services to the agribusiness enterprises that provide the services to the farmers at a fee. This study aimed at finding out whether farmers' trust and perception on this arrangement influences the effectiveness of extension services in terms increasing production, adoption of profitable enterprises and technologies and increase in marketable input. To achieve this, a survey was done involving 261 farmers in one sub-county that was selected purposively. Correlations among the study variables and regression models were done to establish the relationships and predictive powers of the study variables respectively. Results showed that farmers trust and perception on this extension approach is low and these have affected the effectiveness of the extension approach. The study recommends that for increased agricultural output, a holistic approach that builds trust among farmers is essential. This can be done through paying attention to farmers on a more frequent basis, encourage and maintain reliable relationships with them and timely delivery of extension services.

Key words: Trust, perception, effectiveness, agricultural extension.

INTRODUCTION

Agricultural sector is a core sector of Uganda's economy in terms of its contribution to the Gross Domestic Product (GDP), employment, as well as its contribution to ensuring food security. It is the most important sector of Uganda's economy, because it employs over 80% of the work force and contributes about 23.1% of GDP (UBOS, 2014). The sector has been and remains central to Uganda's economic growth and poverty reduction strategies (MFPED, 2014a). However, the sector's performance has been declining over the past decade (UBOS, 2014). The value added of the agricultural activities that include cash crops, food crops, agricultural

*Corresponding author. E-mail: wturyahikayo@mubs.ac.ug. Tel: +256-957295.

support activities, livestock, forestry and fishing is estimated to have grown at a meager rate of 2.7% during the calendar year 2013. In order to increase sustainable production, productivity and value addition in the agricultural sector, extension services are seen as a panacea to unlock and harness Uganda's opportunities.

Traditionally, agricultural extension services have been a preserve of the state owing to the fact that leaving extension services to the private sector would expose farmers to the consequences of market failures that characterize the forces of demand and supply which govern decision making in the free market economy. Many agricultural development analysts have also shown that a key cause of the inadequate performance of public extension is the ineffective incentive structures for public extension agents characterized by lack of information and feedback on different farmer groups' needs and priorities (Anderson and Feder, 2004). In view of such realities, private approaches to extension have been looked at as the appropriate answers to agricultural extension due to their demand-driven nature inherent in them (Birner and Anderson, 2007). Private agricultural extension is the provision of a service or advice by a private firm in exchange for a fee (Chapman and Tripp, 2003). The privatization of agricultural extension services in Uganda was implemented through the National Agricultural Advisory Services (NAADS) programme through an act of Parliament in 2001. This is a semi-autonomous agency of the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF). The effectiveness of this extension approach was to be seen in its ability to increase incomes of commercially active poor farmers through increased adoption of profitable agricultural enterprises and improved technologies and practices, agricultural productivity, and marketed output.

However, the NAADS programme faced a number of challenges associated with farmers' trust and perceptions of the programme that challenged the effectiveness of this demand-driven extension. The contracting process has been subjected to delays to the extent that services have always been provided during the planting season when farmers are too busy to attend the advisory meetings and in some cases planting materials delivered after the planting season. The capacity of the service providers has often times been limited to addressing general issues and concerns. Mangheni et al. (2003) reports that most service providers depended upon their old school notes as their major source of information implying poor articulation of the emerging agricultural challenges and technologies.

The major challenge inherent in the private-sector models of agricultural extension is to identify and put in place the needed conditions under which such models can work, considering the market failures characterizing private sector (Feder et al., 2011). To some scholars such as Parkinson (2009), private extension should be introduced in such situations only as part of a mixed system in which fully funded and delivered public extension remains as an essential component of the extension system. In Uganda, the NAADS programme is embedded in contracts between agribusiness enterprises and government. Companies have always been accused of focusing their advisory work narrowly on the crop that they buy or the input they sell, without addressing broader concerns, for example, poverty reduction and environmental sustainability (Anderson et al., 2000). As a result, the advice given to farmers, while reflecting the company's interest, may not be the most suitable to the farmer's situation (Baumann, 2000).

The NAADS program has further been prone to social exclusion and elite capture. Poor farmers and socially marginalized groups such as women, children and the disabled have played a limited role in the NAADS program. The representation of such categories is often low owing to the socio-cultural constraints they face (Meinzen-Dick, 2007). Although one way to deal with the elite capture and the social exclusion problems is the formation of specialized organizations, such as groups exclusively for women farmers, or the allocation of reserved seats for women and disadvantaged groups in participatory planning and management boards of extension systems; implementation of such a strategy has only remained on paper in Uganda. Due to the above challenges, government went further to adjust the implementation of the programme in 2014 by deploying soldiers in its implementation. In effect, questions relating to the efficacy of privatized extension services remain. Specifically, is this model a panacea for agricultural transformation in terms of increase in incomes, adoption of profitable agricultural enterprises, improved technologies and practices, increase in agricultural productivity and marketed output? Do farmers trust the approach as a credible, honest and reliable form of extension? This study intends to help understand the farmers' trust and perception about the extension system and how these have influenced its effectiveness.

Conceptual framework for the study is given in Figure 1. The model examines the relationship between trust, perception and the effectiveness of extension system in Uganda. Effectiveness of the programme involves changes in farmers' livelihoods as measured by changes in technology, incomes and productivity. Trust on the other hand involves integrity, reliability, commitment, and benevolence (Allen and Meyer, 1990). Literature has it that changes in behaviors and implementing new ideas is a function of influence generated from trust (Morgan and Hunt, 1994), integrity of the source and ability to inspire the recipients of the service (Weltevreden, 2007). On the other hand, perception is about changing the way people see things, shifting altitudes and creating recognition (Koufaris and LaBarbera 2002). In the adoption of new sources of agricultural information, perception is commonly seen in the perceived ease of use of this source and its perceived usefulness (Davis, 1989).

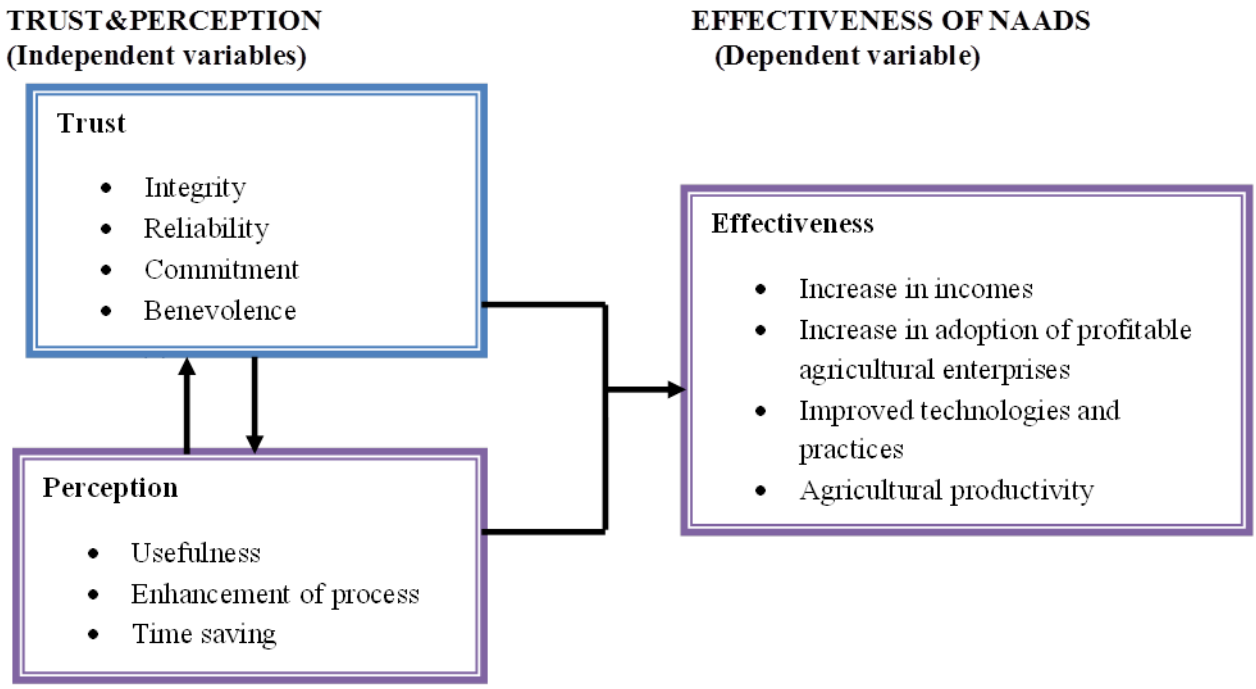


Figure 1. Conceptual framework for the study. Source: Developed from literature.

METHODOLOGY

Research design

A cross sectional survey design was used in this study to provide an in-depth investigation of the relationship between the variables (Sekaran, 2000). The study was carried out in Nyakyera sub county-Ntungamo district, one of the first districts to implement the NAADS extension system in the country. In order to achieve the objectives, a correlation design was adopted to determine relationships between different variables and the questionnaires were formed on this basis. Both quantitative and qualitative data was used in data collection and analysis.

Study population and sample selection and size

The study population included all households in Nyakyera sub county of Ntungamo district. Nyakyera Sub County has a total population of 38,419 people distributed in 7,945 households. Of these households, 84.9% depend on subsistence farming and use rudimentary technologies (UBOS, 2014). The sub county has total land area of188.9 sq. km and a population density of 203.

The researchers used a simple random sampling to select 367 households from Nyakyera Sub County using the Krejcie and Morgan (1970) procedure. The researchers then used systematic random sampling.

Data collection instruments

In the process of collecting data, both primary and secondary data was collected. A self-administered questionnaire` was the major instrument with the measurement scales of all variables using a five point likert scale ranging from strongly agree to strongly disagree and was pre-tested and standardized focusing on issues related to the dependent and independent variables. Questionnaires were administered to farmers. Since most of the smallholder farmers are not educated, the questions for primary data were translated into the local language. Qualitative data was collected using an interview guide with key informants and focus group discussions involving sub-county chief, sub-county NAADS coordinator, sub-county cashier and parish chiefs. These were included because they are key implementers of the NAADS programme and understand the challenges that have been encountered by the programme.

Measurement of variables

The study utilized established measurement items by earlier researchers to operationalize and measure the variables under study. Perception was measured by the perceived usefulness of a new process, that is, private extension service as used in the technology acceptance model (Davis, 1989). Trust was measured using the Doney and Canon (1997) instrument basing on farmers' perception of the programmes' integrity, reliability, commitment and benevolence. Effectiveness of NAADS program was measured using the objectives of the program which include; increase in incomes, increase in adoption of profitable agricultural enterprises, improved technologies and practices, increase in agricultural productivity and increase in marketed output.

Procedure of data collection and analysis

The researcher, through the sub county leadership was introduced to the farmers in the sub county. The survey questionnaires were administered to the farmers in their local language. To reduce the common method variance bias in the data collected from the same persons on a single period of measurement following Podsakoff et al. (2003) recommendations. This was done by separating predictor

Table 1. Survey demographics.

	Frequency	Percentage	Mean	Std. deviation
Gender			**1.6628**	**.47365**
Male	88	33.7		
Female	173	66.3		
Total	**261**	**100.0**		
Marital status			2.1339	.82799
Single	43	16.5		
Married	163	62.5		
Divorced	19	7.3		
Widowed	29	11.1		
Total	254	97.3		
Missing system	7	2.7		
Total	**261**	**100.0**		
Age	**Number**	**Percentage**	3.9522	1.08338
Below 20	12	4.6		
20-29	17	6.5		
30-39	30	11.5		
40-49	104	39.8		
above 50	88	33.7		
Total	251	96.2		
Missing system	10	3.8		
Total	**261**	**100.0**		
Education	**Number**	**Percentage**	1.6873	.89284
No school at all	134	51.3		
Primary	89	34.1		
O level	24	9.2		
A level	7	2.7		
Tertiary	5	1.9		
Total	259	99.2		
Missing system	2	0.8		
Total	**261**	**100.0**		

Source: Primary data.

and criterion variables sections in survey questionnaires, insure response confidentiality, and explicitly assure the participants that there would be no right or wrong answers to the survey questions. The captured data was analyzed using both descriptive and correlation analysis. Quantitative data was sorted, coded, edited and classified into categories using the SPSS (Statistical Package for Social Scientist). Cross tabulation was used to give a general description of categorical data such as age and gender. Correlation and regression were used to establish the strength and direction of relationship between the variables and qualitative information was used to gain deeper insights into the quantitative findings.

RESULTS

Demographic characteristics

The study used a household as the unit of analysis and a household head as a unit of inquiry. The household head was assumed to be the husband or wife in the home because these possess enough agricultural information. There were 261 responses constituting 71.7% response rate. It was noted that females constituted 66.3% with gender having a mean value of 1.6628 which implies that females constituted the majority in the sample. This could be attributed to the fact that women spend most of their time near homesteads while men are away in off-farm activities. In terms of marital status, majority of the respondents were married constituting 62.5% of the total sample as shown in the Table 1.

From the Table 1, majority of the respondents were in the age bracket of 40 to 49 years followed by those above 50 years. Generally, these two categories constituted 73.5%. This reflects the fact that majority of the farmers in Uganda are the aged as the youths occupy nonagricultural activities. It was noted that most of the respondents (51.5%) had not attained any formal education with education having a mean value of 1.6873.

Table 2. Pearson (r) correlation coefficients, means and standard deviations.

Variable	Mean	SD	Integrity	Reliability	Commitment	Benevolence	Perception	Effectiveness
Integrity	9.0541	2.29361	1					
Reliability	9.2008	2.35062	0.013	1				
	-	-	0.841					
Commitment	9.1699	2.39551	0.231**	0.154*	1			
	-	-	0.000	0.013				
Benevolence	9.0465	2.31510	0.224**	0.267**	0.196**	1		
	-	-	0.000	0.000	0.002			
Perception	9.0849	2.31119	0.195**	0.111	0.213**	.107	1	
	-	-	0.002	0.075	0.001	.088		
Effectiveness	9.1622	2.32711	0.094	0.236**	0.156*	.245**	.173**	1
	-	-	0.132	0.000	0.012	.000	.005	

**Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).

In fact, it is observed from the sample characteristics that as formal education increases, employment in agriculture reduces implying that the educated seek for employment in non-agricultural activities.

Farmers' trust, perception and effectiveness of the agricultural extension services

The fundamental question for this study was to find out whether farmers trust and perception affect the effectiveness of the country's extension services. The Pearson (r) correlation coefficient was used in testing for the relationships among these study variables.

From the study, all the components of trust correlated positively with the perception of farmers on extension services; integrity (r=0.195**, p=0.002), reliability (r=111, p=0.75), commitment (r=0.213**, p=0.001) and benevolence (r=0.107, p=0.088) (Table 2). This implies that as people trust a system, they develop a positive attitude towards it. Results show that integrity and commitment of extension service providers significantly influence the perception that farmers develop on extension systems. The correlation between people's perception and effectiveness of extension services was found to be significant (r=0.173**, p= 0.05). The study further shows that the constructs of trust were positively correlated with the effectiveness of extension services. However, integrity was not significantly correlated with effectiveness (r=0.094, p=0.132). The rest of the constructs were correlated with effectiveness in the magnitudes of (r=0.236**, p=0.000), (r=0.156*, p=0.012) and (r=0.245**, p=0.000) for reliability, commitment and benevolence, respectively.

From the results, it was clear that majority of the respondents have negative perception on the extension system (Table 3). In fact, 55.9% strongly disagreed that they are able to accomplish their farming business in time due to the available extension services. Furthermore, 50.6 and 51.7% of the interviewed farmers disagreed that the private extension services enhanced their farming procedures and made it easier to get the services they need respectively.

Regression analysis

The results of the regression model were examined to establish the degree to which trust and perception predict the effectiveness of the extension system.

Among the predictors of effectiveness of the extension service, it was noted that benevolence was the leading predictor with (Beta=0.174), followed by reliability (Beta=0.164). The least predictor was integrity with a beta value of 0.022 (Table 4). This means that reliable extension services in terms of quick and timely delivery of services are fundamental requirements for the effectiveness of extension systems. The model predicts only 10% of the variations in the effectiveness of extension services (R Square=0.100). This would mean that although important, the effectiveness of the extension services needs just more that farmers' trust and perception.

DISCUSSION

From the results, the various constructs of trust were found to have positive correlation with the effectiveness of extension services although integrity was not significantly correlated with effectiveness. One of the reasons integrity was not significantly correlated with effectiveness is reinforced by the qualitative information from the field in which farmers were not aware whether the extension service providers were corrupt or not. As one respond narrated *"…..I am interested in getting planting materials whether the officers are eating money or not. We do not know how much money officers were*

Table 3. Farmers' perception on extension services.

Response item	Response						
	Strongly disagree	Disagree	Not sure	Agree	Strongly agree	Missing system	Total responses
Extension services enable me accomplish my farming business quickly	146 (55.9%)	82 (31.4%)	18 (6.9%)	9 (3.4%)	6 (2.3%)	0 (0%)	261 (100%)
Extension service enhances my farming procedures	132 (50.6%)	102 (39.1%)	10 (3.8%)	10 (3.8%)	7 (2.7%)	0 (0%)	261 (100%)
Using extension services make it easier for me to get services that I need.	135 (51.7%)	86 (33.0%)	18 (6.9%)	14 (5.4%)	7 (2.7%)	1 (0.4%)	260 (96.6%)
I find extension service useful to me.	104 (39.8%)	77 (29.5%)	20 (7.7%)	36 (13.8%)	23 (8.8%)	1 (0.4%)	260 96.6%)
Using extension services enable me save more resources	123 (47.1%)	100 (38.3%)	18 (6.9%)	13 5.0%)	7 (2.7%)	0 0(0%)	261 (100%)

Source: Primary data.

Table 4. Regression.

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.076	0.974		4.186	0.000
	Integrity	0.022	0.065	0.022	.340	0.734
	Reliability	0.168	0.065	0.164	2.575	0.011
	Commitment	0.077	0.062	0.079	1.239	0.217
	Benevolence	0.176	0.065	0.174	2.692	0.008
	Perception	0.115	0.063	0.115	1.832	0.068

Model	R	R^2	Adjusted R^2	R^2 change	F change	Sig. F change
1	0.344[a]	0.118	0.100	0.118	6.482	0.000

Dependent variable: Effectiveness.

given and we do not know how much they ate. For us, we want planting materials……". Overall however, since most of the constructs were significantly correlated, it can be inferred that the effectiveness of extension services requires strong building blocks in social trust. The results of this study have shown that trust is probably the starting point to explain farmers' behavior towards the effectiveness of a government programme. These results imply that the capacity of Uganda's extension system to act competently and reliably, taking the right decisions in the interest of farmers, remaining close to them and showing strong concern for their interests was a major hindrance to the effectiveness of the extension system. These findings are consistent with studies by Cechin et al. (2013) who found a significant and positive relationship between commitment and favorable individual behavior towards a programme.

The correlation between people's perception and effectiveness of extension services was also found to be significant. This means that as people perceive the programme positively, its effectiveness increases. This is in consistent with Davis (1989) who found that the overall feelings or attitudes toward using a system or procedure represent major determinants as to whether or not individuals will ultimately use the system for improving effectiveness. From qualitative data, one of the factors affecting the effectiveness of the extension was the expectations that farmers had from the extension. Whereas government's objectives in the private-sector led extension was to increase production, farmers' incomes, adoption of profitable agricultural enterprises, productivity and improved technologies, farmers expected some extra services such as marketing and information on climatic changes. One farmer narrated *"we planted a lot of maize last year but the rains delayed to come, so we wasted our money yet we are told that government knows when there is going to no rain, a lot of rain etc. even when we are lucky to harvest, traders*

cheat us and we do not get a lot of income from our produce…….". This means that farmers expected more than just provision of high quality seeds which is the major preoccupation of the current extension services. These findings on trust and perception further suggest that, private extension is not a perfect substitute of public extension but the two should work in a complementary manner. These findings are in line with Parkinson (2009) who recommends that private extension should be introduced in such situations only as part of a mixed system in which fully funded and delivered public extension remains as part of the extension menu. The low perception of farmers on private agricultural extension delivery was partly because of the delays in delivering planting materials. As Mangheni et al. (2003) found out, one of the weaknesses of the extension system in Uganda is the contracting process that has been subjected to delays, so that services are provided late during the planting season when farmers are too busy to attend the advisory meetings and providing planting materials after the planting season.

Results further showed that an important source of low perception originated from the discriminatory provision of the services. The poor and the disadvantaged were left out of the privatized extension services especially where agribusiness firms supply seeds for the product they want to buy after harvest. One farmer narrated *"….you see when they are giving seeds, they look for big farmers and relatives. I am a widow with little land. All of us have never been given seeds but even the people who received seeds were given when the rains had stopped".* In such a case, the extension services have not been pro-poor as earlier conceived. Indeed, private extension services delivery seemed not to have enhanced and quickened farming procedures in getting the needed extension services. These findings agree with Baumann (2000) who found out that companies always focus their advisory work narrowly on the crop that they buy or the input they sell, without addressing broader concerns of the population, for example, poverty reduction and environmental sustainability. It can therefore be deduced that lack of integrity originates from the fact that corruption, favoritism and intrigue result into the poor perception, attitude and ultimately reduce the effectiveness of the extension system.

Conclusion

From a practical point of view, these findings show that it is useful to create the conditions which generate farmers' trust because it explains the effectiveness of the extension system. The extension staff needs to demonstrate their reliability and commitment through the advice they give to farmers, whether this advice is technical, economic, strategic, environmental or regulatory in nature. This research contributes to a better understanding of the effectiveness of government's extension programme. The study shows that farmers' trust and perception impact on the effectiveness of the extension services. Therefore, extension service providers should pay attention to farmers on a more frequent basis, encourage and maintain reliable relationships with them. However as the regression model shows, several other factors require extra attention. The extension system should therefore integrate services a multiplicity of services such as climate early warning systems, marketing and storage advice as well as facilitate the formation of farmer organizations and institutions that can enable the disadvantaged to penetrate the markets. There is a need to re-align both the supply of advisory services and demand for the services from farmers such that the services supplied are the services actually demanded by farmers.

Conflicts of Interests

The authors declare that there are no conflicts of interest in this study. They are independent researchers.

ACKNOWLEDGEMENT

Sincere gratitude goes to Makerere University Business School especially Prof. Waswa Balunywa for providing an enabling environment for research.

REFERENCES

Allen NJ, Meyer JP (1990). The measurement and antecedents of affective, continuance and normative commitment to the organization. J. Occup. Psychol. 63(1):1-18.

Anderson J, Crowder L, Van L (2000). The Present and Future of Public Sector Extension in Africa: Contracting out or contracting in? *Public Adm. Dev.* 20:373-384.

Anderson JR, Feder G (2004). Agricultural Extension: Good Intentions and Hard Realities. World Bank Res. Obs. 19(1):41-60.

Baumann P (2000). Sustainable livelihoods and political capital: arguments and evidence from decentralization and natural resource management in India. ODI working paper, 136. London: ODI.

Birner R, Anderson JR (2007). How to Make Agricultural Extension Demand-Driven? The Case of India's Agricultural Extension Policy. IFPRI Discussion Paper 00729, November 2007, International Food Policy Research Institute, Washington DC.

Chapman R, Tripp R (2003). "Changing incentives for agricultural extension: a review of privatized extension in practice", Agricultural Research and Extension Network working paper no. 123, Overseas Development Institute, London.

Cechin A, Bijman J, Pascucci S, Omta O (2013). Decomposing the member relationship in agricultural cooperatives: Implications for commitment. Agribusiness 29(1):39-61.

Davis FD (1989). Perceived usefulness, perceived ease of use and user acceptance of Information technology. MIS Q. 13(3):319-40.

Doney PM, Cannon JP (1997). An examination of the nature of trust in buyer-seller relationships. J. Mark. 61(2):35-52.

Feder G, Birner R, Anderson JR (2011). The private sector's role in agricultural extension systems: Potential and limitations. J. Agribusiness Dev. Emerg. Econ. 1(1):31-54.

Koufaris M, LaBarbera PA (2002). Consumer Behavior in Web-Based Commerce: An Empirical Study. Int. J. Electron. Commer. 62:131-154.

Krejcie RV, Morgan DW (1970). Determining sample size for research activities. Educ. Psychol. Meas. 30:607-610.
Mangheni M, Mutimba J, Biryabaho F (2003). Responding to the Shift from Public to Private Contractual Agricultural Extension Service Delivery: Educational Implications of Policy Reforms in Uganda. Paper presented at the 19th Annual AIAEE Conference, Raleigh, North Carolina, 8_12 April.
Meinzen-Dick R (2007). Institutionalizing the Study of Institutions in Agricultural Research: Reflections on the CGIAR System wide Program on Collective Action and Property Rights (CAPRi). Farmer First Revisited: Farmer Participatory Research and Development Twenty Years On.
Ministry of Finance, Planning and Economic Development (MFPED) (2014). Draft Estimates of Revenue and Expenditure (Recurrent and Development) FY 2014/15
Morgan RM, Hunt SD (1994). The commitment-trust theory of relationship marketing. J. Market. 58:20-38.
Parkinson S (2009). When Farmers Don't Want Ownership: Reflections on Demand-driven Extension in Sub-Saharan Africa. J. Agric. Educ. Ext. 15(4):417-429.
Podsakoff PN, Scott BM, Jeong-Yeon L (2003). Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. J. Appl. Psychol. 88(5):879–903.
Sekaran U (2000). Research methods for business: A skill-building approach. John Wiley & Sons.
Uganda Bureau of Statistics (UBOS) (2014). National housing and population census. Ministry of Finance, Planning and Economic Development, Government of Uganda.
Weltevreden WJ (2007). “Substitution or complementarily? How the Internet changes city Centre shopping". J. Retailing Consum. Serv. 14:192-207.

academicJournals

Vol.8(11), pp. 232-239, November 2016
DOI: 10.5897/JAERD2016.0808
Articles Number: 8D3262261234
ISSN 2141-2170

http://www.academicjournals.org/JAERD

Journal of Agricultural Extension and Rural Development

Full Length Research Paper

Diagnostic support to plantwise plant doctors in Kenya

Idah Mugambi[1]*, Frances Williams[1], James Muthomi[2], Florence Chege[1] and MaryLucy Oronje[1]

[1]CABI, Canary Bird, 673 Limuru Road, Muthaiga, P. O. Box 633-00621, Nairobi, Kenya.
[2] Department of Plant science and Crop Protection, University of Nairobi P. O. Box 29053-00625, Nairobi, Kenya.

Received 3 August, 2016; Accepted 21 September, 2016

Effective extension services are essential to provide farmers with skills and knowledge to manage pests and diseases. These services are provided by government agencies, non-governmental organisations, community based organisations as well as various actors in the private sector. Plantwise aims to help farmers lose less of their crops to pests and diseases, through among other strategies, the establishment of networks of plant clinics. Farmers visit these clinics and explain their plant health problems to plant doctors, who are mostly extension agents trained to provide diagnosis and give recommendations for pest management. However, plant doctors need diagnostic support in order to provide accurate diagnosis especially when faced with new pests. This study was carried out in Kenya to establish the diagnostic support available to plant doctors in the country and provide suggestions for improvement. A total of 133 plant doctors were interviewed and plant clinic data in the Plantwise online management system (POMS) database reviewed to find out how often plant doctors indicated the intention to send samples to a diagnostic lab as a follow up action. Plant doctors interviewed were aware of diagnostic services, and 65% indicated an intention to send samples for diagnosis. Thirty per cent of those interviewed had sent samples to a diagnostic centre, and feedback generally took several days with feedback not received in 27% of the cases, suggesting a need to improve coordination between research and extension. Plant doctors using tablet computers had better access to diagnostic support from their peers through their social online network.

Key words: Extension service, plant clinic, diagnostic service, plant doctor, plantwise.

INTRODUCTION

Agricultural extension plays a major role in dissemination of information to farmers with a view to increasing productivity at the farm level. The Government of Kenya through the Ministry of Agriculture Livestock and Fisheries (MoALF) takes the lead in provision of extension services in the country. In order to break with traditional supply-driven and top-down extension provision, the National Agricultural Extension Policy (NAEP) was established in 2001 advocating for a demand-driven extension system (Kibett et al. 2005). Alongside government agencies, various private actors comprising community based organisations, non-governmental and faith based organisations also provide extension services (Nambiro et al., 2005). Plant clinics, a new type of farmer service promoted by CABI's Plantwise programme, are a key component of the plant health systems approach which

*Corresponding author. E-mail: i.mugambi@cabi.org.

Figure 1. Distribution of diagnostic centres in Kenya.

aims to strengthen links between research, extension, regulation and input supply. These services are by nature demand driven since farmers are the ones who determine the need for advice. They are run by trained plant doctors who are mostly extension staff from the MoALF (Scheidegger and Graf, 2013). Set up in public places such as markets and produce delivery sheds, farmers bring plant samples to the plant clinics for diagnosis and recommendations to manage the pest problems. Details of the farmer name, gender, crop grown, symptoms observed and the recommendations given by the plant doctor are recorded. Currently, data capture methods include paper and electronic using mobile tablet computers (Wright et al., 2016). Data recorded by paper are digitised, cleaned and uploaded to the Plantwise online management system (POMS) data base. Electronically captured data are directly uploaded to the POMS database. All the data in POMS can be downloaded, validated and analysed. Plant doctors occasionally need diagnostic support in order to make correct diagnoses and give the right recommendations (Danielsen et al., 2013). Good and timely diagnosis is essential for management of further spread of pests to new areas and therefore issues that hinder plant doctors' access to quick, accurate diagnostic service must be identified and addressed. Misdiagnosis may lead to more loss of yield and resources to the already resource constrained small scale farmer. Diagnostic support to plant doctors in Kenya is mainly provided by research centres, with the National Agricultural Research Laboratories (NARL) in Kabete taking the lead in provision of these services. However, it is important to establish the diagnostic support these centres contribute to the plant doctors and the linkages that would enable sustainable access to diagnostic services. Figure 1 shows the distribution of diagnostic centres across the country.

MATERIALS AND METHODS

A total of 133 plant doctors in all 13 counties implementing Plantwise in Kenya were interviewed (Table 1) using a questionnaire with both open-ended and close-ended questions. The questionnaire was pre-tested among plant doctors in three

Table 1. Number of plant doctors interviewed in each of the 13 counties implementing Plantwise in Kenya

County	Number of plant doctors interviewed
Nakuru	23
Trans Nzoia	22
Embu	17
Machakos	17
Nyeri	8
Kajiado	8
West Pokot	7
Bungoma	7
Elgeyo Marakwet	6
Kirinyaga	6
Narok	5
Kiambu	5
Tharaka Nithi	2
Total	**133**

Table 2. Plant samples quality as rated by plant doctors across 13 counties in Kenya

County	(%) rating		
	Good	Average	Poor
Tharaka Nithi	100	0	0
Nyeri	88	12	0
West Pokot	86	14	0
Embu	76	24	0
Machakos	76	18	6
Narok	75	0	25
Kajiado	63	37	0
Nakuru	61	39	0
Kiambu	60	40	0
Elgeyo Marakwet	50	50	0
Kirinyaga	50	33	17
Bungoma	43	57	0
Trans Nzoia	27	55	18
Average percentage	62	33	5

clinics. Questions were centred on the quality of samples brought to plant clinics, whether plant doctors have links with diagnostic service providers, if they had sent samples to the lab and how long it took to receive feedback. Plant doctors were also asked to give suggestions on how to strengthen their links with diagnostic service providers and how to enhance accessibility and sustainability of diagnostic services. Plant clinic data downloaded from the POMS database were used to ascertain the number of times plant doctors indicated an intention to send samples to a diagnostic centre.

Data analysis

Data were analysed using MS Excel and Statistical Package for Social Science (SPSS), to generate descriptive statistics and correlations. Qualitative data were coded and content analysis performed.

RESULTS

Challenges faced by plant doctors in making plant pest diagnoses

POMS data showed that 65% of the plant doctors indicated an intention to send samples to a diagnostic centre. Thirty percent of those interviewed during the study said that they had sent samples to a diagnostic centre. However, plant doctors from different counties showed varying need for diagnostic support. Almost all plant doctors indicated that farmers either presented crop health problems verbally or carried plant samples to the clinic. Plant doctors were asked to rate the quality of samples as either good, average or poor. Overall, 62% rated the plant samples as good, indicating that they were fresh and representative enough. In Tharaka Nithi, all plant doctors indicated that farmers presented fresh and representative samples of plant health issues. However, in four counties, 5% of plant doctors indicated that samples presented by farmers were of poor quality (Table 2).

Accessibility of diagnostic services to plant doctors and feedback on samples sent to the diagnostic centres

Over 90% of plant doctors are aware of the availability of diagnostic services and 64% said they have links with diagnostic service providers and can easily engage with them. A diagnosis report was received for 63% of the submitted samples. All plant doctors in Tharaka Nithi and Trans Nzoia received the diagnosis report after a few weeks, Kajiado county after many months and feedback was not received at all in Elgeyo Marakwet county (Table 3). Sixty three percent of those who indicated that they had sent samples for diagnosis indicated that the diagnostic service was a free service to farmers. There were significant positive correlations between plant doctors who said they had links with diagnostic services and those who had sent samples to the laboratory for diagnosis (figure. 2). Plant doctors who indicated likelihood to encounter difficult plant health issues most likely forwarded the samples to the laboratory for diagnosis (Figure 3).

Plant doctors' suggestions on strengthening diagnostic support

Plant doctors were asked to give suggestions on how their links with diagnostic service providers could be strengthened. They suggested increased interactions

Table 3. Period taken before receiving a diagnosis report on samples sent to the lab

County	% receiving Immediately	% receiving after few days	% receiving after few weeks	% receiving after few months	% receiving after many months	% Results not received
Bungoma	0	50	0	50	0	0
Elgeyo Marakwet	0	0	0	0	0	100
Embu	50	33	0	0	0	17
Kajiado	0	0	0	0	100	0
Kiambu	0	33	67	0	0	0
Kirinyaga	0	100	0	0	0	0
Machakos	0	86	14	0	0	0
Nakuru	0	0	20	7	20	53
Narok	0	0	0	0	0	0
Nyeri	0	0	0	0	50	50
Tharaka Nithi	0	0	100	0	0	0
TransNzoia	0	0	100	0	0	0
West Pokot	0	0	0	0	0	0

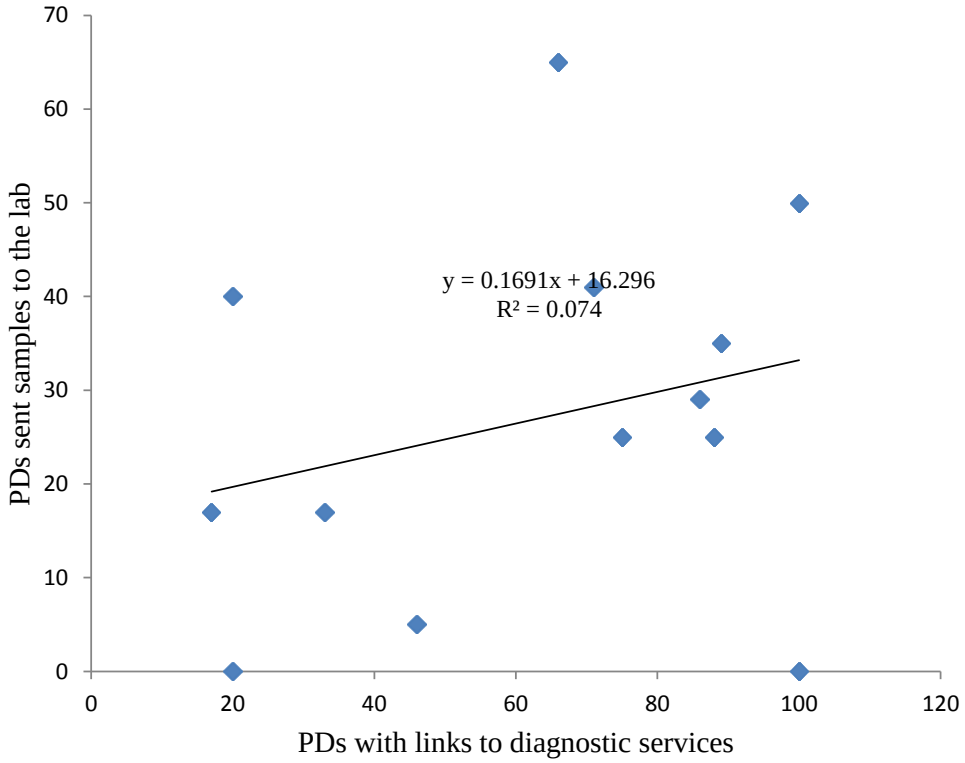


Figure 2. Correlations between Plant doctors with links to diagnostic services and those sending samples to the lab.

with diagnostic service providers through joint trainings, regular backstopping by plant health experts during plant clinic sessions, and exchange visits to the diagnostic centres. About 20% of plant doctors suggested sharing of research findings on pests and diseases. A further 17% suggested that diagnostic service providers perform quick diagnoses as this will boost farmers' confidence in plant clinics. Plant doctors suggested that farmers' awareness creation on the availability of diagnostic services, how to sample plants for diseases and insect pests should be done by the service providers (Figure 4). Plant doctors without tablets showed interest in adopting tablets to use

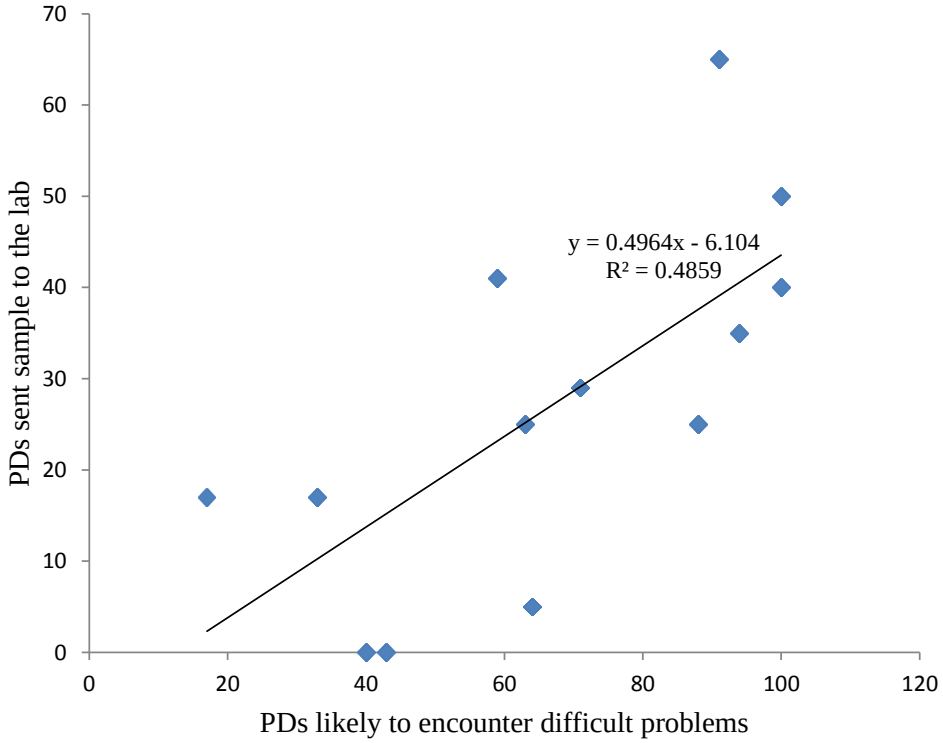


Figure 3. Correlations between Plant doctors with likelihood to encounter difficulties in diagnosis and those sending samples to the lab.

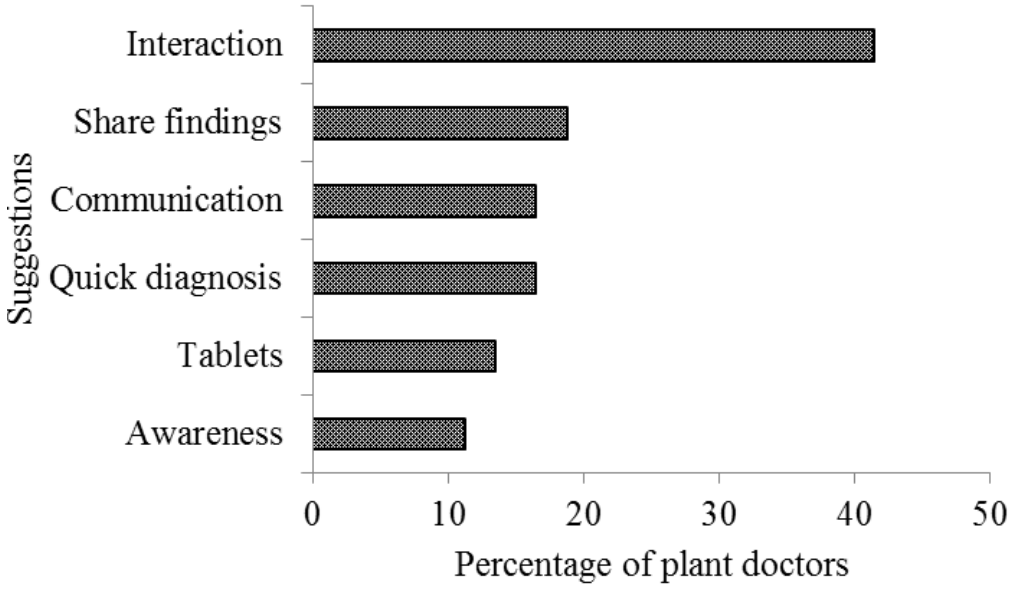


Figure 4. Suggestions by plant doctors on how their links with diagnostic services can be strengthened.

at the plant clinics.

To ensure efficient and sustainable access to diagnostic services, over 60% suggested targeted trainings, having factsheets for all crops, specialised equipment such as microscopes and pH meters as well as tablet computers for all plant doctors to enable them access to literature

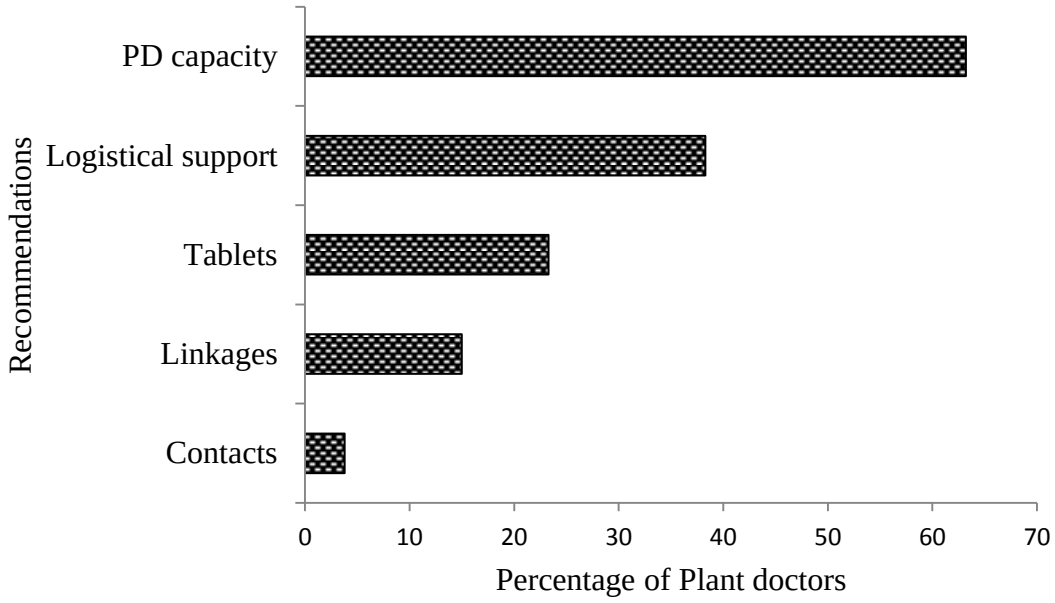


Figure 5. Recommendations for efficient access to diagnostic services by plant doctors.

on insect pests and diseases. Logistical support for sampling, transport and cameras were requested. Plant doctors also suggested that they needed to be linked with diagnostic labs that are located close to them and have the individual contacts of plant health specialists to whom they can refer difficult cases (Figure 5).

DISCUSSION

Challenges faced by plant doctors in making plant disease diagnoses

Plant doctors need diagnostic support from their peers and the plant health experts. Over 60% indicated the intention to send samples for further diagnosis, with only 30% saying that they had sent samples to a diagnostic centre. Poor institutional linkages in the plant health system for instance between extension and plant health experts in diagnostic centres (Kibett et al., 2005) may contribute to plant doctors lacking the confidence to approach these centres, despite having the need to. It may also be due to lack of logistical support to send samples to diagnostic centres and the absence of a quick feedback mechanism. While few of the plant doctors indicated difficulty in diagnosing plant health cases presented by the farmers, the poor status of some of the samples presented may have led to difficulties in diagnosis. This points to a possible positive response bias with plant doctors not willing to admit that they were not able to diagnose a problem. Some farmers did not bring plant samples with them to the plant clinic opting to describe the symptoms on the crop to the plant doctor, while some carried poor or average quality samples. There is therefore a need to train farmers on proper sampling procedure to ensure that plant doctors make correct diagnoses and recommendations which will result to better pest and disease management (Miller et al., 2009).

Accessibility of diagnostic services to plant doctors

Despite the fact that plant doctors interviewed said they were aware of diagnostic services, and some had sent samples to the labs for further diagnosis, it took a long time to receive the diagnosis report. A diagnosis report was not received for about 27% of the submitted samples. In Embu County, plant doctors received the diagnosis report immediately. In this case they personally carried samples to the diagnostic centre since it is located within close proximity to plant clinics. This shows that having the diagnostic centre close to plant clinic sites enables plant doctors to easily access these services and get quick assistance. In other counties, there were challenges with transporting the samples to the diagnostic centres and collecting samples from farmer fields when samples brought to the clinic were not good quality. This is because often times, financial allocations to extension services are low and vehicles used by extension officers are in a poor condition (Muyanga and Jayne, 2006).There was a significant positive correlation between plant doctors who have links with diagnostic services and plant doctors who had sent samples to the lab. Strong linkages with diagnostic centres and individual plant health experts will enhance diagnostic support and further collaboration

between researchers, diagnostic labs and plant doctors. On the other hand a plant doctor who has no links with diagnostic services may be less inclined to access these services when faced with difficult problems (Boa, 2013). According to Danielsen et al. (2012) there are few samples sent to diagnostic centres in Uganda due to absence of clear referral mechanisms and detachment of plant clinics from research institutions.

Plant doctors suggestions on strengthening diagnostic support

Increased interaction with diagnostic service providers, enhanced diagnostic capacity for plant doctors and logistical support to send samples to diagnostic centres were among the suggestions given on strengthening diagnostic support. However, in order to achieve efficient and sustainable diagnostic support to plant doctors there needs to be proper coordination between research and extension and formal mechanisms for engagement put in place. The Government of Kenya, through the Agricultural Sector Development Strategy 2010-2020 (ASDS) and the National Agricultural Sector Extension Policy (NASEP) emphasizes the importance of a robust agricultural extension system and recognises the need for linkages between extension and research (GoK, 2010). The NASEP has adopted a sector-wide approach to extension service delivery and aims to ensure that extension personnel are well trained by conducting in-service staff training. The policy further underscores the need for extension services to be well coordinated, thus providing an enabling environment for interactions between plant doctors and research centres, who are the diagnostic service providers. There are however institutional constraints hindering these interactions such as lack of adequate funding to implement and facilitate useful engagements (GoK, 2010). The weak linkages between plant clinics and diagnostic centres have been reported in Uganda and Ghana where there is no established mechanism for sending samples to diagnostic centres (Cornelius and Coffie, 2015; Danielsen and Matsiko, 2016). The ASDS aims to create strong links between research and extension through coordination of all stakeholders, including private sector actors and to improve agricultural training institutions (GoK, 2010).

Plant doctors without tablets showed interest in adopting them as these would enable them to access diagnostic services faster as opposed to physically taking samples to diagnostic centres. Telegram, an online network, enables them to share with each other crop health problems that are difficult to diagnose. Such plant disease diagnostic networks assist in dealing with the problem of pest and disease identification more efficiently by increasing the speed and accuracy of diagnostic procedures (Miller et al., 2009). They bring together individuals and institutions who are experts in plant disease diagnosis within and outside countries, therefore increasing surveillance at local and regional levels. The tablet computer also facilitates access to the knowledge bank which has information tools such as factsheets to assist in diagnosis (Wright et al., 2016). These services are however only accessible to plant doctors who have the devices. Use of ICTs such as electronic apps, websites and social media improves access to informational products, expert commentary and alerts thus enabling the agriculture sector to efficiently deal with pest and disease outbreaks (Srivastava, 2013; Bostock et al., 2014; Isard et al., 2015). In addition to diagnostic networks, the technique of image processing which involves the use of computer vision applications to detect plant diseases accurately and timely has been seen as a way of improving the efficiency of plant disease diagnostics. This technique can be used on smartphones, eliminating the need for complex equipment and complex software packages (Petrellis, 2015).

Conclusions

Plant doctors are generally aware of the availability of diagnostic services but the poor linkages between them and these institutions hinder useful interactions. This is seen from the difference in number between plant doctors who intended to refer samples and those who actually sent them to a diagnostic centre. The fact that in most cases it took a long time to receive the diagnosis report is seen as a contributing factor to low utilization of these services with plant doctors not feeling motivated to send samples. There is need to strengthen links between research and extension in order to build plant doctors confidence in approaching the diagnostic service providers. Use of ICTs is a fast and efficient way of ensuring access to these services, with the plant doctors already on telegram reporting that they are assisted immediately.

Conflict of Interests

The authors have not declared any conflict of interests.

ACKNOWLEDGEMENTS

We acknowledge all plant doctors and the entire Plantwise Kenya team for their cooperation and efforts towards making this study a success. We would also like to thank Solveig Danielsen, Willis Ochilo and José Gomez for reading through and providing constructive comments. Plantwise is funded and supported by UK Department for International Development (DfID), Swiss Agency for Development Cooperation (SDC), European Commission (DG DEVCO), Netherlands Ministry of

Foreign Affairs (DGIS), Irish Aid, International Fund for Agricultural Development (IFAD), and the Australian Centre for International Agricultural Research (ACIAR)

REFERENCES

Boa E, CABI AI (2013). all things come together: towards a plant health system for kenya.

Bostock R, Thomas C, Hoenisch R, Golino D, Vidalakis G (2014). Plant health: How diagnostic networks and interagency partnerships protect plant systems from pests and pathogens. Calif. Agric. 68(4):117-124.

Cornelius E, Coffie S (2015). Plant clinics and plant health diagnostic labs team up for crop health in Ghana. Res. Brief 1.

Danielsen S, Boa E, Mafabi M, Mutebi E, Reeder R, Kabeere F, Karyeija R (2013). Using Plant Clinic Registers to Assess the Quality of Diagnoses and Advice Given to Farmers: A Case Study from Uganda. J. Agric. Edu. Ext. 19(2):183-201.

Danielsen S, Matsiko F, Mutebi E, Karubanga G (2012). Second Generation Plant Health Clinics in Uganda-Measuring clinic perfomance from a plant health system perspective. Working Paper No.2

Danielsen S, Matsiko FB (2016). Using a plant health system framework to assess plant clinic performance in Uganda. Food Secur. 8(2):345-359.

GoK (2010). Agricultural Sector Development Strategy pp. 1-20.

GoK (2010). National Agricultural Sector Extension Policy. P 55.

Isard S, Russo J, Magarey R, Golod J, VanKirk J (2015). Integrated Pest Information Platform for Extension and Education (iPiPE): Progress through sharing. JIPM: 6(1):15.

Kibett J, Omunyin M, Muchiri J (2005). Elements of agricultural extension policy in Kenya : Challenges and opportunities. ACSS Conference Proceedings 7:1491-1494.

Miller S, Beed F, Harmon C (2009). Plant disease diagnostic capabilities and networks. Ann. Rev. Phytopathol. 47:15-38.

Muyanga M, Jayne T (2006). Agricultural Extension in Kenya: Practice and Policy lessons. Tegemeo Institute of Agricultural Policy and Development Working Paper No. 26.

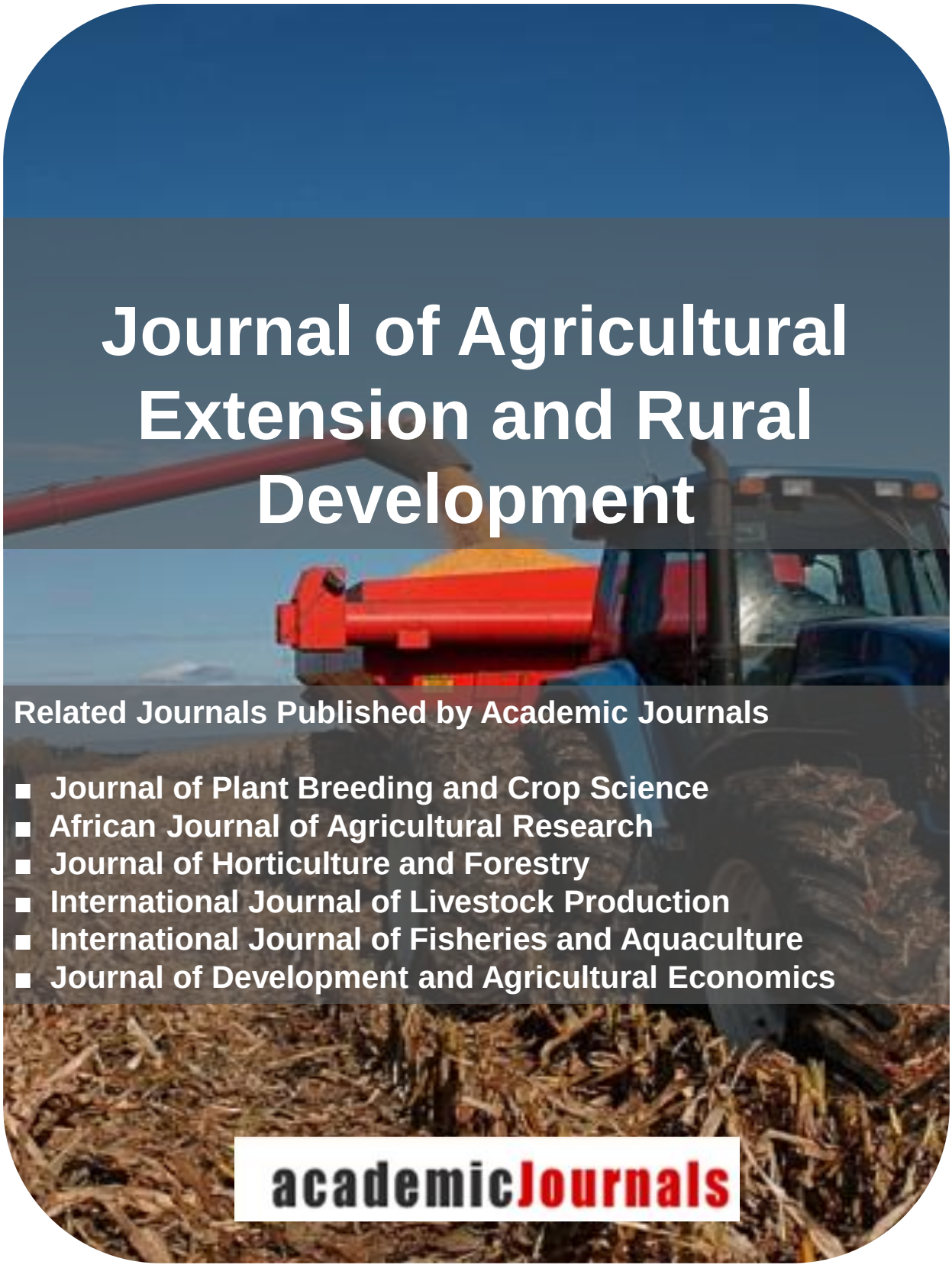
Nambiro E, Omiti J, Mugunieri L (2005). Decentralization and Access to Agricultural Extension Services in Kenya. SAGA Working Paper.

Petrellis N (2015). Plant Disease Diagnosis Based on Image Processing, Appropriate for Mobile Phone Implementation. Proceedings of the 7th International Conference on Information and Communication Technologies in Agriculture, Food and Environment (HAICTA 2015), Kavala, Greece, 17-20 September 2015.

Scheidegger U, Graf B (2013). Plantwise External Evaluation. SDC contribution Phase 1.

Srivastava MP (2013). Plant clinic towards plant health and food security. Int. J. Phytopathol. 2(3):193-203.

Wright H, Ochilo W, Pearson A, Finegold C, Oronje M, Wanjohi J, Kamau R, Holmes T, Rumsey A (2016). Using ICT Strengthen Agricultural Extension Systems for Plant Health. J. Agric. Food Inform. 17(1):23-36.



Journal of Agricultural Extension and Rural Development

Related Journals Published by Academic Journals

- Journal of Plant Breeding and Crop Science
- African Journal of Agricultural Research
- Journal of Horticulture and Forestry
- International Journal of Livestock Production
- International Journal of Fisheries and Aquaculture
- Journal of Development and Agricultural Economics

academicJournals