STRENGTHENING ACCOUNTABILITY IN PUBLIC AGRICULTURAL EXTENSION SERVICES: A CASE STUDY FROM UGANDA

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EXECUTIVE SUMMARY

A well-managed and accountable agricultural extension service can play an essential role in realizing food security and improving rural livelihoods. However, for the majority of the developing countries, establishing an accountable agricultural extension system remains a challenge. Public agricultural extension services, in particular, have been highly criticized for weak accountability of field agents to both their supervisors and their clients. Public agricultural extension systems often deploy large numbers of field agents in geographically dispersed, remote areas, which makes supervision difficult. Typically, there is also a lack of resources and of robust mechanisms to enable both the supervisors and beneficiaries to adequately follow up the activities of the field agents and provide feedback, which contributes to problems of absenteeism of field staff. Due to resource constraints, central managers also face challenges to supervise the agricultural extension managers, who are the supervisors of the field agents.

Taking Uganda as a case study, this thesis explores the use of new mechanisms for addressing these long-standing challenges of creating accountability in public agricultural extension services. The thesis had three objectives: (1) To design a diary for agricultural field agents, which should facilitate planning and supervision of agricultural extension service provision; (2) to assess the potential of different versions of this diary for strengthening accountability in public extension services; and (3) to analyze the performance of agricultural extension managers.

To meet the first two objectives, three versions of a diary for agricultural field agents were designed. The first version was a diary in a paper format, which was specifically designed to match the system of planning and reporting applied in Uganda's public extension service. This version was then transformed into an electronic version of the diary ("e-diary"), which resembled an electronic questionnaire. Based on the assessment of these two diary versions, an improved e-diary was developed, which comprises a smartphone application to be used by the field agents, and a web-based system that allows extension supervisors to review the data entered by the field agents and provide them with feedback. Moreover, the system was designed in such a way that it is possible for extension supervisors to collect information from

the beneficiaries for verification. For the assessment of the three different versions of the diary, a qualitative participatory research approach was applied. Data on the experience with using the diary was collected through a combination of focus group discussions and individual face-to-face interviews. The content analysis method was applied to analyse the data.

The results suggest that a diary for agricultural field agents has a unique potential to strengthen accountability in public agricultural extension services. This is achieved through improving planning, reporting, monitoring and evaluation of extension activities and through reducing absenteeism as well as enabling of beneficiary feedback. The findings further indicate that, for the following reasons, an electronic version of the diary is more effective in strengthening accountability than a paper version: An e-diary can make use of the Global Positioning System (GPS), which allows extension supervisors to verify whether field agents actually conducted the activities that they indicate in the diary. Thus, an e-diary enables remote supervision, which reduces the time and costs of supervision. An e-diary also facilitates real-time reporting, which enables near real-time supervision, thereby increasing the frequency of supervision. However, the first e-diary version that resembled an electronic questionnaire had drawbacks, since it focused on data collection and had limited opportunities for feedback and interaction between the extension agents and their supervisors. However, the final e-diary version, which combines a smartphone app with a web-based system, made it possible to address this limitation.

Expectedly, the assessment also revealed some limitations regarding the e-diary. Some of the users were initially apprehensive about the e-diary due to their limited experience with the use of smartphones. Consequently, the implementation of the e-diary necessitates intensive training of the users, which should not be underestimated. The results also showed that the use of the e-diary was affected by inaccessibility to electricity. Therefore, promoting the use of solar chargers or power banks in areas with poor electrification is recommended. Moreover, limited network coverage implies that the e-diary needs to be programmed in such a way that data can be entered off-line. Furthermore, the findings suggest the need to combine the implementation of the e-diary with incentives, such as awards of recognition.

In view of the essential role that extension managers, as the supervisors of the field agents, play for accountability, an analysis of their performance was included as the third objective of the thesis. To meet this research objective, a quantitative research approach was applied. The main data source was the extension management system that was set up by the Ugandan Ministry of Agriculture, Animal Industries and Fisheries (MAAIF). This system provides data on the

timeliness of the submission of work plans and reports by the extension managers, which makes it possible to calculate measurable indicators of managers' performance based on their expected roles and responsibilities. In addition to preparing descriptive statistics of such performance indicators, econometric models were estimated, using additional data from secondary sources on variables, which were hypothesized to influence the managers' performance.

The descriptive statistics of the performance indicators showed that the majority of the extension managers were not able to meet the performance requirements of MAAIF. The econometric analysis made it possible to identify factors that were associated with performance. The amount of the extension grant provided to the district and the ratio of extension workers to households were found to be key factors. The findings led to the recommendation to improve the performance of the extension managers through capacity building, especially in management, and through setting-up a strict performance monitoring system, to which the use of the e-diary could contribute. It was also recommended to increase funding to the districts and improve the ratio of extension workers to households so as to provide better working conditions and incentives to extension staff and their managers.

Overall, the thesis indicates that diaries, especially electronic ones, in combination with monitoring systems for extension managers, offer a unique and largely underutilized potential to address entrenched problems of ensuring accountability in public agricultural extension services. It was also pointed out that additional accountability mechanisms will be useful to further strengthen accountability, in particular mechanisms that allow the beneficiaries of the extension service to provide direct feedback on the quality of service provision. The thesis also highlights the potential of using digital tools for strengthening both upward and downward accountability in public extension services. The findings of the thesis are likely to be relevant not only for agricultural extension services but also for other public services, such as rural health care and education, which face similar problems of managing large numbers of field agents in geographically dispersed, remote areas, where effective supervision is an inherent challenge.

ZUSAMMENFASSUNG

Ein gut geführter, verantwortlicherund rechenschaftspflichtiger landwirtschaftlicher Beratungsdienst kann eine wesentliche Rolle bei der Verwirklichung von Ernährungssicherheit und der Verbesserung ländlicher Lebensgrundlagen spielen. Für einen Großteil der Entwicklungsländer bleibt es jedoch eine Herausforderung, ein gut geführtes landwirtschaftliches Beratungssystem zu etablieren. Insbesondere öffentliche landwirtschaftliche Beratungsdienste wurden wegen der geringen Rechenschaftspflicht derBerater sowohl gegenüber ihren Vorgesetzten als auch gegenüber ihren Kunden stark kritisiert. Öffentliche landwirtschaftliche Beratungssysteme setzen oft eine große Anzahl von Berater/-innen in geografisch großen und abgelegenen Gebieten ein, was deren Überwachung erschwert. Typischerweise fehlen auch Ressourcen und robuste Mechanismen, die es sowohl den Vorgesetzten der Berater/-innen als auch den Landwirt/-innen ermöglichen, die Tätigkeiten der Berater angemessen zu verfolgen und Feedback zu geben. Das trägt zu Problemen von Abwesenheit der Berater/-innen bei. Aufgrund von Ressourcenengpässen ist es auch fürdie Manager der Beratungsdienste im Ministerium auf der zentralen Ebene eine Herausforderung, die Manager der auf der Ebene der Distrikte zu beaufsichtigen.

Am Beispiel von Uganda wird in dieserFallstudie die Verwendung neuer Mechanismen zur Bewältigung deranhaltenden Herausforderung untersucht, Rechenschaftspflicht in öffentlichen landwirtschaftlichen Beratungsdiensten zu schaffen. Die Arbeit hatte drei Ziele: (1) die Entwicklung eines Tagebuchs für landwirtschaftliche Berater/-innen, das die Planung und Überwachung der landwirtschaftlichen Beratungsdienste erleichtern soll; (2) die Bewertung des Potenzials verschiedener Versionen dieses Tagebuchs zur Stärkung der Rechenschaftspflicht bei öffentlichen Beratungsdiensten; und (3) die Verwendung digitaler Daten zur Analyse der Leistung der Managerder landwirtschaftlichen Berater auf Distrikt-Ebene.

Um die ersten beiden Ziele zu erreichen, wurden drei Versionen eines Tagebuchs für landwirtschaftliche Berater/-innen entworfen. Die erste Version war ein Tagebuch in Papierform, das speziell auf das Planungs- und Berichtssystem des öffentlichen Beratungsdienstes Ugandas abgestimmt wurde. Diese Version wurde dann in eine

elektronische Version des Tagebuchs ("E-Tagebuch") umgewandelt, die einem elektronischen Fragebogen ähnelte. Basierend auf der Bewertung dieser beiden Tagebuchversionen wurde ein verbessertes E-Tagebuch entwickelt, das eine Smartphone-Anwendung für die Berater/-innen und ein computergestütztes System umfasst, das es den Managernder landwirtschaftlichen Beraterauf Distrikt-Ebene und auf der zentralen Ebene ermöglicht, die von den Beratern erfassten Daten zu überprüfen und ihnen Feedback zu geben. Darüber hinaus wurde das System so konzipiert, dass es den Berater/-innen möglich ist, Informationen von den Landwirt/-innenaufzunehmen, die den Beratungsdienst in Anspruch nehmen. Damit können die Manager des Beratungsdienstes zur Überprüfung auch direkt bei den Landwirt/-innen Anfragen stellen.

Für die Bewertung der drei verschiedenen Versionen des Tagebuchs wurde ein qualitativer partizipativer Forschungsansatz verwendet. Die Daten über die Erfahrungen mit der Nutzung des Tagebuchs wurden durch eine Kombination aus Fokusgruppen-Diskussionen und individuellen Einzelinterviews gesammelt. Zur Analyse der Daten wurde die Methode der Inhaltsanalyse angewendet.

Die Ergebnisse zeigen, dass ein Tagebuch für landwirtschaftliche Berater/-innen ein einzigartiges Potenzial hat, die Rechenschaftspflicht in den öffentlichen landwirtschaftlichen Beratungsdiensten zu stärken. Dies wird erreicht durch eine Verbesserung der Planung, Berichterstattung, Überwachung und Bewertung von Beratungsmaßnahmen, durch die Verringerung von Abwesenheit und durch die Ermöglichung von Feedback durch die Landwirt/-innen. Die Ergebnisse zeigen zudem, dass aus folgenden Gründen eine elektronische Version des Tagebuchs die Rechenschaftspflicht effektiver stärkt als eine Papierversion des Tagebuchs: Ein E-Tagebuch kann das Global Positioning System (GPS) nutzen, das es Managern der landwirtschaftlicher Berater/-innen ermöglicht, zu überprüfen, ob sich ein/-e Berater/-in tatsächlich am im Tagebuch angegebenen Ort befand. Damit ermöglicht ein E-Tagebuch eine Fernüberwachung, was den Zeit- und Kostenaufwand für die Aufsicht reduziert. Ein E-Tagebuch erleichtert zudem das Echtzeit-Reporting und somit eine zeitnahe und effizientere Aufsicht. Die erste E-Tagebuch-Version, die einem elektronischen Fragebogen ähnelte, hatte jedoch Nachteile, da sie sich auf die Datenerfassung konzentrierte und nur begrenzte Möglichkeiten für Feedback und Interaktion zwischen den Berater/-innen und ihren Vorgesetzten hatte. Mit der endgültigen E-Tagebuch-Version, die eine Smartphone-Anwendung mit einem computergestützten System kombiniert, konnte diese Einschränkung jedoch behoben werden.

Erwartungsgemäß zeigten sich auch einige Einschränkungen des E-Tagebuchs. Einige der Nutzer/-innen waren zunächst besorgt über das E-Tagebuch, da sie nur begrenzte Erfahrungen mit der Nutzung von Smartphones hatten. Die Umsetzung des E-Tagebuchs erfordert daher eine intensive Schulung der Nutzer/-innen, die nicht zu unterschätzen ist. Die Ergebnisse zeigten auch, dass die Nutzung von E-Tagebüchern durch eingeschränkte Verfügbarkeit von Elektrizität beeinträchtigt wurde. Daher wird empfohlen, den Einsatz von Solar-Ladegeräten oder Power Banks in Gebieten mit schlechter Elektrifizierung zu fördern. Darüber hinaus führt die begrenzte Netzabdeckung dazu, dass das E-Tagebuch so programmiert werden muss, dass die Dateneingabe offline erfolgen kann. Außerdem deuten die Ergebnisse darauf hin, dass die Umsetzung des E-Tagebuchs mit Anreizen wie Auszeichnungen kombiniert werden muss, um eine hohe Nutzungsrate des E-Tagebuchs zu erreichen.

In Anbetracht der wesentlichen Rolle, die die Manager der landwirtschaftlichen Berater/-innen für die Rechenschaftspflicht spielen, wurde eine Analyse ihrer Leistung als drittes Ziel in die Arbeit aufgenommen. Um dieses Forschungsziel zu erreichen, wurde ein quantitativer Forschungsansatz angewandt. Eine wichtige Datenquelle war das Monitoring-System, das für das landwirtschaftliche Beratungswesen im Ministerium für Landwirtschaft, Tierzucht und Fischerei (MAAIF) eingerichtet wurde. Dieses System liefert Daten über die rechtzeitige Vorlage von Arbeitsplänen und Berichten durch die die Manager der landwirtschaftlichen Berater/-innen. Damit können messbare Indikatoren für die Leistung der Manager auf Grundlage der von ihnen erwarteten Rollen und Verantwortlichkeiten berechnet werden. Zusätzlich zur Erstellung deskriptiver Statistiken solcher Leistungsindikatoren wurden ökonometrische Modelle geschätzt, die zusätzliche Daten aus Sekundärquellen zu Variablen verwenden, von denen angenommen wurde, dass sie die Leistung der Manager beeinflussen.

Die deskriptive Statistik der Leistungsindikatoren zeigte, dass die Mehrheit der Manager nicht in der Lage war, die Leistungsanforderungen des MAAIF zu erfüllen. Die ökonometrische Analyse ermöglichte es, Faktoren zu identifizieren, die die Leistung beeinflussten. Die Höhe des im jeweiligenDistrikt gewährten Beratungs-Budgets und das Verhältnis von Berater/-innen zu Landwirt/-innen wurden als Schlüsselfaktoren identifiziert. Die Ergebnisse führten zu der Empfehlung, die Leistung der Manager durch Kapazitätsentwicklung, insbesondere im Management, und durch die Einrichtung eines stringentenMonitoring-Systems zu verbessern.Dazu könnte die Nutzung des E-Tagebuchs beitragen. Es wurde zudem empfohlen, die Budgetsfür die Distrikte aufzustocken und das Verhältnis von Berater/-innen zu Landwirt/-

innen zu erhöhen, um bessere Arbeitsbedingungen und Anreize für das Beratungspersonal und seine Führungskräfte zu schaffen.

Insgesamt zeigt dieseStudie, dass Tagebücher - insbesondere elektronische - in Kombination mit Monitoring-Systemen für die Manager der Berater/-innen ein beachtliches und weitgehend ungenutztes Potenzial bieten, um die schon lange bekannten Probleme des Managements in öffentlichen landwirtschaftlichen Beratungsdiensten anzugehen. Es wurde zudem aufgezeigt, dass zusätzliche Mechanismen nützlich sein werden, um das Management weiter zu stärken. Dazu gehörten insbesondere Mechanismen, die es den Begünstigten des Beratungsdienstes, also den Landwirt/-innen, ermöglichen, direktes Feedback über die Qualität der Leistungserbringung zu geben. Die Studie zeigt außerdem das Potenzial der Verwendung digitaler Instrumente zur Stärkung des Managements im öffentlichen Beratungswesen auf, und zwar sowohl in Bezug auf die Manager als auch auf die Berater/-innen vor Ort. Die Ergebnisse der Arbeit dürften nicht nur für landwirtschaftliche Beratungsdienste, sondern auch für andere öffentliche Diensterelevant sein, wie etwa die Gesundheitsversorgung und das Bildungswesen im ländlichen Raum. Auch diese Dienste kämpfen mit ähnlichen Problemen beim Management einer großen Anzahl von Angestellten in großen und oft abgelegenen Gebieten, in denen eine wirksame Aufsichtdes im Feld eingesetzten Personals eine große Herausforderung darstellt.

LIST OF ACRONYMS AND ABBREVIATIONS

App	Application
DAAD	German Academic Exchange Service
e-diary	Electronic diary
E-Systems	Electronic Systems
GDP	Gross Domestic Product
GPS	Global Positioning System
GRM	Grievance Redress Mechanisms
ICTs	Information and Communication Technologies
Km	Kilometers
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
NAADS	National Agricultural Advisory Delivery System
p-diary	Paper diary
SMS	Short Messaging Services
UBOS	Uganda Bureau of Statistics
UGX	Ugandan Shillings
ZARDI	Zonal Agricultural Research and Development Institute

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1 INTRODUCTION

1.1 Problem Statement and Justification of the thesis

A well-managed and accountable agricultural extension service delivery system is an essential component for realizing food security and improving rural livelihoods. Agricultural extension facilitates the transfer of knowledge and technologies to the farmers and other agricultural commodity value chain actors, thus enhancing productivity and increase in income (Anderson & Feder, 2004; Dercon *et al.,* 2006; Anderson & Feder, 2007; Swanson and Rajalahti 2010; Ragasa *et al.,* 2016). However, in many developing countries, agricultural extension still faces the challenge of establishing an accountable system (Birner & Anderson, 2007). The public agricultural extension system, in particular, has been highly criticized for the weak accountability of the field agents to both their supervisors (upward accountability) and clients (downward accountability).

This thesis is thus aimed at strengthening accountability in the public agricultural extension services, but the findings may also be relevant to other public services that deploy large numbers of rural-based field staff, such as health and education. In the study, the potential of both paper and electronic diaries for strengthening accountability in the public agricultural extension services was investigated. Furthermore, the performance of agricultural extension managers was analysed. This introductory chapter covers; the problem statement and justification of the study, objectives of the study, literature review, study context and methodology.

Public agricultural extension systems often deploy large numbers of field agents in geographically dispersed, remote areas, thereby making supervision transaction-intensive in terms of time and costs (Feder *et al.*, 1999; Anderson & Feder, 2004; Feder *et al.,* 2010). Moreover, the supervisors of the field agents are usually constrained by time, underdeveloped transport infrastructure and insufficient financial resources (DeRenzi *et al.,* 2011; Nakasone & Torero, 2016). Additionally, public bureaucracies tend to adopt hierarchical, top-down and supply-driven management systems, which also make accountability to the beneficiaries a challenge (Feder *et al.*, 1999; Anderson & Feder, 2004; Feder *et al.,* 2010). Furthermore, there

is a lack of robust mechanisms to enable both the supervisors and clients to adequately follow up the activities of the field agents. Due to these difficulties in providing effective supervision, the field agents are generally not held accountable to both their supervisors and beneficiaries. Inadequate supervision lowers the incentive of the field agents to work and results in absenteeism of the field agents, thereby reducing the utility of the services to the beneficiaries (Rogers & Vegas, 2009; Aker, 2011).

Just like with the agricultural extension services, strengthening accountability in other public service systems has remained a challenge. Most public systems that require large numbers of rural-based field staff, such as health and education also face inherent difficulties of absenteeism, shirking and moonlighting due to difficulty in supervision of the field staff (Chaudhury *et al.*, 2006; García-Prado & Chawla, 2006; Goldstein *et al.*, 2010; Ramadhan, 2013; Fujii, 2019). The literature highlights various mechanisms such as decentralisation, performance monitoring and reporting structures and processes that have been attempted in the different systems to strengthen accountability (Anderson & Van Crowder, 2000; Devas & Grant, 2003; Smoke, 2003; Duflo & Hanna, 2005; Taylor, 2007; Birner & Anderson, 2007; Yilmaz *et al.*, 2010). However, it appears that the potential of using diaries to strengthen accountability remains less explored. In this study, therefore, a diary was designed to improve accountability: a Diary for Agricultural Field Agents. Taking Uganda as a case study, the Diary for Agricultural Field Agents was assessed for its potential in strengthening accountability in the public agricultural extension services. The diary was designed to enable field agents to report their daily activities, supervisors to follow up the field agents' reported activities, and beneficiaries to verify and provide feedback on the reported activities. This is a unique case study because as further pointed out in the literature review section below, only a few agricultural extension systems have developed diaries for agricultural field agents (MACO, 2011; MAIWD, 2016). Moreover, empirical studies assessing the potential of the diaries for strengthening accountability in the public agricultural extension services are still scarce.

The first version of the Diary for Agricultural Field Agents was developed in a paper format and was referred to as the paper diary (p-diary). However, the rapid spread of mobile phone coverage in many developing countries creates new opportunities for using information and communication technologies (ICTs) such as smartphone applications to improve service delivery (Aker and Mbiti, 2010). Consequently, the Diary for Agricultural Field Agents was also converted into an electronic version called electronic diary (e-diary). The first e-diary was

based on “survey solutions,” which is a smartphone application developed by the World Bank for survey data collection (Fiji & Radyakin, 2017). On assessment, the electronic version was found to be more promising in strengthening accountability compared to the paper version. However, since the “survey solutions” application was designed purposely for data collection, the e-diary was found to have two major drawbacks. First, the field agent could not retain a copy of the reported activities for future reference, as this was not relevant in data collection. Secondly, survey solutions only used three levels and therefore, only three categories of users were able to interact with each other on the system. However, although Uganda’s agricultural extension system consists of three levels, there is more than one category of users at each level. Thus, in order to address the above drawbacks, an improved version of the e-diary was developed. The improved e-diary, which was in the form of an android smartphone application, allowed the field agent to retain a copy of the reported activities. Additionally, it was designed based on the existing agricultural extension structure and therefore, all actors along the structure were included. Subsequently, the improved “e-diary” was also assessed for its potential to strengthen accountability in the public extension services.

In addition to assessing the potential of diaries in strengthening the accountability of field agents, the performance of agricultural extension managers and factors influencing it were analysed. The agricultural extension managers are referred to as the District Production and Marketing officers and are responsible for the management and coordination of all agricultural extension services at the Local government extension level. Just like with the supervision of the field agents, central management faces challenges in the supervision of the agricultural extension managers. An important step though, has been the construction of indicators by the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) to measure the performance of the agricultural extension managers. Whereas several studies have been undertaken to determine the performance of agricultural extension personnel, the focus has been on the performance of the field agents and less on the extension managers (Khalil *et al.*, 2009; Ifenkwe, 2012; Okwoche & Asogwa, 2012; Ragasa *et al.*, 2016). In this study, therefore, the performance of the extension managers and the factors influencing it were determined based on the MAAIF established measurable indicators.

1.2 Objectives of the thesis

The overall objective of this study was to develop and assess mechanisms for strengthening accountability in the public agricultural extension services. The thesis used a case of Uganda to address three specific objectives of which each constitutes a separate empirical chapter of the thesis. The specific objectives include:

1) To design a diary for agricultural field agents, and assess its potential for strengthening accountability in the public agricultural extension services.
2) To assess the potential of smartphone applications in strengthening accountability in the public agricultural extension services.
3) To analyse the performance of agricultural extension managers

Given that each of the objectives constitutes a separate chapter of the thesis, they each had specific objectives which are stated below:

To design a diary for agricultural field agents and assess its potential for strengthening accountability in the public agricultural extension services.

1) To design a diary for agricultural field agents as a tool for strengthening accountability in the public agricultural extension services.
2) To assess the potential of the diary for agricultural field agents in strengthening accountability in the public agricultural extension services.

Assessing the potential of smartphone applications in strengthening accountability in the public agricultural extension services.

1) To assess whether smartphone applications can be used to strengthen accountability in the public agricultural extension services.

Analysing the performance of agricultural extension managers

1) To analyse the performance of the agricultural extension managers based on the established measurable performance indicators.
2) To determine the factors influencing the performance of the agricultural extension managers in relation to these indicators.

1.3 Literature Review

The following section presents the literature review, which encompasses (i) Accountability in public service delivery, (ii) Mechanisms for strengthening accountability in public services. (iii) Potential of using diaries to strengthen accountability in service delivery, (iv) Potential of using information and communication technologies (ICTs) to strengthen accountability in service delivery and (v) Measurement of performance in agricultural extension services.

1.3.1 Accountability in public service delivery

Accountability can be defined as the obligation for an individual or organization to answer for one's actions. In the context of public service delivery, accountability entails the responsibility for public servants to meet the expected objectives and standards and to answer for all actions involved in service delivery (World Bank, 2010). Accountability in public service delivery can be conceptualised into upward and down accountability. Upward accountability is where the public servants are answerable to their higher-level supervisors (Yilmaz *et al.,* 2010). Downward accountability, on the other hand, is where the public servants are answerable to the beneficiaries of the services (Devas & Grant, 2003; Wongtschowski *et al.*, 2016). As highlighted in the background, the accountability problem of the field agents is on both the upward and downward fronts.

Regarding upward accountability, the supervisors have difficulty to follow up the activities of the field agents due to their wide geographical dispersion in the hard-to-reach areas (Feder *et al.,* 1999; Anderson & Feder, 2004; Feder *et al.,* 2010). Contrariwise, the downward front is characterised by hierarchical, top-down and supply-driven management approaches in the public bureaucracies making accountability to the beneficiaries a challenge (Anderson & Feder, 2003; Anderson & Feder, 2004; Feder *et al.,* 2010). Whereas some form of upward accountability may exist in many extension programs, the mechanisms for downward accountability are rare (Wongtschowski *et al.* 2016). Consequently, many field agents tend to focus only on the routine activities as assigned by their supervisors with limited if at all any attention to meet the beneficiaries' needs (Swanson & Rajalahti, 2010). Furthermore, since supervisors cannot easily monitor activities, the field agents become accountable to nobody, thereby reducing their incentive to work (Feder *et al.,* 1999). As such, the public systems face inherent difficulties of absenteeism, shirking and moonlighting (Chaudhury *et al.*, 2006; García-Prado & Chawla, 2006; Goldstein *et al.*, 2010; Ramadhan, 2013; Fujii, 2019).

1.3.2 Mechanisms for strengthening accountability in public services

Public sectors around the world have embarked on several mechanisms to strengthen accountability. The mechanisms for upward accountability include; independent monitoring bodies, administrative courts, and structures within the bureaucratic hierarchies such as reporting, performance monitoring and performance measurement systems (Devas & Grant, 2003; Taylor, 2007; Yilmaz, *et al.*, 2010). The major mechanism for downward accountability is the decentralization of public services (Rivera, 1996; Anderson & Van Crowder, 2000; Devas & Grant, 2003; Smoke, 2003; Birner & Anderson, 2007). Other mechanisms of downward accountability include public and local council meetings, media, public complaint systems, opinion surveys, citizen scorecards, participatory planning and participatory budgeting (Blair, 2000; Edwards *et al.*, 2015; Goetz & Gaventa, 2001; Jilke, 2013). The downward accountability mechanisms present an opportunity for the citizens to monitor the services received and have a voice in the government policies (Yilmaz *et al.*, 2010). As noted by James & Sulemana (2014), the citizen's voice is important not only for policies but also in transferring relevant technologies and any other efforts geared towards improving citizen livelihoods. Although several initiatives have been undertaken to strengthen accountability in public systems, little has been explored about the potential of using diaries in this regard.

1.3.3 Potential of using diaries to strengthen accountability in service delivery

Diaries present a unique mechanism for strengthening accountability in public services. In general, diaries have been used in different disciplines such as medicine (Richardson, 1994; Valimaki *et al.*, 2007; Furness & Garrud, 2010; Bedwell *et al.*, 2012; Munyewende & Rispel, 2014) and psychology (Mohr *et al.*, 2001; Cates *et al.*, 2004; Laurenceau & Bolger, 2005) to monitor various human behaviours, daily events and experiences. In these fields, diaries have been found to not only generate rich data regarding processes but also to provide more accurate descriptions as they enable prospective recording of the users' experiences.

In spite of their widespread use in other fields and the benefits associated with them, documented examples of the application of diaries in agriculture remain relatively scarce. Moreover, little is known regarding their use for strengthening accountability in public agricultural extension services. The studies on the use of diaries in agriculture have focused more on capturing agricultural production statistics (Deininger *et al.*, 2012) and analysing time and labour allocation among farming households (Apis *et al.*, 2013; Daum *et al.*, 2018). Only

a few agricultural extension systems have documented examples of diaries for agricultural field agents (MACO, 2011; MAIWD, 2016). Moreover, there is a paucity of studies assessing their potential for strengthening accountability in the public agricultural extension services.

Furthermore, literature shows that the existing diaries for agricultural field agents are in a paper version. However, technological advancements have enabled the application of electronic versions of diaries in other fields (Straka *et al.*, 1997; Tiplady *et al.*, 1997; Stone *et al.*, 2003; Jamison, 2001; Hufford *et al.*, 2002; Bolger *et al.*, 2003; Quinn *et al.*, 2003; Palermo *et al.*, 2004; Nyholm *et al.*, 2004; Green *et al.*, 2006; Sife *et al.*, 2007; Lane *et al.*, 2006; Dale & Hagen, 2007; Broderick, 2008 & O'Connor *et al.*, 2016). Nonetheless, studies exploring the potential of electronic diaries for strengthening accountability in public services are still scarce. Against this background, this study was aimed at closing this knowledge gap.

1.3.4 Potential of using ICTs to strengthen accountability in service delivery

An important element of this thesis is the use of an electronic version of the diary. Thus, it was also found useful to review the potential of ICTs in general. The existing literature highlights some attempts that have been made regarding the use of ICTs for strengthening accountability in public services that employ large numbers of rural-based field staff. In education, for example, cameras with a tamper-proof date and time function were used to monitor the attendance of teachers in rural schools (Duflo & Hanna, 2005). Similarly, Cilliers *et al.* (2013) piloted a mobile phone SMS-based monitoring system designed to improve teacher attendance. Both of these studies reported that the use of these systems in combination with monetary incentives resulted in a decline in teacher absence. In health, successful examples have also been reported. For example, WhatsApp mobile messaging was found useful in enhancing the supervision of health services (Henry *et al.*, 2016). Similarly, a mobile phone and web application was also found to be largely useful, feasible and acceptable in the supervision and support of health workers (Modi *et al.*, 2015). In another study, a simple feature mobile phone-based community health management information system was also found to be feasible and viable for the provision of community-based health information needed to improve the supervision of health services. Although in this case, smartphones and computers would be needed for data analysis and visualization of the information collected (Biemba *et al.*, 2017).

In the agricultural sector, however, efforts in regards to the use of ICTs for accountability have mainly been geared towards strengthening the beneficiaries' voice (Jarvis *et al.*, 2015; Gilberds

et al., 2016). There is a dearth of literature on the use of ICTs for enabling supervisors to follow up and monitor the activities of the agricultural field agents. In particular, hardly any study has assessed the potential of using smartphone applications in this regard. Yet, the recent rapid spread of mobile phone coverage in many developing countries creates new opportunities for exploring the potential of smartphone applications (Aker and Mbiti, 2010). Moreover, supervision is harder in the agricultural services were the field agents visit beneficiaries who are widely dispersed as compared to the education and health services were the teachers and health workers are usually stationed at one school or health center, respectively. This study was therefore intended to close this knowledge gap by; assessing the potential of a smartphone application for strengthening accountability in the public agricultural extension services.

1.3.5 Measurement of performance in agricultural extension services

Analysing the performance of the agricultural extension managers was also another important aspect of this study. The performance of the extension managers is also crucial for establishing an effective and accountable agricultural extension system, given that the agricultural extension managers are responsible for the management and coordination of all the extension services at the local government level. While some studies have analysed performance in agricultural extension service delivery, the focus has been more on the performance of either agricultural extension field agents or extension organisations (Khalil *et al.*, 2009; Ifenkwe, 2012; Okwoche & Asogwa, 2012; Ragasa *et al.*, 2016). There is hardly any study on the performance of the managers of the field agents. Furthermore, since most of these studies measured the performance of the field agents, the indicators used for measuring the performance of the extension staff were constructed based on the expected roles and responsibilities of the field agents.

1.4 Study context

1.4.1 Overview of agricultural extension services in Uganda

This study was conducted in Uganda. Similar to many other developing countries, agriculture is the backbone of Uganda's economy. According to the National Population and Housing Census Main Report of 2014, approximately 80% of all the households in the country were involved in agriculture (UBOS, 2016). The agricultural sector contributes about 26% of the country's gross domestic product (GDP) and nearly half of the exports. However, the majority of the farmers are small scale farmers who are estimated to deliver more than 75% of the total

agricultural output (MAAIF, 2016a). The country has a strategic plan of transforming agriculture from subsistence to commercial farming, and agricultural extension forms one of the key components to achieving this transformation (MAAIF, 2016b). For a long time, Uganda has used agricultural extension as one of the major strategies to achieve agricultural transformation. In an attempt to put in place an effective agricultural extension system, the government of Uganda has embarked on several agricultural extension reforms. In the past, agricultural extension services were provided through a centrally-controlled public extension system. However, the public extension system was seen as a supposedly an out-of-date, top-down, supply-driven model that is prone to administrative bureaucracies (Semana, 1998). Additionally, the public extension system was also faced with other challenges including; failure to practically monitor the quality of extension services, lack of accountability to beneficiaries, failure to have sufficient impact, lack of enough extension workers to meet the requirements of all the farmers and lack of financial sustainability, a problem exacerbated by the high cost of the system (Anderson & Feder, 2003; Barungi *et al.,* 2016).

In order to improve the accountability of the extension services and to address other challenges of a centrally-controlled extension system, the extension services were decentralized during the late 1990s (Anderson & Van Crowder, 2000; Bashaasha *et al.,* 2011; Barungi *et al.*, 2016). Despite the decentralization, the provision of agricultural extension services was still faced with challenges. Consequently, in 2001, the government made another reform that shifted the delivery of the agricultural extension services from the public sector to a private sector-led extension system referred to as National Agricultural Advisory Delivery System-NAADS (Rivera, 2004). NAADS targeted the development and use of farmer groups and institutions to empower farmers to; contract out private agents to provide the extension services, and conduct demand-driven monitoring and evaluation of the delivery of the agricultural advisory services (Bukenya, 2010; Benin *et al.,*2011; Mukembo & Edwards, 2015; AfranaaKwapong & Nkonya, 2015). However, NAADS was also found to be unsatisfactory (Joughin & Kjær, 2010; Rwamigisa *et al.,* 2018; Ilukor *et al.,*2015; Barungi *et al.,*2016; AfranaaKwapong & Nkonya, 2015). Accordingly, in 2014, the government undertook further reforms in which the extension function was transferred from NAADS back to the public sector. The new public extension system referred to as the "Single Spine Extension System" is aimed at rebuilding and revitalizing the public extension system within the context of pluralism (MAAIF, 2016a).

1.4.2 Uganda's public agricultural extension structure

Uganda's public agricultural extension system is structured at three levels. It starts at the national level, which is at the top through the district level, to the sub-county level at the bottom (see figure 1). At the national level is the Ministry of Agriculture, Animal Industry and Fisheries, which is mandated to coordinate and manage all the agricultural extension services in the country, through the Directorate of Agricultural Extension Services. The directorate is under the headship of the Director Agricultural Extension Services.

At the district level is the Department of Production and Marketing, which coordinates the delivery of all agricultural extension services within the district. The Department of Production and Marketing is headed by the District Production and Marketing Officer. The District Production and Marketing Officer is administratively supervised by the Chief Administrative Officer, and technically by the Directorate of Agricultural Extension Services through the Commissioner Agricultural Extension Services. The Chief Administrative Officer is the head of administration at the district. The Department of Production and Marketing has five divisions headed by respective subject matter specialists. The subject matter specialists include; District Veterinary Officer, District Agricultural Officer, District Fisheries Officer, District Entomologist and District Commercial Officer. All the subject matter specialists report to the District Production and Marketing Officer.

At the sub-county level are the field agents, who are responsible for delivering agricultural extension services to the farmers and other beneficiaries within the sub-county. Each sub-county is planned to have three field agents. These include; an Agricultural Officer, Veterinary Officer and a Fisheries Officer, responsible for crop services, veterinary services, and Fisheries services, respectively. The field agents are technically supervised by the respective subject matter specialists located at the district and administratively by the sub-county chief. The sub-county chief is the head of administration at the sub-county.

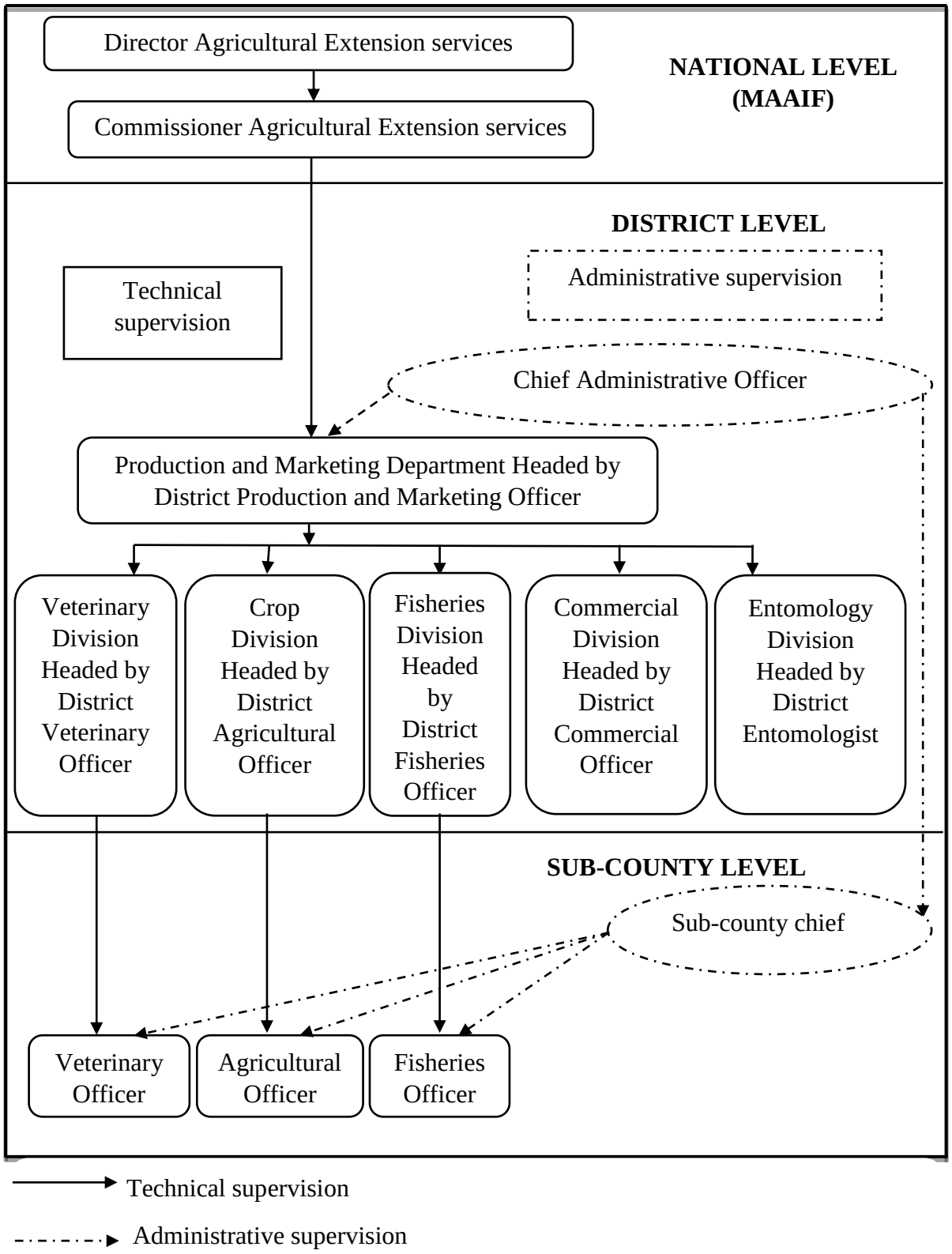

Figure 1: Uganda's Agricultural extension structure

Source: Adapted from MAAIF (2015)

1.5 Methodology

In the thesis, a combination of both qualitative and quantitative research methods was used. The data collection methods used included; individual face-to-face interviews, focus group discussions and secondary data sets. The rest of this section presents the methods that were used to address the different objectives.

Objective one and objective two were addressed using a qualitative participatory research approach (Cornwall & Jewkes, 1995). This involved bringing together the researchers and the intended users to jointly design the diary for agricultural field agents and assess its potential for strengthening accountability in the public agricultural extension services. The benefit of this approach is that it provides the researcher the opportunity to collect the users' feedback, which is essential for developing the innovations according to the specific needs of the users (Martin& Sherington, 1997). Data was collected using a complementary combination of focus group discussions and individual face-to-face interviews, both of which are methods used to collect qualitative data (Berg & Lune, 2012). The data collection was conducted in two stages. In the first stage, which involved the development of the diary and assessment of its potential for strengthening accountability in the public agricultural extension services, data collection was carried out between June and November 2017. Subsequently, in the second phase, which involved the assessment of the potential of the improved e-diary for strengthening accountability in the public extension services, the data was collected between April and July 2019 (see details on data collection in the respective Chapters addressing the two objectives).

The analysis of the data was conducted using content analysis, which is a method used to analyse qualitative data (Holsti, 1968). Content analysis involves coding of texts and, thereafter, transforming them into common themes (Elo and Kyngäs, 2008). In this study, the data collected from the focus group discussions and individual interviews were used to develop common themes with a particular focus on the structure, content, features, and appearance of the diary, as well as the potential of the diary to strengthen accountability in the public agricultural extension services.

For objective three of analyzing the performance of agricultural extension managers, a quantitative research approach was used. Three indicators were used to measure the performance of the managers and these included; responsiveness to staffing, responsiveness to planning and responsiveness to reporting. Responsiveness to staffing was based on the staffing

ratio (the ratio of the number of staff recruited to the number of staff approved to be recruited) of the district for which the manager is in charge. Responsiveness to planning was based on the submission of the annual work plans by the extension managers, whether the manager submitted annual work plans and whether the submission was within the required time. Responsiveness to reporting was based on the submission of quarterly reports by the extension managers; whether the manager submitted reports and whether the submission was in time. The data on these indicators were obtained from the MAAIF management system, where it is regularly compiled. Additionally, on the factors associated with the performance of the extension managers, statistics as of November 2018 were obtained from secondary data sources. The data obtained included the individual characteristics of the extension managers and the characteristics of the districts in which they operate. These characteristics were mainly obtained from the Uganda Bureau of Statistics, the Electoral Commission and MAAIF (MAAIF, 2017; Electoral commission, 2016; UBOS, 2016).

The performance of the agricultural extension managers was analyzed using descriptive statistics, including means, frequencies and percentages. The factors influencing the performance of the agricultural extension managers were determined using econometric models. Specifically, the factors influencing responsiveness to staffing were determined using a fractional logit model (Papke and Wooldridge, 1996). This model was suitable because the dependent variable (staffing ratio) was a fraction with values greater than zero and less than or equal to one. The factors influencing responsiveness to planning were estimated using an ordered logit model. The ordered logit model is used when the dependent variable has more than two categorical dependent variables and the values of each category have meaningful sequential order (Greene & Hensher, 2010). In this case, the categories included; extension managers who submitted the annual work plan in the required time, those who submitted but not on time and those that never submitted. The factors influencing responsiveness to reporting were determined using a logit model (Hoetker, 2007; Cameron and Trivedi, 2009; Wooldridge, 2013). This model was suitable due to the binary dependent variable composed of managers that never submitted any report versus those that submitted at least one report. The factors that influenced the aggregated performance from the three indicators were determined using a fraction logit model. The fraction logit model allows for analysis when the dependent variable is greater than or equal to zero and less than or equal to one (Papke and Wooldridge, 1996).

1.6 Thesis layout

This thesis comprises of five chapters. Chapter 1 forms the introduction of the study. Chapter 2 presents insights on the development of the diary for agricultural field agents and the assessment of its potential for strengthening accountability in the public agricultural extension services. Chapter 3 presents an assessment of the potential of smartphone applications in strengthening accountability in the public agricultural extension services. Chapter 4 analyses the performance of the extension managers and the factors influencing it. Finally, Chapter 5 presents the discussion of the key findings with a focus on the contribution of the major research findings to the literature. The chapter also presents the limitations of the study and future research as well as the recommendations for policy.

2 STRENGTHENING ACCOUNTABILITY IN PUBLIC AGRICULTURAL EXTENSION SERVICES: USING A DIARY AS A GAME CHANGER

Abstract

A well-managed and accountable agricultural extension service delivery system is one of the primary drivers of agricultural production and rural development. However, for the majority of the developing countries, establishing an accountable system remains a challenge because agricultural field agents, who often work in remote rural areas, are difficult to supervise. To address this challenge, a tool was designed to improve accountability: a diary for agricultural field agents. The diary was developed both in paper and electronic versions. Taking Uganda as a case study, the potential of the diary for strengthening accountability in public services was assessed. A participatory approach using a combination of focus group discussions and individual face-to-face interviews was employed to collect data, and the content analysis method was applied. The analysis revealed that the diary has the potential to strengthen the accountability of public services through improving planning, reporting, monitoring and evaluation, and reducing absenteeism as well as the integration of beneficiary feedback. The findings further indicated that the electronic version is more promising in strengthening accountability than the paper version. However, it may be susceptible to inadequate information and communication skills among the users, limited access to electricity and poor mobile network connectivity.

Keywords: Accountability, diary, agricultural extension services, public sector, Uganda.

2.1 Introduction

Agricultural extension is one of the primary drivers of agricultural production in developing countries. An effective, well-managed and accountable agricultural extension service delivery system is central to achieving food security and improving rural livelihoods (Anderson & Feder, 2003). However, for the majority of the developing countries, establishing an accountable agricultural extension system is a challenge (Birner & Anderson, 2007). The public agricultural extension system, in particular, has been highly criticized for being ineffective and inefficient, in addition to weak accountability of both the quantity and quality of the services provided (Rivera, 1996; Anderson & Feder, 2003; Anderson, 2007).

Weak accountability is not limited to agricultural extension, but a rather general problem of public administration in many developing countries. It is common in most public systems that require large numbers of rural-based field staff, such as health and education (Chaudhury *et al.*, 2006; Banerjee *et al.*, 2008; Fujii, 2019). Such systems have accountability problems on both the upward and downward accountability fronts, as they are deficient of robust mechanisms to adequately monitor the activities of the field staff. Various mechanisms including monitoring and reporting structures and processes have been implemented in different systems to address the accountability problem (Yilmaz *et al.*, 2010). However, it appears that most of these mechanisms focus on processes and less on tools. This study is aimed to reduce this knowledge gap through developing an accountability tool: a diary for agricultural field agents, and assesses its potential for strengthening both upward and downward accountability, taking Uganda's agricultural extension services as a case study. The diary is expected to foster upward and downward accountability by facilitating the higher-level supervisors to follow up, monitor and evaluate field agent's activities. It is also expected to provide a channel through which beneficiaries can assess and provide feedback on the services received. The objectives of the study were:

1. To design a diary for agricultural field agents as a tool for strengthening accountability in the public agricultural extension services.
2. To assess the potential of the diary for agricultural field agents in strengthening accountability in the public agricultural services.

The findings are not only expected to provide knowledge for strengthening accountability, but also relevant for practitioners in public systems where the supervision of large numbers of rural-based field agents is a challenge.

2.2 Literature Review

This section presents a literature review and is divided into two sections. The first section is a review of the use of diaries in general, while the second is about the use of diaries in agricultural extension service delivery.

2.2.1 Overview of the use of Diaries

A considerable body of literature exists on the use of diaries in various disciplines. In medicine, diaries have been used with increasing frequency to monitor various aspects of disease management (Richardson, 1994; Furness & Garrud, 2010; Valimaki *et al.*, 2007). The working experiences of the health workers have also been explored using diaries through the daily recording of their activities (Bedwell *et al.*, 2012; Munyewende & Rispel, 2014). In psychology, diaries have been used to monitor and understand various human behaviours such as marital processes (Laurenceau & Bolger, 2005), sleep behaviour (Cates *et al.*, 2004), alcohol consumption (Mohr *et al.*, 2001) and depression (Alloy *et al.*, 1997). These studies revealed that diaries have the advantage of generating rich data regarding processes as they record daily events over time. Diaries also provide more accurate descriptions by allowing prospective recording of the users' behaviour, experiences, and events. The potential disadvantage of the diaries, however, is that they require time to instruct, follow and analyse. Nevertheless, their benefits offer a unique opportunity to collect data with little retrospection (Laurenceau & Bolger, 2005; Bedwell *et al.*, 2012).

2.2.2 Use of diaries in agriculture

Despite the widespread use of diaries in other fields and the unique benefits accrued from their use, documented examples of their application in agriculture remain relatively scarce. Moreover, the existing literature focuses on the application of diaries at the household level. Apis *et al.* (2013) and Daum *et al.* (2018) reported the successful application of diaries in capturing how farming households allocate their time and labour on various activities. Similarly, Deininger *et al.* (2012) explored the possibility of using diaries to capture agricultural production statistics and found the diary a useful tool. However, little is known regarding the use of diaries as tools for accountability in agricultural extension service delivery. Although some countries like Zambia MACO (2011) and Malawi MAIWD (2016) have developed diaries for agricultural field agents, no published studies are assessing their ability

to strengthen accountability in the public agricultural extension services. This study, therefore, sought to close this knowledge gap.

Furthermore, literature shows that the existing diaries for agricultural field agents are in a paper form. Recent technological advancements, however, have enabled the utilisation of electronic versions of diaries in other fields. Electronic diaries have been found to be more timely in terms of data receipt and handling, thus allowing for quick resolution of queries, easy formation of databases and rapid review of data (Hufford *et al.*, 2002; Quinn *et al.*, 2003; Bolger *et al.*, 2003; Lane *et al.*, 2006). They have also shown higher levels of compliance relative to paper diaries. A study by Straka *et al.* (1997) assessed the compliance of the paper diary using a computerised event monitoring system. It was found that the paper diaries statistically overestimated actual compliance relative to that determined by the electronic devices. Similarly, Stone *et al.* (2003) compared paper diaries fitted with instrumented tracking devices and electronic diaries. It was found that subjects using paper diaries falsified some of their paper diary entries, keeping missed diary cards and back-filling them after the fact. The subjects submitted diary cards corresponding to 90% of assigned times, but the tracking devices indicated that actual compliance was only 11%. By comparison, the reported compliance was equivalent to actual compliance for the electronic diaries. Several other studies, Jamison (2001), Hufford *et al.* (2002), Palermo *et al.* (2004), Nyholm *et al.* (2004) Dale & Hagen (2007), also reported electronic diaries to have higher levels of compliance than paper diaries. However, the compliance advantage presented in the use of the electronic is disputed by Green *et al.* (2006) who could not find significant differences between the two diaries. The authors concluded that; compliance is not dependant on whether a dairy is administered in paper or electronic form but rather an issue of the design and motivation of subjects that use the diary. The electronic diaries have also been found to be susceptible to technical challenges like battery problems, poor mobile network connectivity and device malfunctions or even total device failure (Tiplady *et al.*, 1997; Broderick, 2008; Sife *et al.*, 2007; O'Connor *et al.*, 2016). Nonetheless, the electronic diary presents a great opportunity. This study also addressed the knowledge gap by exploring the possibility of using electronic diaries for accountability in agricultural extension service delivery.

2.3 Methodology

This section presents the research design and the methods employed for data collection and analysis.

2.3.1 Research design

In this study, a qualitative participatory research approach was employed (Cornwall & Jewkes, 1995). The aim was to bring together the researcher and the users of the diary to jointly design and assess its potential for strengthening accountability in the public agricultural extension services. Participatory research provides the opportunity for feedback and adjustment of innovations according to the users' criteria and the specific needs of the local conditions (Martin & Sherington, 1997). Hence, it increases the relevance and effectiveness of the research for the users of the innovation (Bruges & Smith, 2008). The participatory approach was applied both during the development and the piloting of the diary.

The development of the diary, both the paper (p-diary) and electronic (e-diary), included the following steps: designing its structure, content, features, and appearance. Since the diary was intended to fit within the existing agricultural extension structure, participants for its development were selected at all levels of the structure (see Figure 1). This started at the national level, through the district to the sub-county. At the national level, purposive sampling of key officials at the Ministry of Agriculture, Animal Industry and Fisheries was undertaken. The selected officials were those responsible for monitoring, supervision and technical support of field agents in local governments. These included heads of departments and staff of the Directorate of Agricultural Extension Services. The information obtained at the ministry focused on building features of the diary that simplified the supervision of the extension services and also aided in the design of the data collection tools for both the district and sub-county levels. At the district level, one out of 122 districts of Uganda was randomly selected and respondents purposively selected based on their roles in planning, supervision, monitoring and evaluation of extension activities. These included: Chief Administrative Officer, who is the head of administration, District Production and Marketing Officer, who is responsible for the technical supervision of all agricultural extension services within the district, and the subject matter specialists, who are the technical supervisors of the field gents. These included; District Veterinary Officer, District Agricultural Officer, District Fisheries Officer, District Entomologist and District Commercial Officer. Information obtained from these interviews was also instrumental in the design of the checklists for the focus group discussions, which were administered to groups of field agents, farmers, and local political leaders at the sub-county. At the sub-county level, nine out of 15 sub-counties in the selected district were randomly sampled, and all the field agents deployed in these sub-counties constituted the focus

group discussions. These included Agricultural Officers, Veterinary Officers and Fisheries Officers. The information obtained from the field agents focussed on ways in which the diary can be used to plan, document and report the extension activities. Focus group discussions were also conducted for the sub-county chiefs (administrative supervisors), local political leaders and farmers within the selected sub-counties. In administering the focus group discussions of the farmers, gender concerns were considered where male and female groups were constituted for the exercise. The discussions with farmers helped obtain information on how farmers can provide feedback on the performance of the field agents.

The pilot phase involved the pretesting of both versions of the diary. The criteria for the selection of the pilot area were to consider a cluster of three neighbouring districts that must have recruited at least 50% of the required number of field agents. As a result, 22 clusters were created out of the districts that satisfied this criterion and one cluster was randomly selected. During the pilot, each diary was administered to three sub-counties per district. The three districts comprise 15, 12 and 13 sub-counties respectively. The three sub-counties in which the e-diary was administered were purposively selected to target field agents who owned and used smartphones. The three sub-counties in which the p-diary was administered, were randomly selected from those in which the e-diary was not administered. All the selected sub-counties had two field agents except one which had three. In total, 19 field agents piloted the p-diary while 18 piloted the e-diary. Before the administration of the diary, all officers were first trained on its use. During the training, the users were divided into four groups; field agents who used the p-diary, p-diary supervisors, field agents who used the e-diary and e-diary supervisors. Each group was separately trained for a day. Since the technical supervisors were to supervise both diaries, they participated in the training of both. During the training, the officers filled-in the diaries and provided feedback which was used to make improvements. The revised diaries were then used by the field agents for two months, during which feedback was obtained from the users of the diaries. These included; the field agents, supervisors and the beneficiaries (i.e. farmers and other agricultural commodity value chain actors) visited by the field agents. At the end of the pilot, the diaries were presented in a workshop with all the District Production and Marketing Officers and feedback was obtained and used to further improve the diaries.

2.3.2 Data Collection

Data collection was carried out between June and November 2017. The data collection methods employed were individual face-to-face interviews and focus group discussions. In the

development phase, interviews were conducted with sixteen officials from the ministry. At the district, interviews were conducted with the Chief Administrative Officer and all the technical supervisors, thereby making a total of seven interviews. This was followed by three focus group discussions with the 21 sub-county field agents deployed in the selected sub-counties. Each group comprised of six to eight members. Subsequently, a focus group discussion was held with sub-county-chiefs and another with the political leaders of the selected sub-counties. Successively, three focus group discussions were held with the farmers. The three groups constituted 7-9 members from different age groups and with different farm sizes.

During the pilot, a total of eleven focus group discussions were conducted in the selected districts each comprising of 6-9 members. Participants were drawn from supervisors, field agents and beneficiaries. For the technical supervisors, three focus group discussions were conducted; one within each district while for sub-county chiefs two focus group discussions were conducted; one for each version of the diary. For the field agents, six focus group discussions were conducted. These included two groups per district; one for the users of each version of the diary. On review of the diaries, a total of 18 beneficiaries, one from each sub-county were randomly selected and interviewed. Table 1 shows an overview of the interviews conducted.

Table 1: Overview of interviews conducted with the users of the diary

	Number of interviews	**Number of participants**	**Total number interviewed**
Development phase			
Individual interviews	23	1	23
Focus Group Discussions	8	6-9	63
Pilot phase			
Individual interviews	18	1	18
Focus Group Discussions	11	6-9	73
Total interviews	**60**		**177**

2.3.3 Data Analysis

The focus group discussions and interviews were transcribed and thereafter analysed using content analysis (Holsti, 1968). Content analysis involves coding of texts and then transforming the codes into common themes (Elo and Kyngäs, 2008). In the development phase, the important features that each stakeholder group recommended for inclusion in the diary were pooled to develop the draft diary. Subsequently, experiences of the different users of the diary

captured during the pilot phase were incorporated, resulting in a coherent and final diary. Furthermore, the feedback from the pilot was used to develop common themes with a particular focus on the potential of the diary to strengthen accountability in public services.

2.4 Results

The results are categorised into two sections: The first section is the description of the diary, while the second section presents the potential of the diary for strengthening accountability in the public services.

2.4.1 Description of the Diary

The design of the diary is in two versions; the paper diary (p-diary) and the electronic diary (e-diary). The p-diary is a book containing monthly schedules to be filled by the field agent under the supervision of both the technical and administrative supervisors. The structure of the p-diary is shown in figure 2 which constitutes tables 2-4. At the beginning of each month, both the field agent and the technical supervisor plan and agree on the activities to be executed. The agreed-upon activities are recorded and signed by the field agent, technical and administrative supervisors. Table 2 shows the arrangement of the planned activities in the p-diary. During the month, the field agent records the daily activities as shown in table 4. At the end of the month, the records are summarized, discussed with the supervisors and assessments of achievements against set targets undertaken. Table 3 shows the arrangement of the end of month activities as in the p-diary. A copy of the planned and completed activities is kept on the files of both supervisors for reference. The p-diary has an inbuilt beneficiary feedback mechanism in that the contacts of beneficiaries are captured while recording the daily activities. This provides an avenue for the supervisors to obtain feedback from the beneficiaries.

The e-diary, on the other hand, is a smartphone application but with monthly schedules and the feedback mechanism similar to that in the p-diary. However, it also has a Global Positioning System (GPS) component which captures the location of the activity. The e-diary uses survey solutions; a computer-assisted personal interviewing platform developed by the World Bank for survey data collection (Fiji & Radyakin, 2017). Survey solutions is structured into three levels. The first is the headquarter, which is a cloud-hosted server, responsible for centralized survey management. At this level, the survey project is defined including; staff, sample, and instruments. It also assigns and reviews the supervisors' work and manages the data collected. The second level is the supervisor which is also cloud-based, responsible for field-based survey

management and assigns questionnaires to interviewers and reviews their work by either approving or rejecting it. The third level is the interviewer which is not cloud-based but instead found on a tablet or mobile phone. The interviewer receives assignments in the form of new questionnaires, completes them through data collection and submits the completed assignments for approval. In this case, survey solutions was customized to the requirements of the e-diary. The headquarter which is located at the MAAIF assigned the diary to the supervisors who in turn provided instructions to the field agents. The latter filled in the diary with the activities and synchronized the information to the supervisors who either approved or rejected the filled-in activities. The approved activities were submitted to the MAAIF and a copy retained by the supervisors, while the rejected activities were sent back to the field agents for corrections. Figure 3 shows how Survey Solutions was customized to the e-diary.

Table 2: Monthly planned activities

January

Monthly Planned Activities

No.	Activity	Topic	Planned No. of Times	No. of Target Beneficiaries

Signature: ……..……..
Agricultural Field Agent

Technical Supervisor	Administrative Supervisor
Name: ……	Name: ……
Sign: …….....	Sign: …….

Table 3: Monthly completed activities

January

Monthly Completed Activities

Was the activity carried out? (Yes/No)	No. of Times carried out	No. of reached beneficiaries	General Remarks
			Lessons Learnt
Additional Activities carried out			Recommendations

Signature: ……..……..
Agricultural Field Agent

Technical Supervisor	Administrative Supervisor
Name: …….	Name: ……
Sign: ……..……..	Sign: …….

Table 4: Daily activities

January: Daily Activities

Date	Day	Activity	Topic	Enterprise	Location (Village)	No. of beneficiaries reached		Name of reference beneficiary	Phone number reference beneficiary	Signature reference Beneficiary
						Male	Female			
1	Mon									
2	Tue									

Notes:

Figure 2: Structure of the p-diary

Note: This structure shows only the concept of the diary. The real diary has sufficient space to be filled.

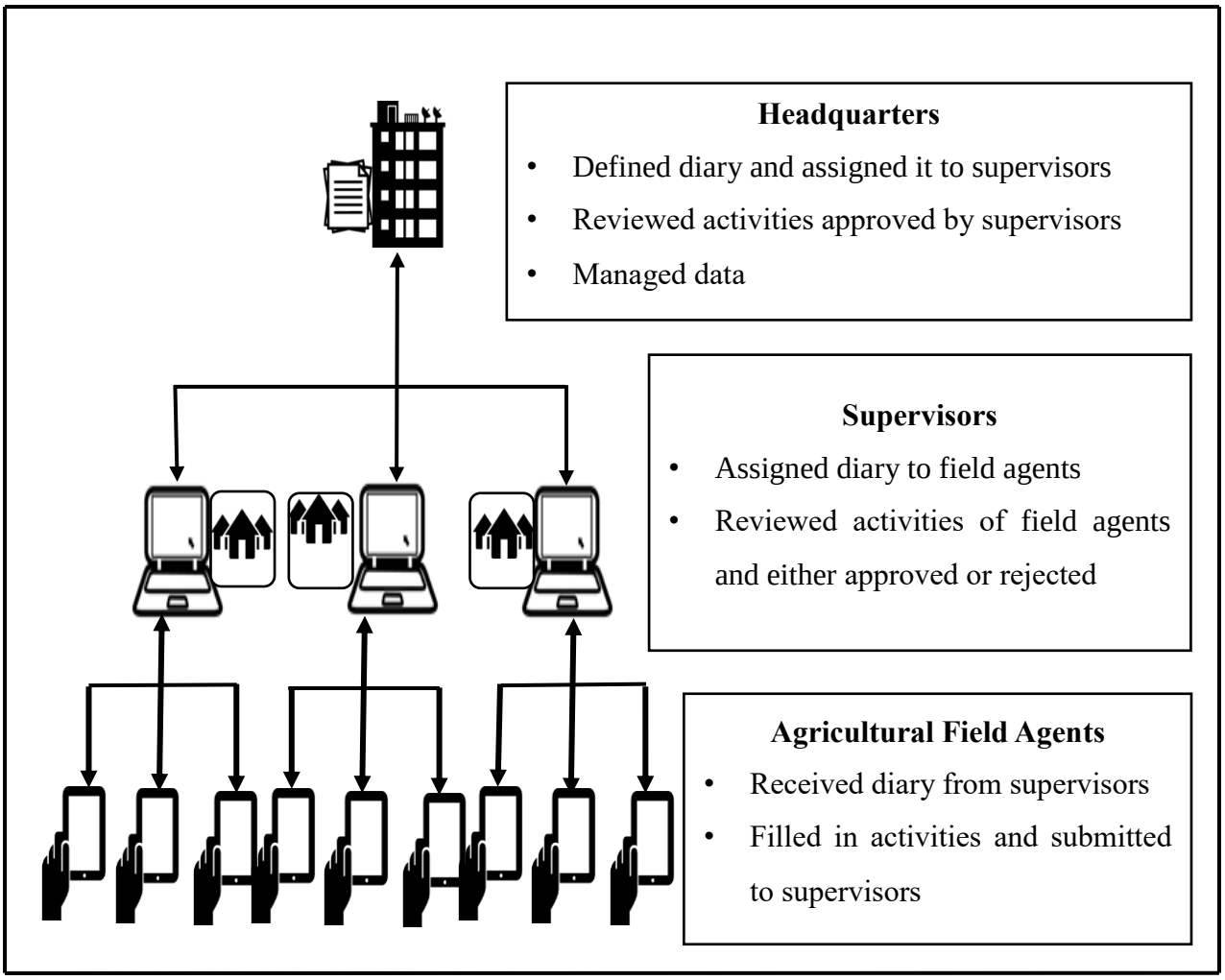

Figure 3: Customization of Survey solutions to the e-diary

Source: Adapted and modified from Fiji & Radyakin (2017)

2.4.2 Potential of the diary in strengthening accountability in Agricultural Extension services

The results revealed the potential opportunities and challenges of using the diary in fostering public accountability.

2.4.2.1 Opportunities of using the diary

The opportunities of the diary in strengthening public accountability of extension services were categorised into various themes; planning, monitoring and evaluation, reporting, self-assessment, reduction in absenteeism and integrated beneficiary feedback. Table 5 shows the magnitude of the different opportunities based on the number of respondents that referred to them during the interviews.

Table 5: Opportunities of using the diary

Themes	Percentage of respondents who mentioned the theme		
	Supervisors (36 respondents)	Field agents (37 respondents)	Beneficiaries (18 respondents)
Planning of extension activities	66.7	56.8	-
Monitoring and Evaluation tool	100	-	-
Reporting tool	77.8	78.4	-
Self-assessment tool	-	29.7	-
Potential to reduce absenteeism	83.3	-	-
Integrated beneficiary feedback mechanism	58.3	-	100

Application of the diary in planning field extension activities

Proper planning helps to set clear targets, thereby creating a verifiable course of action towards the attainment of the set targets, hence improving accountability. The diary was acclaimed to achieve this through; facilitating monthly mutual planning and acknowledgment of the planned activities by both the field agents and supervisors. The routine mutual planning made it easier for the supervisors to systematically track the progress of the execution of activities by the field agents. One supervisor stated;

> *"The diary has simplified my work. It has helped me to set targets with the field agents, supervise and hold them accountable based on the set targets. Since we have a clear track of records, I have a reference point to easily follow up on their activities."*

On the other hand, the field agents viewed routine mutual planning as an opportunity to have clear, well-defined targets and strategies to achieve them. This was reflected in the following statement by one of them:

> *"This diary has helped me to design my program with my supervisor. It has worked like a work plan because it has a summary of what I am supposed to do. It has been a guideline for which activities to do and where to carry them out."*

The above suggests that the diary fosters participatory planning between the supervisors and the field agents and limits top-down planning which is characteristic of public systems.

The diary as a monitoring and evaluation tool

The primary duty of the supervisors is to monitor the activities of the field agents and hold them accountable. The diary was reported to simplify this role through its precise structure and beneficiary feedback mechanism. The structure enabled the precise recording of the planned and completed monthly activities. This simplified both the follow up of the planned activities and the evaluation of the performance of the field agents. The beneficiary feedback mechanism captured the phone numbers of the visited beneficiaries and this enabled supervisors to verify the reported activities without physically meeting the beneficiary. Thus, monitoring is made easier and cheaper. One supervisor shared his experience in this regard;

> *"With the farmers' phone numbers, we can easily make a phone call based on the information provided in the diary. I have been able to call some of the farmers confirming the activities recorded by the field agents without having to move to the farmer's home, and that has reduced my workload and cost of supervision."*

By comparison, the majority of the supervisors that used both diaries (12 out of 18) reported the e-diary to be even more effective in monitoring because of its inbuilt GPS. This tracks the exact location of the activity, thereby minimizing the manipulation of entries. One supervisor stated;

> *"Although the diary as a tool is good for monitoring purposes, I would choose the electronic over the paper because the GPS captures the actual location, so forgery is minimized."*

Additionally, 7 out of the 18 supervisors that used both diaries observed that monitoring of the field agents could conveniently be done at any location by just logging into the e-system. This is expressed in a statement by one of them;

> *"I think the e-diary is better because anywhere you are, even with minimum resources, you can still log into the system, pick the farmer's phone number and call. The supervisor does not need to first meet the field agent in order to get the farmers' numbers as is with the p-diary."*

On the other hand, the p-diary can easily be manipulated by the field agents as expressed by one supervisor;

> "*Despite its checks and balances, the p-diary can easily be forged especially regarding the location of the activity and signatures of the beneficiaries. It is possible for the field agent to sign for himself and then put a phone number of his friend. One could also call a neighbour to sign on behalf of the beneficiary."*

Although the diary, in general, can be good for monitoring and evaluation, the p-diary was observed to be vulnerable to malpractices in comparison to the e-diary. The latter's integrated features such as GPS made it difficult to manipulate.

The diary as a reporting tool

A good reporting structure enhances accountability since reports are a means of verification. The majority of the field agents and their supervisors commended the diary for improving the reporting of extension activities. One of the field agents compared his experience before and after the diary;

> *"The diary has made my reporting simplified. In the last month, I had a precise record of all my activities carried out and all farmers visited. So, when I was making my report, all I did was to refer to the diary and simply extract my report. Before the diary, I struggled with report writing as I had to put together the many narratives that I had written while conducting my activities since they were not well structured."*

Supervisors observed that report compiling from many field agents was simplified by the precise structure. This not only simplified reporting but also saved time during the preparation of reports as one of the supervisors stated;

> *"The summarized monthly activities of the field agents on my file have made life simpler. All I do is to get these summaries and put them together. I do not have to read big reports and struggle to extract a report. This summary highlights achieved versus set targets, challenges, lessons learned and recommendations. These are the core issues that we report."*

Although both versions of the diary were reported to improve reporting, the majority of the supervisors that used both diaries (13 out of 18) appreciated the e-diary for its real-time reporting.

Unlike the p-diary which produced monthly reports, the e-diary produced daily reports. Hence, enabling the field agents to get immediate responses from the supervisors especially on issues that require immediate attention. One of the field agents stated;

> *"The e-diary has given us a quick and easy way of reporting to our supervisors. Assuming there is an emergency like a disease outbreak, the supervisors receive communication by the end of the day. The feedback is fast and remedial actions are timely."*

The importance of quick reporting was emphasized by the supervisors who highlighted that quick reporting also translates into quick information flow to the ministry and other concerned stakeholders.

It can, therefore, be inferred that, with the precise reporting structure of the diary, every party is held accountable for their actions in implementing extension activities. The quick feedback mechanisms integrated into the e-diary makes it even a more suitable option.

The diary for self-assessment

The results from the interviews with the field agents also revealed that the diary had the potential to improve self-assessment and therefore self-accountability. They highlighted that the precise structure of the diary enabled them to keep track of their planned activities and progress by comparing the completed against the planned activities. The precise structure, coupled with the beneficiary feedback, encouraged them to reflect on their performance and to identify their strengths and areas that required improvement.

Potential to reduce absenteeism

As shown in table 5, the majority of the supervisors believed that the introduction of the diary would reduce the absenteeism of the field agents since they are expected to report activities on each person-day. At the end of the month, they will be held accountable for the days that they did not report on duty as noted by one of the supervisors;

"The diary will improve on the commitment of the field agents in the execution of their duties. In addition to being held accountable for the planned activities, they will also be answerable for the days that they have not done any activity."

Based on the above assertions, it may not be far-fetched to conclude that the diary if institutionalised, has the potential to significantly reduce absenteeism; which has characterised the public service for a long time.

The Integrated beneficiary feedback mechanism

One of the major challenges that have faced public services has been the near absence of beneficiary feedback. This has made performance assessment of public services difficult to undertake. The findings revealed that the diary was providing an avenue where the beneficiaries can communicate directly with the supervisors of the field agents; making it possible for beneficiary participation in the agricultural extension processes. All the beneficiaries interviewed recounted that the diary provided them an opportunity to evaluate and provide feedback on the services received, enabling them also to hold the field agents accountable. This is reflected in the following statement by one of the farmers;

"*I think the diary is good especially that the farmers are also part of the evaluation of the field agents. Since the diary requires that the farmers sign and are followed up with phone calls, the field agents will be forced to work because no farmer will approve without receiving good services."*

The above findings imply that the diary can increase beneficiary participation in the evaluation of the extension services, thereby improving the quality of services provided.

2.4.2.2 Challenges of using the diary

Despite the opportunities, the findings revealed some of the challenges likely to affect the diary, which are discussed below.

Difficulties in obtaining beneficiary signatures

The main challenge reported by the field agents that used the p-diary (11 out of 19) was the difficulty to convince the beneficiaries to append signatures against the completed activities. This problem was mainly attributed to low literacy levels among the beneficiaries as reflected in the following statement by one of the field agents:

> *"One thing that brings rigidity in signing is illiteracy. If you ask the farmers to sign, some become bitter, others shy away since they do not know how to read and write, while others do not have signatures."*

Additionally, some beneficiaries were hesitant to sign because, at the time of data collection, the country was in the process of amending the constitution to remove the presidential age limit. During this time, different political groups were collecting signatures to petition against the amendment. As such, many beneficiaries were worried that they might be lured into signing the petition. Furthermore, more than half of the beneficiaries also agreed that they were reluctant to append their signatures. However, they attributed it to the failure of the field agents to properly sensitize them on why the beneficiaries' signatures were needed.

Inadequate Information and Communication Technological (ICT) skills, electricity, and mobile network connectivity for the e-diary

The e-diary required the users to be comfortable with ICTs. However, some of the supervisors (11%) considered the electronic system to be problematic and preferred the p-diary because its operation did not require ICT skills. One supervisor expressed concern as follows;

> *"Given an opportunity, I would choose the p-dairy because all it requires is a person who can read and write. The e-diary, on the other hand, requires ICT skills, and yet some officers lack ICT expertise. For now, only field agents who own smartphones have been selected. That is why everyone seems comfortable with the e-diary. However, remember not every agent is familiar with smartphones."*

As shown in table 6, the field agents criticized the e-diary for being limited by inaccessibility to electricity in rural areas. An extension agent stated:

"The challenge is that one cannot use the e-diary when there is electricity failure, in an area where there is no electricity and the battery of the phone is not fully charged. We are mainly field-based, and we work in rural areas without electricity."

Additionally, the e-diary was reported by a considerable number of agents (table 6) to face problems of poor mobile network coverage, which made it hard for them to send their information to the supervisors.

The inability of the e-diary to retain information for the field agents

As shown in table 6, all field agents reported this limitation. The survey solution platform used to develop the e-diary was mainly designed for purposes of collecting data via surveys. It does not require the interviewer to keep a copy of the filled-in interviews. Hence, the platform does not create room for the field agent to retain a copy of the submitted activities. Consequently, in addition to the e-diary, the agent has to write on paper which makes it double work. This is reflected in the statement by one field agent;

"My major problem with the e-diary is that after filling in the information and synchronizing, the field agent cannot see the work again. This becomes tricky because it is not easy for one to remember all the planned activities and how they should be executed. It is the planned activities that should guide my work throughout the month."

Table 6: Challenges of the e-diary to the field agents

Challenge	Percentage
Inability to retain a copy of recorded activities	100
Poor mobile phone network coverage	62.5
Requires electricity	37.5

The challenges of the diary stated above imply that the implementation of the p-diary is likely to be hindered by the beneficiaries' perception about the signatures while the implementation of the e-diary is likely to be affected by lack of adequate ICT supporting infrastructure.

2.5 Discussion

The results suggest that the diary has the potential to strengthen upward and downward accountability in public service delivery. This section discusses the findings in this regard.

2.5.1 Upward Accountability

The diary strengthens upward accountability by simplifying monitoring of the activities by the field agents in addition to reducing their absenteeism. Regarding monitoring, the precise structure of the diary eases planning, follow up and reporting of the field activities. Indeed, Taylor (2007) noted that reporting of key indicators by public agencies helped in holding the agencies accountable. Loevinsohn *et al.* (1995) found that systematic supervision using a checklist of clearly defined indicators in a format that encourages follow up led to increased accountability and improvement in the quantity and quality of services. The authors noted that the incremental costs of implementing such a supervisory system are modest in comparison to its apparent benefits.

The diary also captures the phone numbers of the beneficiaries which strengthens its monitoring facet. By making phone calls to the beneficiaries, the supervisors can verify the field agent's visit without traveling to the field. This minimizes the monitoring costs and additionally addresses the failure to effectively monitor the field agents due to their wide geographical dispersion. Aker and Mbiti (2010) report that the rapid growth of mobile telephones in developing countries lowers monitoring costs over a large geographic area.

Additional to simplifying monitoring, the diary has the potential to reduce the absenteeism of the field agents. Since the diary records activities on each person-day, the field agents are held accountable when no activity is recorded. This finding corroborates with Duflo and Hanna (2005) who found that daily monitoring of teacher attendance was effective in reducing absenteeism. However, the authors state that regular monitoring is effective when coupled with incentives or punishments for non-attendance. Eckardt (2008) notes that mechanisms that sanction non-compliance of public agents are likely to reduce opportunistic behavior among public servants, thereby improving public service provision.

2.5.2 Downward accountability

Downward accountability mechanisms provide a platform for citizens to give feedback and control government action (Yilmaz *et al.*, 2010). The feedback mechanism embedded within the diary creates an opportunity for the beneficiaries to evaluate and approve the extension services received. This improves accountability since the field agents put into account the needs of the beneficiaries while delivering services. Bitzer (2016) agrees that establishing feedback systems between field agents and beneficiaries creates incentives to focus on the priorities of

the beneficiaries. According to Birner and Anderson (2007), it is vital to provide services that meet the priorities of the beneficiaries. Empowerment of the beneficiaries and holding their service providers accountable are essential conditions for increasing the effectiveness of public service provision. Eckardt (2008) notes that governments often fail to deliver basic services if the beneficiary demands are not taken into consideration. The author states that through its checks on the allocation of resources, accountability to the beneficiaries is likely to improve the quantity and quality of public services provided.

2.5.3 Comparison between paper and electronic diaries

Although both versions of the diary have the potential to strengthen accountability in the public services, results suggest that the e-diary is a superior alternative. This can be attributed to the following salient features embedded within the e-diary.

The e-diary was designed with a GPS component that tracks the actual geographical location for which a particular data entry was made. This component minimizes forgery since the field agent cannot easily fill in information without going to the field. Hence, high compliance was associated with the e-diary. The entries in the p-diary are approved by the beneficiaries' signatures, which could be forged. This finding is in line with Stone *et al.* (2003), and Straka *et al.* (1997), who found that subjects using paper diaries falsified a majority of their paper diary entries. Conversely, the reported compliance was equivalent to actual compliance for the electronic diaries. Similarly, several other studies by Jamison (2001); Hufford *et al.* (2002); Palermo *et al.* (2004); Nyholm *et al.* (2004); Dale & Hagen, (2007) found electronic diaries to have higher levels of compliance than paper diaries. However, Green *et al.* (2006) did not find significant differences in compliance between the two diaries.

In addition to the GPS, the e-diary also makes faster reporting possible. Unlike the p-diary, where reporting is done every month, the e-diary produces daily reports. Hence, the supervisor can monitor and verify the extension activities at the end of each day rather than having to wait for the end of the month as is the case with the p-diary. This finding is in line with Hufford *et al.* (2002); Quinn *et al.* (2003) and Lane *et al.* (2006) who found that data can be collected and analysed more quickly using electronic than paper diaries. Omisore (2014) notes that through daily reporting, the supervisors can monitor subordinate productivity on a consistent basis. Consequently, regular supervision acts as a continuous monitoring mechanism which allows both supervisors and subordinates to express concerns and ask questions immediately, rather

than waiting for monthly or annual reviews. This increases the accountability of the subordinates to their supervisors and consequently increasing the productivity and overall performance.

The findings further reveal that the e-diary is better for addressing the problem of dispersion of the field agents over a wider geographical area. With the e-diary, the supervisor can log into the system from any location and monitor the activities of the field agents in different locations. Therefore, even if the supervisors are not able to meet the agents face to face, they are still aware of the extension activities at any location.

Despite being more superior in strengthening accountability, operationalizing the e-diary is likely to be limited by the need for ICT skills among the various users. The results revealed that some of the supervisors were apprehensive about the e-diary because it required ICT skills. Hence there is a possibility that officers without the required ICT skills are averse to this innovation as observed in similar studies (O'Connor *et al.,* 2016). The design of a very user-friendly application might help to address this problem. The e-diary is also likely to be affected by problems of inaccessibility to electricity since it operates on mobile phones whose batteries require charging. According to the World Bank Sustainable Energy for All database of 2016, only 26.7 % of the population in Uganda is connected to the electricity national power grid, the main source of power in the country. This figure drops to 18% in the rural areas where most of the agricultural activities take place. In line with this finding, Tiplady *et al.* (1997) and Broderick (2008) also found the e-diaries susceptible to battery problems. Furthermore, the e-diary is susceptible to unreliable mobile network connectivity, which is common to the rural areas where the majority of the agricultural extension activities are conducted. Poor network connectivity has also been reported by Sife *et al.* (2007) and O'Connor *et al.* (2016) as a major impediment to operationalizing mobile phone technologies in developing countries. Another challenge of the e-diary is the inability of the field agents to retain a copy of the filled-in activities once sent to the supervisors.

2.6 Conclusion

In this study, a diary for agricultural field agents was designed as a supervisory, monitoring and evaluation tool, and its potential for strengthening accountability in the public services was assessed. The study was motivated by the need to address both the weak upward and downward accountability that is characteristic of public services. The findings reveal that the diary can be

a game-changer by strengthening accountability in public services. Its design provides for both upward and downward accountability. The findings further suggest that the electronic version of the diary is more effective in strengthening accountability compared to the paper version. However, the implementation of the e-diary necessitates training of the field agents and their supervisors on the use of the E-Systems and ICTs in general. Additionally, it requires promoting the use of solar chargers or power banks in areas with poor electrification. The findings also indicate that the e-diary needs a provision that enables the field agents to retain a copy of the filled-in activities. Moreover, limited network coverage implies that the e-diary needs to be programmed in such a way that data can be entered off-line. Overall, the study indicates that using diaries, in particular, electronic ones, offers a unique and largely underutilized potential to address entrenched problems of ensuring accountability in public services. The findings are likely to be relevant for other public services, such as health care and education, which face similar problems of managing large numbers of field staff in rural areas, where effective supervision is an inherent challenge.

3 "ONLY A MOUSE CLICK AWAY": EXPLORING THE POTENTIAL OF A SMARTPHONE APPLICATION FOR STRENGTHENING ACCOUNTABILITY IN PUBLIC AGRICULTURAL EXTENSION SERVICES

Abstract

The growth in the use of information and communication technologies has created new opportunities for using smartphone applications to strengthen accountability in the public agricultural extension services. Public agricultural extension service systems play a key role in agricultural development. However; they often face a major challenge of weak accountability since they deploy large numbers of field agents in remote, widely dispersed areas. Moreover, supervision is constrained by time, underdeveloped transport infrastructure, insufficient financial resources and lack of robust supervisory tools. In this study, the potential of using smartphone applications for strengthening accountability in the public agricultural extension services was assessed. Taking Uganda as a case study, a smartphone application called the "e-diary" was developed and piloted. The e-diary was intended to enable field agents to report their daily activities, supervisors to follow up the field agents' reported activities, and beneficiaries to verify and provide feedback on the reported activities. To explore the potential of the e-diary, a participatory approach using focus group discussions and individual face-to-face interviews was employed for data collection, and the content analysis method applied. The findings indicate that smartphone applications have the potential to strengthen accountability in the public agricultural extension services by enabling real-time reporting and remote supervision, which reduce the time and costs of supervision. However, the study suggests combining smartphone applications with incentives such as awards of recognition.

Keywords: Smartphone applications, electronic diary, accountability, agricultural extension services, public sector, Uganda.

3.1 Introduction

The growth in the use of information and communication technologies (ICTs), such as mobile phone tools, has created new opportunities for delivering services to farmers in developing countries. The more recent advancement in mobile phone technologies has led to a proliferation of smartphone-based applications especially for; disseminating agricultural information (Aker, 2011; Nakasone *et al.*, 2014), collecting agricultural data (Dillon 2012; Daum *et al.*, 2018), and supporting of on-farm activities such as fertilizer application (Saito *et al.*, 2015; Bueno-Delgado *et al.*, 2016), irrigation (Bartlett *et al.*, 2015; Vellidis *et al.*, 2016), pest and disease control (Carmona *et al.*, 2018), and farm management (Lantzos *et al.*, 2013). While such examples demonstrate the potential of smartphone applications, their potential for strengthening the accountability of public agricultural extension services remains less explored. Yet, public agricultural extension plays a key role in agricultural development, especially because in most developing countries, agricultural extension services are majorly provided by the public sector (Swanson & Samy, 2002; Rivera & Alex, 2004; Anderson & Feder, 2004). Moreover, the public agricultural extension systems often face a major challenge of weak accountability of the field agents to both their supervisors and clients.

Public agricultural extension systems usually deploy large numbers of field agents in remote and widely dispersed geographic areas (Anderson & Feder, 2004; Feder *et al.*, 2010). Further, the supervision of the field agents is usually by supervisors visiting the reported beneficiaries or duty stations of field agents or by accompanying the field agents on beneficiary visits, all of which are transaction-intensive in terms of time and costs. Moreover, the supervisors are often constrained by time, underdeveloped transport infrastructure, insufficient financial resources and lack of robust supervisory tools (DeRenzi *et al.*, 2011; Nakasone & Torero, 2016). Consequently, the field agents are to a large extent, not held accountable by their supervisors. Additionally, given the hierarchical, top-down, supply-driven management approach in most public bureaucracies, accountability to the clients also becomes a challenge (Feder *et al.*, 1999; Anderson & Feder, 2003; Anderson & Feder, 2004). Consequently, the weak accountability on both fronts tends to result into absenteeism, shirking and moonlighting of the field agents, as reported in several studies on supervision of public systems which deploy large numbers of rural-based field staff (Chaudhury *et al.*, 2006; García-Prado & Chawla, 2006; Goldstein *et al.*, 2010; Ramadhan, 2013; Fujii, 2019). Due to these challenges, the utility of the services to the beneficiaries is reduced (Rogers & Vegas, 2009; Aker, 2011).

As further detailed in the literature on the use of ICTs, a number of ICT tools have been tried to enable more effective supervision in the public systems which deploy large numbers of rural-based field staff (Duflo & Hanna, 2005; Cilliers *et al.*, 2013; Modi *et al.*, 2015; Henry *et al.*, 2016; Biemba *et al.*, 2017). However, only a few attempts have been made in regard to the use of smartphone applications. Furthermore, most of these attempts have been limited to education and health services. There is hardly any study assessing the potential of using smartphone applications for strengthening accountability in the public agricultural extension services. Moreover, strengthening accountability is harder in the agricultural services were the field agents operate in vast areas as compared to the education and health services were the teachers and health workers are usually stationed at one school or health center, respectively.

In principle, smartphone applications can strengthen the accountability of a large number of geographically widely distributed field agents. This is because smartphone applications can provide platforms that enable remote or distant monitoring and supervision, which can eliminate the costs associated with physical supervision. Additionally, smartphone applications can enable the supervisors to follow up the activities of the field agents in near real-time and quickly provide feedback (DeRenzi *et al.*, 2011). Smartphone applications can also be used to capture beneficiary data which could be used to verify agents' visits to the beneficiaries (Aker, 2011; Aker *et al.*, 2016). Moreover, the studies on the use of smartphone applications for supervision in the health and education services have shown promising usefulness, feasibility and acceptability of smartphone applications (Modi *et al.*, 2015; Henry *et al.*, 2016).

It is against this background that a smartphone application called "e-diary" was developed in this study. The e-diary was designed to enable field agents to report their daily activities in real-time and to enable remote supervision of the activities by the supervisors. Taking Uganda as a case study, the e-diary was piloted in two districts. The objective of the study was to assess the potential of using smartphone applications in strengthening accountability in the public agricultural extension services. This is a unique contribution, given that studies assessing the potential of the smartphone applications for strengthening accountability in the public agricultural extension services are scarce in the existing literature.

3.2 Use of ICTs for strengthening Accountability in service delivery

The use of ICTs presents a unique opportunity for strengthening accountability in public services. The existing literature highlights several ICT initiates in regard to strengthening

accountability in public services that employ large numbers of rural-based field staff. In education, for example, Duflo & Hanna (2005) reported on an intervention that used cameras to monitor the attendance of teachers in rural India. The time and date stamps on the photographs provided evidence for attendance, which was later used to compute financial incentives for the teachers. The intervention resulted in an immediate decline in teacher absence. In another study, alternative designs of an SMS based monitoring system were piloted in Uganda. Monitors, who were either head teachers or parents, reported teacher attendance via SMS. Results indicated that both monitoring schemes understated the teacher absenteeism and thus stricter protocols to discourage under-reporting were suggested. Nonetheless, monitoring by head teachers with bonus payments increased teacher attendance (Cilliers *et al.,* 2013). Similarly, a prototype system that used a combination of voice-biometrics and location tagging was developed for low-cost remote attendance tracking of teachers or health workers in developing regions. The evaluation of the system suggested that it could be a useful tool for tracking attendance (Reda *et al.*, 2011).

In health, WhatsApp mobile messaging was used to enhance the supervision of health services in Kenya. Through a WhatsApp group, community health workers documented their activities, of which photos constituted the major evidence for the activities. The results demonstrated that WhatsApp messaging was useful in the supervision of health services (Henry *et al.,* 2016). In Zambia, a mobile phone-based community health management information system was developed for community health workers and their supervisors. The platform used simple feature mobile phones to provide real-time, community-based information from community health workers to their immediate supervisors and higher levels of the health system. Through the system, the supervisors tracked the reports from the community health workers and provided feedback. Results indicated that using simple feature phones was feasible for reporting, but smartphones and computers would be needed for data analysis and visualization (Biemba *et al.*, 2017). Similarly, Modi *et al.* (2015) piloted a mobile phone and web application designed to improve the delivery of health services by accredited social health activists in India. The health activists would log into the application, review their daily schedule, complete assigned tasks and report the completed tasks. The supervisors were then expected to log into the web interfaces to supervise and support the health activists. The application was also found to be largely acceptable, feasible, and useful.

Efforts have also been made in the agricultural sector. For example, Farm Radio International explored the potential of using interactive radio in improving the accountability of extension services to farmers in Tanzania. This was through the Listening Post model which combined interactive radio broadcasts with an interactive voice response system that collected and aggregated real-time feedback from farmers. The findings indicated that the model had the potential to improve accountability and enhance the impact of agricultural projects (Gilberds *et al.*, 2016). Similarly, Jarvis *et al.* (2015) piloted an automated voice-surveys platform to obtain feedback from all the project stakeholders including beneficiaries. The pilot showed that the ICT approach provided near real-time feedback and was more cost-effective for monitoring compared to traditional methods.

Despite the promising usefulness, feasibility and acceptability of ICT tools for strengthening accountability, initiatives in the agriculture sector have mainly focused on strengthening the beneficiaries' voice. There is a dearth of literature on the use of ICTs for enabling supervisors to follow up and monitor the activities of the agricultural field agents. In particular, hardly any study has assessed the potential of using smartphone applications in this regard. This study was therefore intended to close this knowledge gap by; assessing the potential of a smartphone application for strengthening accountability in the public agricultural extension services.

3.3 Methodology

The "e-diary" was developed in a joint project between the University of Hohenheim, Germany and the Ministry of Agriculture, Animal Industry and Fisheries of Uganda.[1] This section describes the system architecture of the e-diary (see 3.3.1). Section 3.3.2. describes the methods of data collection and analysis employed.

3.3.1 E-diary architecture

The e-diary was designed based on the roles and responsibilities of the different actors within the public agricultural extension structure of Uganda (see figure 1). The e-diary has two categories of users. The first are the "field agents," who are located at the sub-county and are responsible for delivering agricultural extension services to the farmers and other agricultural

[1] The author developed the design of the e-diary in close collaboration with Patience B. Rwamigisa from the directorate of agricultural extension services, MAAIF. The app was programmed by Musoke Herbert Thomas Nsubuga, a professional programmer, who was hired as a consultant for the project. Regina Birner and Thomas Daum participated in the field activities and provided feedback.

commodity value chain actors. The field agents include Agricultural Officers, Veterinary Officers and Fisheries Officers responsible for crop services, veterinary services, and Fisheries services, respectively. The second category of users are the "Supervisors". At the sub-county are the sub-county chiefs, who are responsible for the direct administrative supervision of the field agents. At the district are the subject matter specialists, who are the immediate technical supervisors of the field gents. These include; District Veterinary Officer, District Agricultural Officer, District Fisheries Officer, District Commercial Officer, and District Entomologist. Also, at the district is the District Production and Marketing Officer, who is responsible for the technical supervision of all agricultural extension services within the district and the Chief Administrative Officer, who is responsible for the administrative supervision of all government activities in the district. From the Directorate of Agricultural Extension Services are the Principal Agricultural Extension Coordinators-Livestock, Crops and Fisheries, each responsible for the supervision of extension services in the respective subject matter. The Principal Agricultural Extension Coordinators are under the headship of the Commissioner Agricultural Extension Services, who is supervised by the Director Agricultural Extension Services. The director is responsible for the management and coordination of all extension services in the country.

3.3.1.1 User Interfaces

The e-diary was designed with different user interfaces that communicate into a central database where all the data is compiled. The user interfaces for the field agents are an android smartphone-based, while the supervisors' are web-based. The different interfaces are interlinked, such that the information filled in by the subordinates is reflected on the interfaces of the respective supervisors and vice versa.

All interfaces were designed in adherence to the existing agricultural extension service delivery procedures. The procedures start with planning, which is followed by conducting the planned activities, reporting, monitoring, evaluation and feedback. These procedures are reflected by the features of the interfaces. The interface of the field agents (see figure 4) shows the following features: profile (field agent profile, area profile, popular commodities and potential commodities), work plan (annual work plan), my activities (view quarterly planned activities, add daily activities, view daily activities and evaluation), feedback (compose messages, inbox and sent messages to respective supervisors) and GRM (A Grievance Redress Mechanism

intended to be linked to a public app such that the field agents can monitor the grievances of the beneficiaries and respond to them).

The interfaces of the supervisors within the district are a reflection of the interfaces of the field agents. As shown in figure 5, the district supervisors' interfaces highlight the profiles, work plans and activities of all field agents supervised. The structure of the interface of all the district supervisors is similar. The only difference is that for each supervisor, the content reflected is from only the field agents supervised. For example, in figure 5, the interface for the District Agricultural Officer shows profiles and content from only the Agricultural Officers in the district. Similarly, the sub-county chiefs' interface reflects content only from the three field agents within the sub-county. Since the District Production and Marketing Officer, and the Chief Administrative Officer supervise the entire district, their interfaces reflect content from all the subject matter specialists within the district regardless of the subject matter.

The interfaces for the supervisors at MAAIF take on the same structure as that of the supervisors from the district. The exception is that the content captured at the MAAIF is from all districts in the country. Just like the district supervisors, the supervisors at MAAIF also see information based on their subject matters. The interfaces of the Principal Agricultural Extension Coordinators-Livestock/Crops/Fisheries reflect content from their respective subject matter specialists. Since the Commissioner and the Director Agricultural Extension Services coordinate all extension services in the country, their interfaces reflect content from all the subject matters.

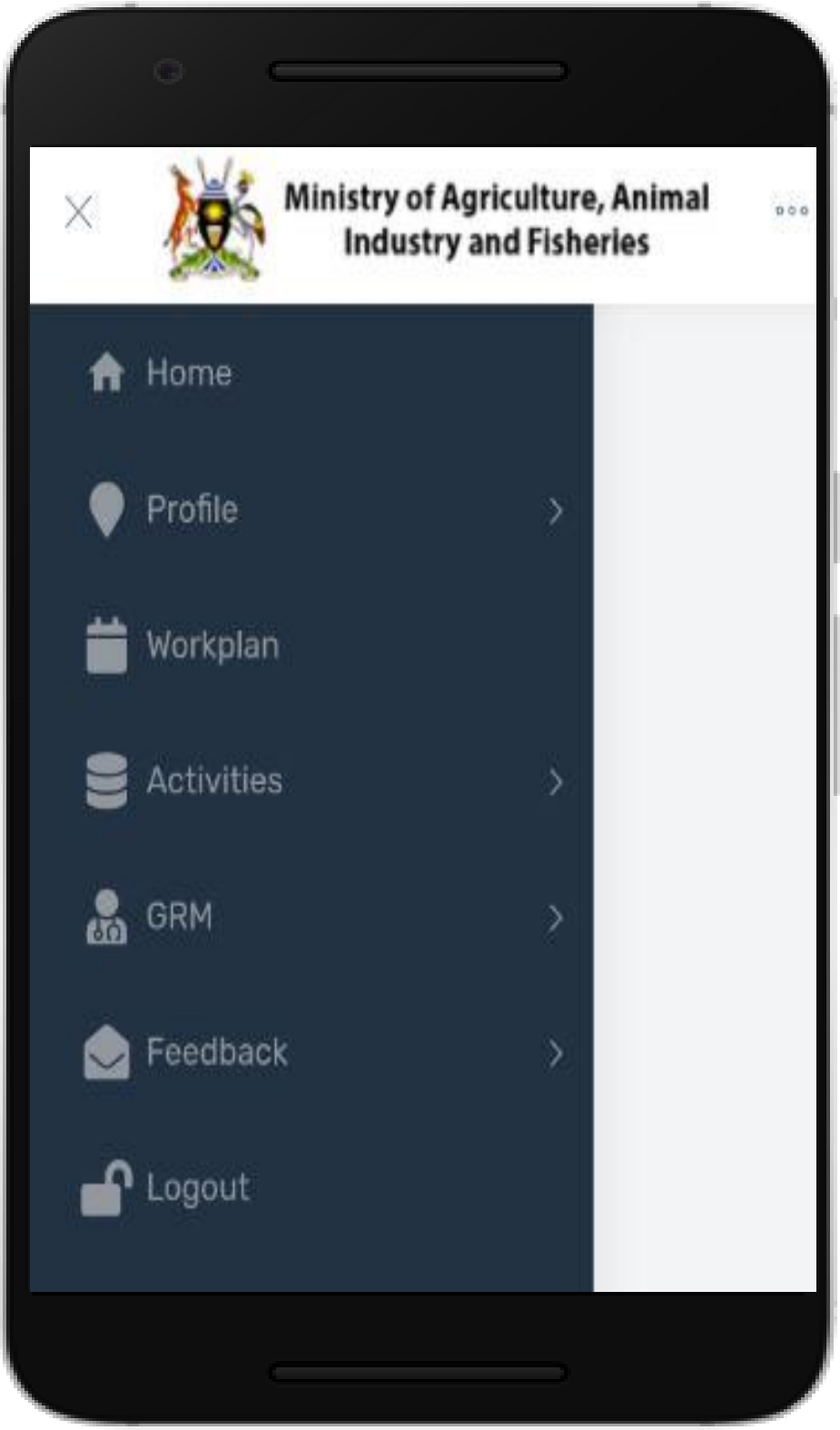

Figure 4: Field agents' mobile phone-based interface

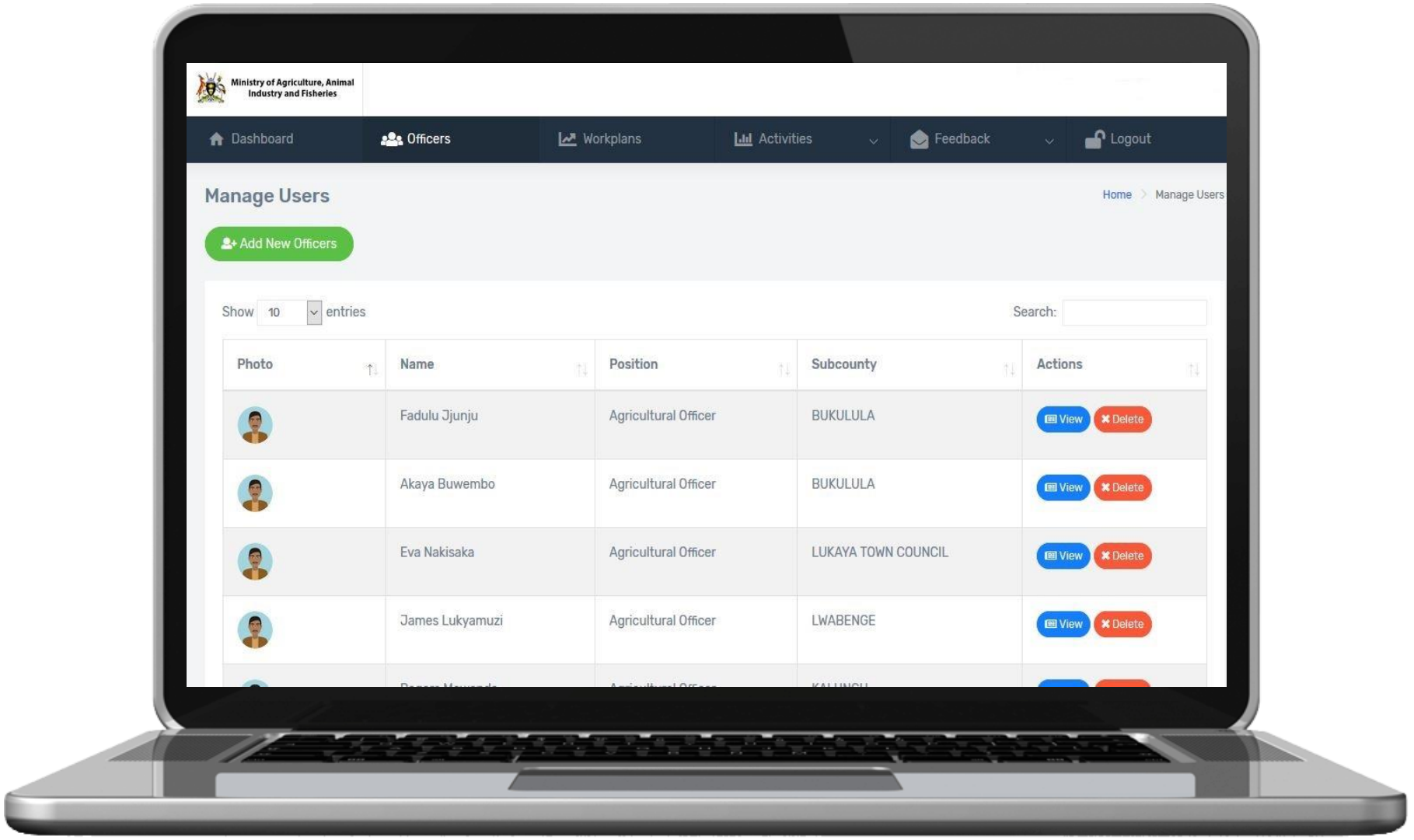

Figure 5: District Agricultural Officers' interface

3.3.1.2 How the e-diary works

As already highlighted, the e-diary works within the existing agricultural extension procedures; planning, conducting of activities, reporting, monitoring, evaluation and feedback. The planning is annual and results in the formulation of annual work plans. However, the funds to conduct activities are released every quarter (every three months), and therefore the work plan is implemented quarterly. As such, the e-diary was designed based on these processes.

At the beginning of each financial year, the field agent, together with the respective subject matter specialist plan and agree on the activities to be conducted that year. Through this process, the annual work plan of the field agent is formulated. The content of the annual work plan includes; outputs, key indicators, targets, activities to be carried out and budgets to be allocated to each activity. Subsequently, the subject matter specialist uploads the agreed-on field agent's annual work plans into the e-diary via the subject matter specialists' account (see figure 6). The annual work plan is then reflected on the account of the field agents as well as other supervisors at the different levels. At the beginning of each quarter, the field agent together with the subject matter specialist, select from the annual work plans, the quarterly activities to be carried out. These quarterly activities are further broken down into; topics, enterprises, activity budget, number of times activity is planned to be carried out and number of target beneficiaries. The subject matter specialist further uploads the selected quarterly activities into the e-diary (see Figure 7). During the quarter, the field agent logs into his/her account, reviews the planned quarterly activities and selects daily activities. Subsequently, the field agent conducts and reports the completed daily activities. Through their accounts, the supervisors are able to track the daily activities of the field agents, thereby holding them accountable.

The e-diary is embedded with special accountability features to enable the supervisors to verify the reported daily activities of the field agent. These include a beneficiary verification mechanism, location of activity (village and Global Positioning System-GPS) and activity photos. Regarding the beneficiary verification mechanism, for each activity, the field agent has to record the name and phone number of the beneficiary or reference beneficiary in the case of a group. Using the captured phone numbers, the supervisor can call the beneficiaries and verify the field agent's visit. For the location, the field agent has to record the name of the village in which the activity was conducted. In addition, the system automatically captures the GPS

coordinates, which verify the location entry. Concerning the activity photos, the field agent has to attach at least one activity photo that also provides evidence of the reported activity. Figures 8 and 9 show how the accountability features are tagged to the daily activities.

In order to facilitate evaluation, at the end of each quarter, an automatic summary report of the field agent's activities is generated. The report highlights the activities conducted, topics and enterprises covered, locations visited and the number of beneficiaries reached. While the field agent's report focuses only on the activities carried out by the individual agent, the supervisor's report further computes activities from all agents supervised. Furthermore, an automatic quarterly performance evaluation of the field agent's activities is generated. The evaluation, which is in table form, presents the percentages that are generated by comparing the completed against the planned activities, beneficiaries and budget. Figure 10 shows an example of an evaluation summary.

The e-diary also allows for feedback from the supervisors to the field agents. The field agents can send and receive messages from their immediate supervisors, who can also send and receive messages from their superiors. This facilitates communication regarding extension activities, thereby improving service delivery.

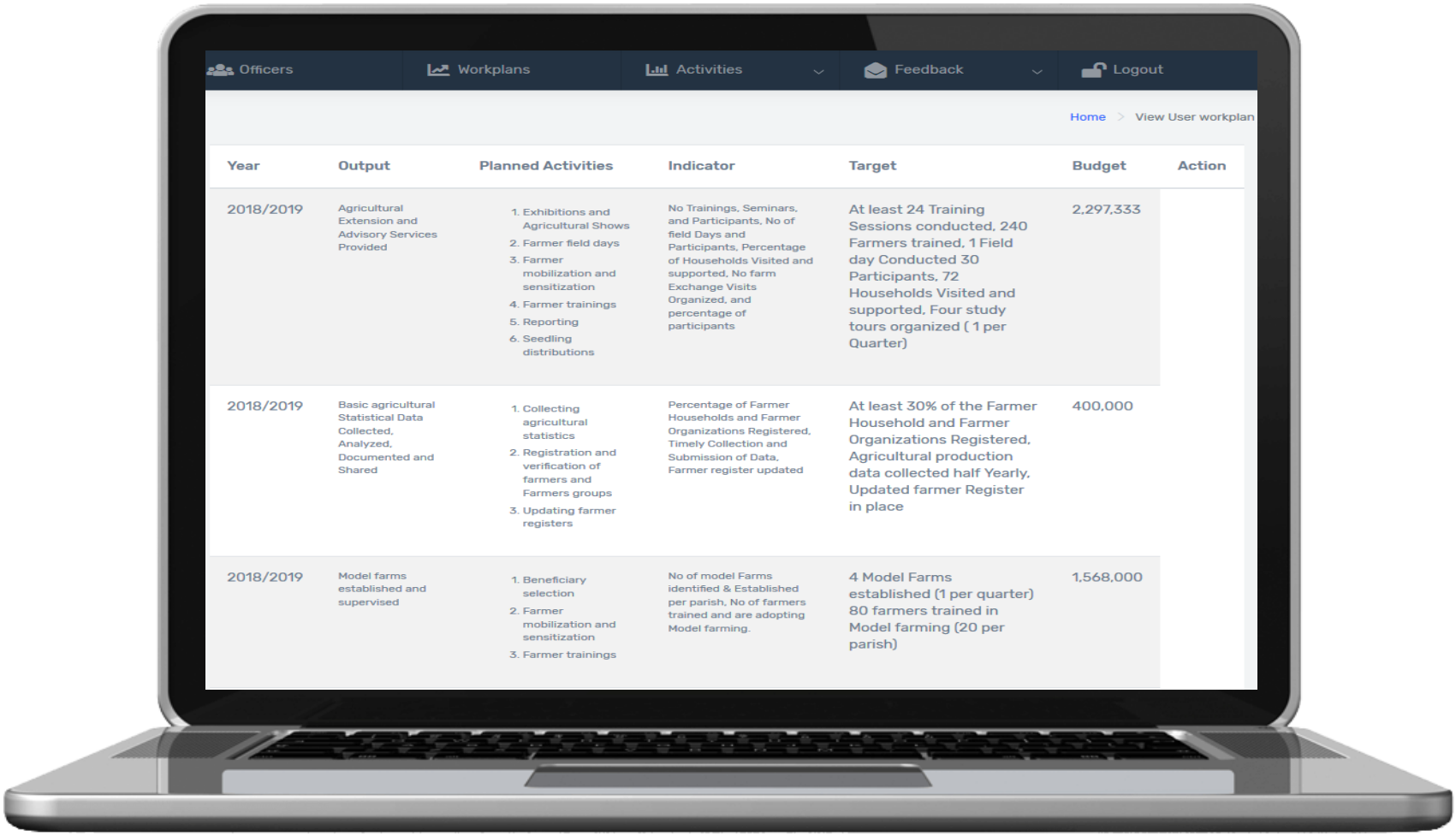

Figure 6: An example of the filled-in annual work plan

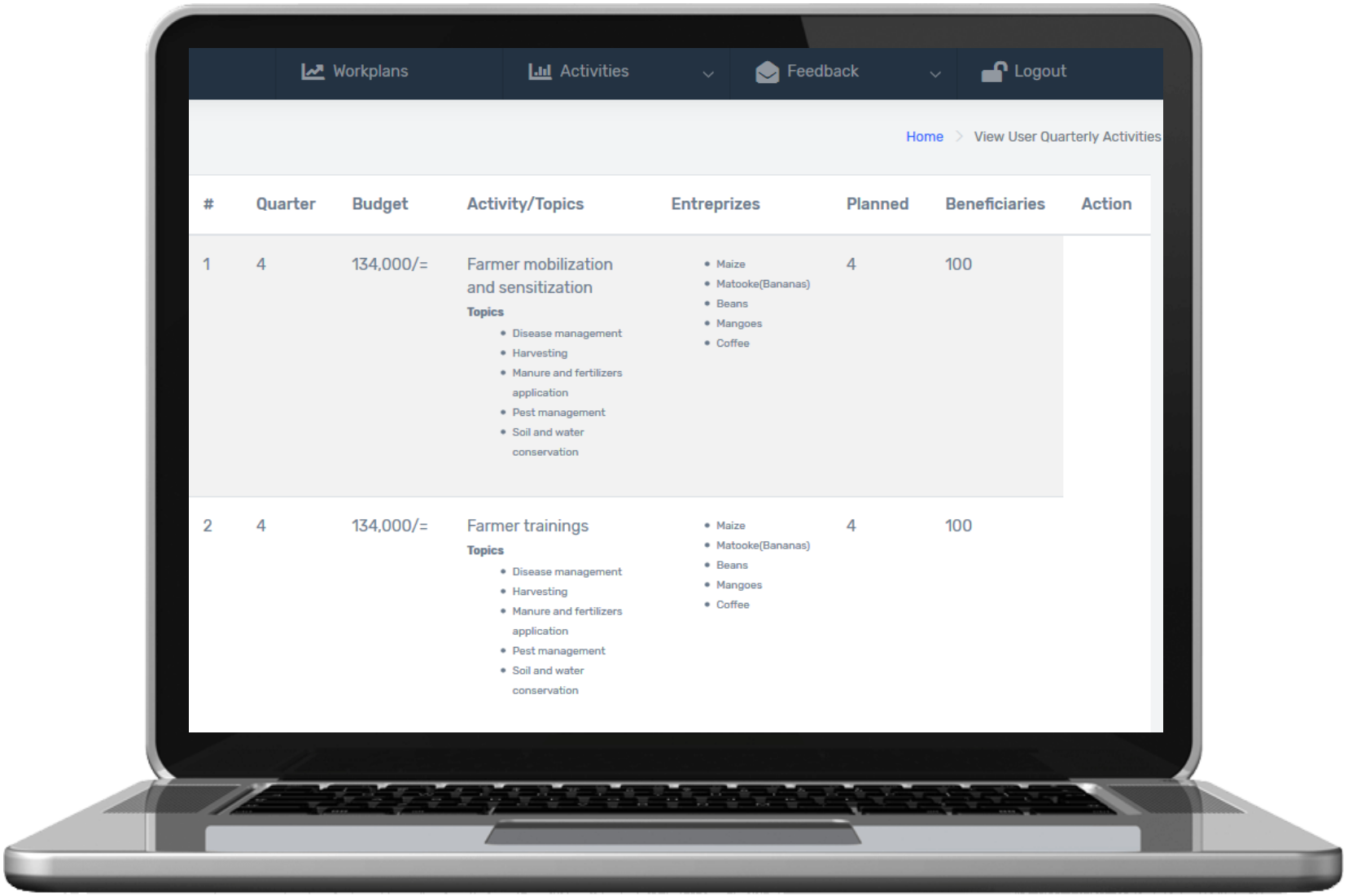

Figure 7: An example of the filled-in planned quarterly activities

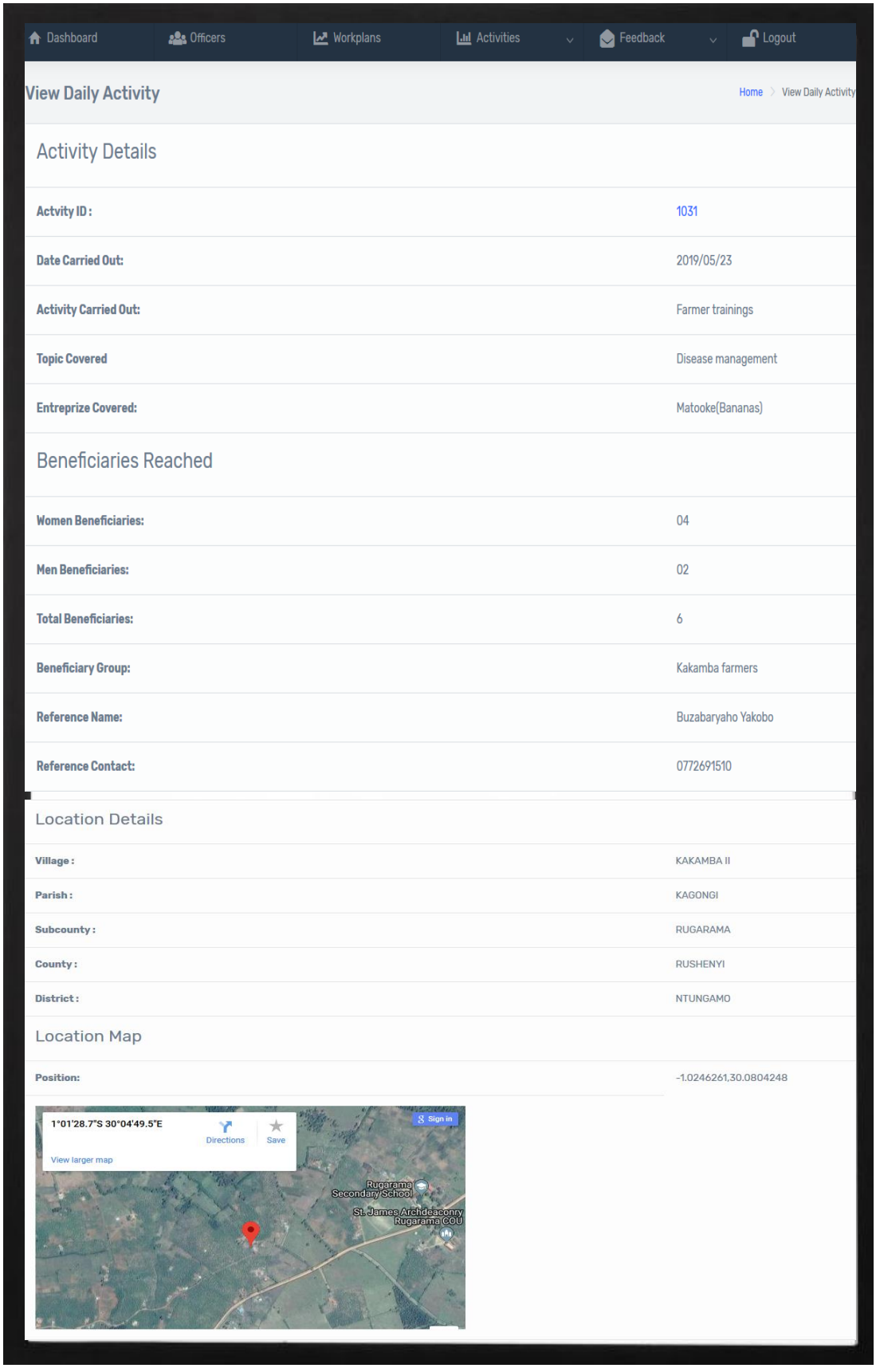

Figure 8: Activity location and beneficiary details for a daily activity

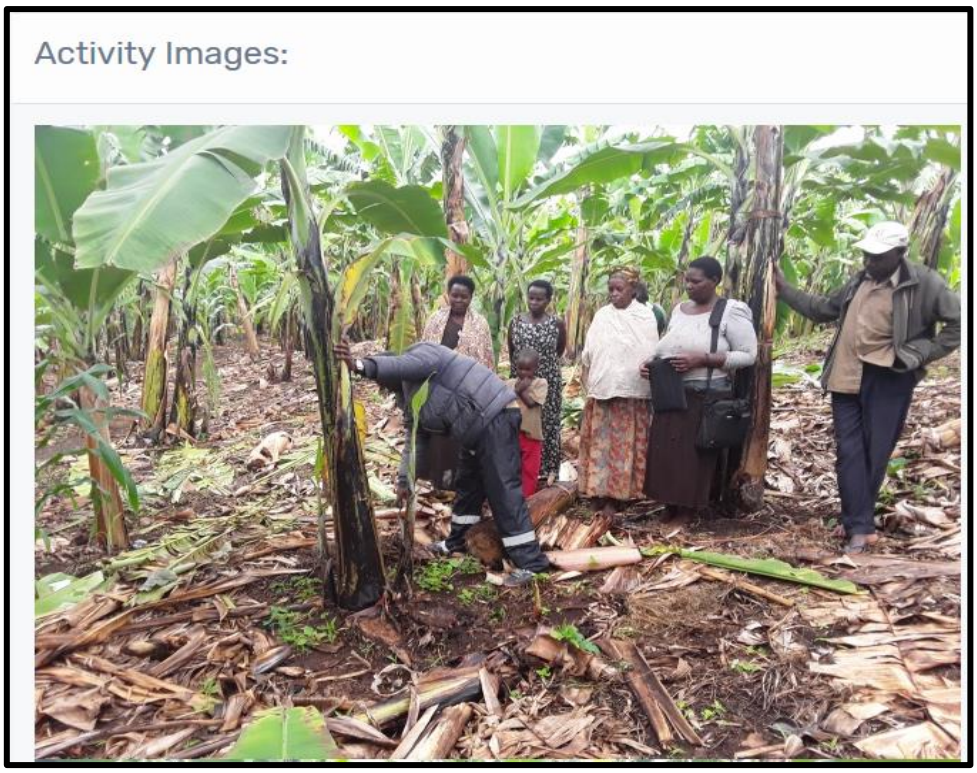

Figure 9: Activity photo under the recorded daily activity

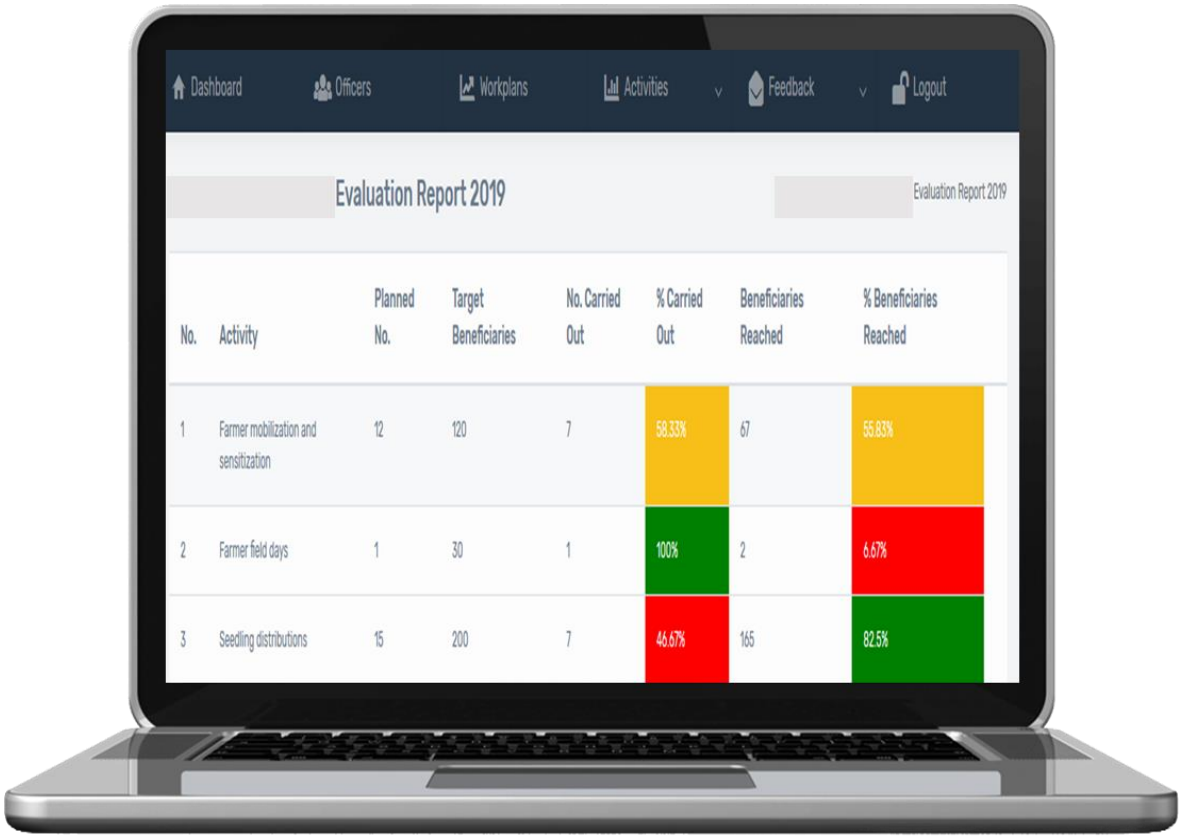

Figure 10: An example of a field agent's evaluation

3.3.2 Research design and data collection for evaluating the e-diary

A qualitative participatory research approach was employed, whereby the intended users were involved in the development and assessment of the e-diary (Cornwall & Jewkes, 1995). The study commenced with the research team developing an e-diary prototype. The prototype was based on the existing paper diary, the agricultural extension structure and the roles of the different actors along the structure. Subsequently, a dry run of the e-diary prototype was conducted. The purpose of the dry run was to test for the functionality of the e-diary to mitigate the possibility of failure. The dry run was conducted in one randomly selected district out of the 122 districts of Uganda as per the time of the study. Out of the 13 sub-counties in the selected district, two sub-counties were randomly selected for the dry run. The participants included a District Production and Marketing Officer, a Chief Administrative Officer, five subject matter specialists, two sub-county chiefs (one from each of the selected sub-counties) and three field agents (Agricultural Officers, Veterinary Officers and Fisheries Officers) per selected sub-county. The dry run was conducted for two days. This involved a one-day training in which the field agents and supervisors were first separately trained on their respective interfaces, after which a joint training was conducted. The second day involved the users applying the e-diary and thereafter, providing feedback on its functionality, content and features. The feedback was used to improve the e-diary.

The improved e-diary was then piloted in two other districts that were randomly selected out of the remaining 121 districts in which the dry run was not conducted. The pilot was conducted between April and July 2019, and all the field agents in these districts and their respective supervisors were considered. The first district comprised of 36 field agents, 26 sub-county chiefs, five subject matter specialists, a District Production and Marketing Officer and a Chief Administrative Officer. The second district comprised of 20 field agents, 7 sub-county chiefs, five subject matter specialists, a District Production and Marketing Officer and a Chief Administrative Officer. In addition, five supervisors from the Directorate of extension services of MAAIF were involved in the pilot. All users were first trained on the e-diary before its administration. Training for each district was conducted separately. Each category of users (field agents, sub-county chiefs, technical supervisors) received separate training about their respective interfaces. Subsequently, joint training was conducted. After the training, the users practiced with the e-diary in the field for three days after which the actual recording of activities

started. During the pilot, data was obtained in the form of feedback from the different categories of users. The data feedback was in the form of perceptions and experiences of using the e-diary.

Data was collected through focus group discussions and individual face to face interviews. For the field agents, two focus group discussions were conducted in the district with the 20 field agents. One was for the ten Agriculture Officers and one for the eight Veterinary Officers. In the district with the 36 field agents, 32 used the e-diary to report daily activities. Hence, only 32 were considered while collecting perceptions and experiences. In that regard, three focus group discussions were conducted for the 18 Agricultural Officers and two for the 12 Veterinary Officers. Since each of the two districts had recruited only two Fisheries Officers, four individual interviews were conducted for the Fisheries Officers. Additionally, five focus group discussions were conducted with the subcounty chiefs. Four were for the district with 26 sub-county chiefs and one for the district with the 7 sub-county chiefs. For the district-level supervisors, one focus group discussion was conducted per district. Furthermore, five individual interviews were conducted for the five supervisors at MAAIF. Subsequently, a joint workshop aimed at obtaining joint feedback from all users of the e-diary was conducted in each of the pilot districts. Table 7 shows an overview of the number of interviews conducted with the users of the e-diary.

Data obtained from the focus group discussions and individual interviews was transcribed and analysed using content Analysis (Holsti, 1968). Content analysis is an approach for analysing qualitative data through assigning codes to texts and then transforming the codes into common themes (Elo and Kyngäs, 2008). In this study, the perceptions and experiences of the users were developed into common themes with a particular focus on the potential opportunities and challenges of using the e-diary for strengthening accountability in the public agricultural extension services.

Table 7: Overview of interviews conducted with the users of the e-diary

	Number of interviews	Number of participants	Total number interviewed
Focus Group Discussions			
Field agents	7	6-10	48
Sub-county chiefs	5	6-7	33
District level supervisors	2	7	14
Individual interviews			
Field agents	4	1	4
MAAIF supervisors	5	1	5
Total interviews	**23**		**104**

3.4 Results

The results are divided into three subsections: perceptions and experiences of the users of the e-diary, the e-diary user statistics, and researchers'experiences in developing the e-diary.

3.4.1 Perceptions and experiences of the users of the e-diary

The perceptions and experiences of the users highlighted the perceived benefits and challenges of using the e-diary for strengthening accountability in the public agricultural extension services. The perceived benefits include; ease of use, convenience, real-time reporting and centralized online evidence. The challenges highlighted included poor network connectivity and inaccessibility to electricity. Table 8 shows the magnitude of the perceived benefits and challenges based on the number of respondents.

Table 8: Perceptions and experiences of the users of the e-diary

Themes	**Percentage of respondents who mentioned the theme**	
	Field agents (52 respondents-those that reported at least a daily activity)	Supervisors (52 respondents)
Perceived benefits		
Ease of use	82.7	80.8
Convenience	69.2	86.5
Real-time reporting	59.6	75
Centralized online evidence	86.5	-
Perceived challenges		
Poor network connectivity	80.8	-
Inaccessibility to electricity	40.4	-

3.4.1.1 Ease of use

Ease of use saves efforts and time in reporting and supervision of the extension activities. The majority of the field agents (82.7%), as well as their supervisors (80.8%), commended the e-diary for being easy to use. Ease of use was expressed in terms of the simplicity of the interfaces, content, language and mode of operation. The field agents reported that it took them very little time to familiarize themselves with the e-diary since their interface was easy to navigate and the content simple to understand. They were mainly intrigued by the ease with which they reported the daily activities, which were already preloaded in the system based on the annual work plans. Reporting of daily activities was by selection from a drop-down list of activities, topics and enterprises. This simplified the use of the e-diary as reflected in the following statement by one of the field agents:

"The e-diary is user-friendly as it is easy to fill. It is just a click and go. I just select an activity and, in a few minutes, everything is captured. There is not so much typing needed, unlike the cumbersome paper reporting."

The ease to use the e-diary also motivated those that were initially afraid of the electronic system as reported by one field agent:

"In the beginning, when I heard that the reporting was going to become electronic, I was worried given the fact that I am not good with ICTs. However, after the training and using the app in the field, I realized that it is an easy tool."

The supervisors also reported that understanding their interfaces did not require much effort. They highlighted that their interfaces were pretty straight forward and easy to use to follow up on the extension activities. Although the subject matter specialist had initially complained that it was cumbersome to fill in the work plans and quarterly activities of each of the field agents. They later appreciated since this is only done once a year or quarter for the annual and quarterly work plans, respectively. Moreover, the field agents are accountable based on these filled in work plans.

3.4.1.2 Convenience

The majority of the field agents and supervisors found the app convenient for reporting and supervision of activities, respectively. The field agents expressed convenience in terms of portability of the smartphone. They liked the idea of having the work plans and reporting of their daily activities on a mobile phone, which they claimed to carry with them most of the time. One field agent stated;

"Am happy that we are moving away from carrying books to the field because they are bulky. Everything with the e-diary is on the phone, which is portable. The e-diary eliminates the process of first writing down the different activities and then compiling reports. Everything is compiled in the system. Secondly, unlike with the paper-based reporting were all information is lost once the books are misplaced, I have noted that with the e-diary, I can install the app on another phone and access my data."

On the other hand, the supervisors focused on convenience in the tracking of extension activities. They indicated that the accountability features of the e-diary made tracking of field

activities easier and less costly. This was compared to before the e-diary when supervision of the extension activities was mainly by the supervisors physically visiting the sub-counties and the beneficiaries. This is reflected in the statement by one of the supervisors:

> *"Monitoring is now only a mouse click away. Before the e-diary, we had to travel to different locations to be able to follow up on the extension activities. This was more expensive and also required more time since we deal with many agents who work in large sub-counties. The e-diary is a simple way of monitoring the activities without having to run after the field agents. We can verify the reported activities using the phone numbers of the registered farmers, the GPS, which captures the location of the activity and the activity photos. One photo speaks more than a thousand words."*

The above findings imply that the e-diary has the potential to strengthen accountability by reducing the bulkiness associated with capturing of extension activities and compiling reports. Also, the accountability features facilitate remote supervision, which reduces the costs and time associated with physically supervising the field agents.

3.4.1.3 Real-time reporting

The e-diary was also commended for its real-time reporting since the daily activities were uploaded immediately after they were conducted. Real-time reporting facilitates immediate supervision and, therefore quick feedback from the supervisors to the field agents. One field agent stated:

> *"The app captures firsthand information. There is no time lag between conducting an activity and reporting it. At the end of each day, the supervisor can see what is happening on the ground. It is better than writing a report which takes days or even months to reach the ministry. The timely reporting helps the field agent to get immediate feedback from the supervisor."*

Similarly, a supervisor stated:

> *"The advantage of this e-diary is that I can get the information in real-time. Even simple statistics of how many beneficiaries have been reached in a day are generated instantly. When I want to see what my officers have done today, I just check on the system and advise them immediately and if there is an emergency, I handle it immediately."*

It can, therefore, be inferred that the e-diary has the potential to foster real-time reporting, which facilities immediate supervision and feedback, thereby holding the field agents accountable.

3.4.1.4 Centralized online evidence of activities

Most of the field agents (86.5%) were pleased that the e-diary provided an online proof for their field activities. It was highlighted that often, the beneficiaries refute the field activities when supervisors go to verify. However, with the evidence in the e-diary database, the GPS coordinates and activity photos, the field agents could easily prove their activities. One of the field agents stated:

> *"Sometimes farmers claim that we are not on ground especially when they need favours from our supervisors or politicians. However, with the e-diary, within a few minutes, we can prove to the entire nation that we are working. For example, attaching an activity photo shows proof that the activity was conducted. The GPS also shows that the agent was in the sub-county."*

Another further stated:

> *"Since we have so many farmers in the sub-county, sometimes it is not possible to reach all of them. Therefore, some of the farmers may claim that we are not working. This e-diary shows that even if I am not able to reach all farmers, at least I try to reach those I can, given the available means."*

3.4.1.5 Poor Network connectivity

At the start of the pilot, poor network connectivity was reported by the majority (80.8%) of the field agents. Due to the remoteness of their work areas, the poor network connections interfered with the reporting of the daily activities. However, this was managed by introducing a component that allowed for the offline recording of the daily activities. The application would then automatically synchronize the captured daily activities with the online system once a connection was received.

3.4.1.6 Inaccessibility to electricity

The e-diary was also reported to be affected by the challenge of inaccessibility to electricity. The field agents emphasized that they operate in rural areas, some of which do not have access to electricity yet the e-diary operates on mobile phones, which need to be charged.

3.4.2 User statistics for reporting of daily activities by the field agents

This subsection presents statistics on the use of the e-diary by the field agents to report daily activities.

3.4.2.1 Descriptive statistics for the use of the e-diary for reporting daily activities

The statistics showed that the majority of the field agents (52 out of 56) were able to report at least one daily activity in the e-diary. However, no field agents reported for all the 69 days of piloting the e-diary. The maximum number of days that a field agent reported daily activities was 38 days, the minimum was one day, the average was 17 days and the median also 17 days. On finding out why reporting was not done every day, the field agents revealed that they reported mainly on days that they conducted field-based activities and did not report office-based activities. This was because most of the activities budgeted for in the work plans were the field-based. For the four field agents that did not report any daily activity, one went on sick leave, and the other three reported to have been hindered by the technical problems with the phones that they used. However, they still did not report any activity even after giving them other phones. The failure to report daily activities using the e-diary could have been due to the absence of sanctions for failure to report.

3.4.2.2 Effect of open recognition on reporting of daily activities

During the pilot of the e-diary, a mechanism was designed to test the effect of open recognition on the reporting by the field agents. This involved the creation of WhatsApp groups for each of the participating districts. The WhatsApp groups comprised of all categories of users of the e-diary in the district, MAAIF supervisors and researchers. In the WhatsApp group, recognition was given to the field agents that reported the daily activities more consistently, while those who were inconsistent or not reporting at all were queried. The effect of this mechanism on the reporting of daily activities is demonstrated by three phases that are shown in figure 11. During phase 1, which marks the period when the field agents started reporting daily activities, there

was no open recognition. Hence, reporting of the daily activities was at a low level. However, the rate of reporting went higher during phase 2 in which open recognition was continuously done. The rate of reporting remained consistently higher throughout phase 2, with the exception of a drastic drop between days 36-40. This period was the first week of a new financial year, during which the field agents were doing more of the office activities in preparation for the field activities for the new financial year. Just like in phase 1, the rate of reporting went down and remained consistently lower in phase 3 when the open recognition had stopped. It can thus be argued that open recognition of the field agents that reported the daily activities more consistently, together with the querying of those who were inconsistent or not reporting at all, was an incentive for the field agents to use the e-diary for reporting of daily activities.

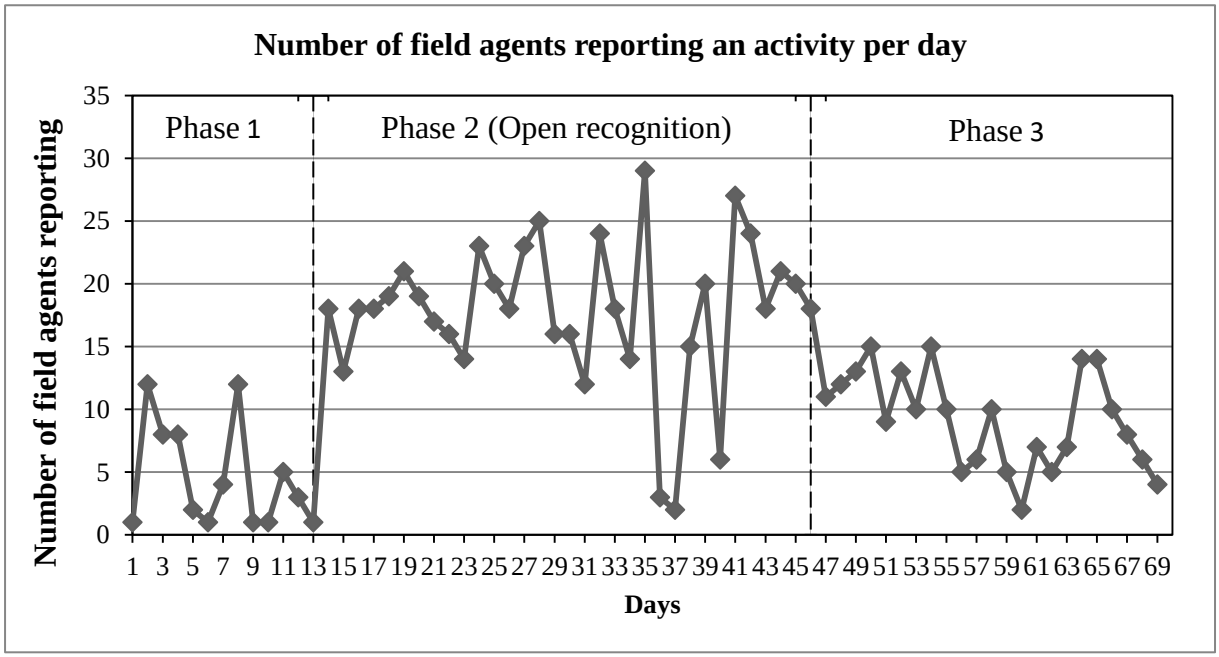

Figure 11: Number of field agents reporting an activity per day

3.4.3 The researchers' experiences in developing the e-diary

This section describes the experiences of the researchers while developing the e-diary. These included: consideration of users' context, training of users and lessons from pretesting of the app

3.4.3.1 Consideration of the users' context

Successful implementation of an application requires considering the context of the users. This facilitates user acceptance and therefore, buy-in. Consequently, the e-diary was designed based on the existing agricultural extension structure. This helped in identifying all the relevant user

categories, their roles and responsibilities and the different lines of supervision. The identification was useful in designing interfaces for the different categories of users, as well as the linkages between the interfaces. Additionally, the e-diary operations were designed based on the existing agricultural extension procedures. For instance, it was observed that the conducting of extension activities was based on an annual work plan and that due to the quarterly release of funds, the work plan was implemented on a quarterly basis. Thus, the e-diary was structured to capture the annual work plan and to facilitate the quarterly implementation of the work plan rather than monthly as earlier planned. Considering the existing procedures enabled the e-diary to aid rather than conflict with the existing processes.

3.4.3.2 Training of users

It was crucial to conduct training for the users before administering the e-diary. Since the e-diary had different categories of users, the training was conducted stepwise. At first, each category of users was separately trained on their respective interfaces. Subsequently, joint training was conducted for all the users since the different interfaces are interlinked. Each training comprised both theoretical and practical sessions. Whereas the theoretical sessions were intended for the users to understand the background of the e-diary and its purpose, the practical sessions were intended for hands-on experience prior to the use of the e-diary. During the practical sessions, the users practiced and explored the different features of the e-diary as they asked questions where they needed clarity. The training was conducted per district as it provided the opportunity to handle smaller groups at a time. Overall, the training was useful in overcoming the phobia that some of the users had towards the e-diary due to their limited experience with the use of smartphones.

3.4.3.3 Lessons from pretesting the app

The e-diary was pretested with some of the intended users through the dry run and pilot test. The feedback obtained from the users during the pretest was useful in determining the functionality, usefulness and user-friendliness of the e-diary. This was invaluable in modifying the e-diary to ensure that the users do not face challenges when implementing it. The presence of the programmer on the field team made it possible to make the required modifications while in the field and to test them immediately. One of the major modifications was the introduction of an offline component for the recording of the daily activities by the field agents. Initially, the recording of daily activities was done online. However, due to poor network connectivity

in some of the areas where the agents operated, it was a problem for some of them to upload the daily activities. Modifications were also made on the wording to fit the commonly used vocabulary in the work plans of the users. For example, the button “My Objectives” was replaced with “My Outputs” and “costs” with “budget”. Additions were also made on the content. This was especially with the activities, topics and enterprises to be selected from in the work plans. The initially developed drop-down menu of activities and topics was based on the expected roles of the field agents. However, new activities, topics and enterprises, were suggested by the field agents during the pretest and they were also included. It was noted that the field agents occasionally forgot to activate the GPS location on the device while they filled in their daily activities. Thus, the e-diary was modified such that it can only be started if the GPS location is activated. Additionally, it was observed that the field agents sometimes conduct activities outside their areas of jurisdiction (sub-counties). For example, farmer exchange visits or farmer trade shows where farmers are taken to other sub-counties or districts. Consequently, the location button was modified to accommodate other places outside the sub-counties, unlike the original design which restricted the agent to only report activities within their sub-county. Furthermore, it was observed that sometimes the field agents conduct activities outside their work plans, especially in cases of emergencies like disease outbreaks. As such, a new button was created to allow for the recording of unplanned daily activities. However, a safeguard was included such that the agent provides a justification for each unplanned activity.

3.5 Discussion

This section is divided into two subsections. In the first subsection, the potential of the e-diary for strengthening accountability in the public agricultural extension services is discussed. The second subsection discusses the potential of expanding the e-diary to support other extension services.

3.5.1 Potential of the e-diary for strengthening accountability in the public agricultural extension services

The results suggest that the e-diary has the potential to strengthen accountability in two ways. First, the e-diary was reported to enable real-time reporting of the daily activities by the field agents. Real-time reporting enabled the supervisors to follow up and verify the reported activities in near real-time rather than waiting for quarterly reports as with paper-based reporting. Thus, increasing the frequency of supervision. This finding corroborates the

supposition that mobile tools can enable the supervisors to monitor the activities of the field agents in near real-time and provide immediate feedback or immediate interventions were necessary (DeRenzi *et al.*, 2011).

Secondly, the use of the Global Positioning System (GPS), activity photo and beneficiary verification mechanism facilitated remote or distant supervision. Due to the GPS that captures the actual location for which a particular activity is reported, the supervisors are able to log into the system from any location and track the activities of the field agents conducted in different locations. The activity photo also provides additional evidence for the type of activity conducted as also reported by Duflo and Hanna (2005) and Henry *et al.* (2016), who found that photos constituted the major evidence in the supervision of teachers and health workers respectively. The beneficiary verification mechanism, which captures the phone numbers of the beneficiaries, can be used by supervisors to verify agents' reported activities as earlier suggested (Aker, 2011; Aker *et al.*, 2016). This finding supports the assumption that smartphone applications can provide platforms that enable remote supervision (DeRenzi *et al.*, 2011). Remote supervision is not only convenient but also reduces the time and costs of travel associated with physically supervising large numbers of field agents working in remote, widely dispersed geographic areas.

However, the results revealed that incentives are necessary to motivate the field agents to use the e-diary for reporting. As observed, the open recognition of the field agents who reported more consistently against those who were inconsistent or not reporting at all, increased the number of field agents reporting per day. The open recognition was via WhatsApp groups but a more automated mechanism could be created within the e-diary. Furthermore, the incentive to report could even be higher if the recognition is coupled with rewards for those reporting more consistently and sanctions for those not reporting. Such rewards could include; employee awards of recognition, promotion opportunities, career development and financial benefits such as bonus payments (Bitzer, 2016; Armstrong, 2010). The expectancy theory suggests that staffs are likely to be motivated when they believe that their efforts will be rewarded (Vroom, 1964). This finding is in line with Duflo & Hanna (2005) and Cilliers *et al.* (2013), who found that coupling monitoring with incentives increased teacher's attendance.

The results further indicated the need for training of the users before the implementation of the e-diary. In line with this finding, Daum *et al.* (2018) also found it essential to train participants before implementing a data collection smartphone application in Zambia. The results also

showed that the e-diary could be limited by inaccessibility to electricity as most field activities are conducted in rural areas, sometimes with no access to electricity. Another limitation of the e-diary is that it focuses more on whether or not the field agents conducted activities and less on the quality of the activities conducted. Thus, future studies could design a mechanism that could enable the beneficiaries captured in the e-diary to rate the quality of services received.

3.5.2 Potential of expanding the e-diary

Another way of increasing the incentive for using the e-diary is to make it more useful for every routine of the field agents in addition to strengthening accountability. This can be achieved by (i) modifying the e-diary with other features and (ii) linking the e-diary to other ICT tools.

3.5.2.1 Modification of the e-diary with new features

Regarding modification, the e-diary could be further developed with new features. For example, the e-diary could be expanded to enable the beneficiaries to rate the quality of services received. This is currently a limitation of the e-diary since it mainly focuses on whether or not the field agents conducted activities and less on the quality of the activities conducted. So far, the e-diary captures the names and phone numbers of the beneficiaries that are visited. Thus, the supervisor can call the beneficiaries to verify the activities and in addition obtain feedback on the quality of services received. However, there is no standard format for evaluating quality. Thus, an automated system could be incorporated in the e-diary in this regard. This could be in the form of an SMS based system by which SMS messages are automatically sent to the beneficiaries requesting them to rate the services received from the field agents. At free of charge, the beneficiaries can rate the services based on a scale that measures the level of satisfaction. This could be in combination with a voice response system which allows the beneficiaries to leave a voice message. The system can then automatically generate an aggregate rate for each field agent, which is received by the supervisor in addition to the voice message. Automated response systems were found to provide near real-time feedback and were more cost-effective for monitoring compared to traditional methods (Jarvis *et al.*, 2015; Gilberds *et al.*, 2016).

The e-diary could also be embedded with a crisis surveillance mechanism. This could be in the form of alert notifications by which field agents inform supervisors about crises such as pest and disease outbreaks and natural disasters such as floods and landslides. A similar mechanism by which field agents send daily activities could be explored such that the field agents send

photos of the crises and the GPS location automatically captured. A study by Quinn *et al.* (2011) demonstrated that camera phones can be useful in monitoring the spread of pests and diseases.

There is also a possibility of including a new interface for the financial office to follow up with the financial accountability for the different activities reported in the e-diary. By the time of the study, the field agents were submitting paper receipts of the funds spent under each activity alongside a paper-based report to the financial office for accountability. The e-diary can simplify this process by enabling the field agents to upload scanned copies of receipts under each daily activity via the same mechanism used to upload daily activity photos. Thus, simplifying the flow and management of the agricultural extension funds.

Furthermore, a new command button of a stakeholder profile could be created under the area profile in the e-diary. This would enable the field agents to register important stakeholders, for example, the non-state agricultural extension service providers, input dealers and farmer groups in their sub-counties. As at the time of the study, the existing farmer groups in each sub-county had been manually profiled and manual registration for the new groups was still ongoing (MAAIF, 2017). However, electronic systems have been found to be simpler and more timely in terms of data receipt, data management and formation of databases (Hufford *et al.*, 2002; Quinn *et al.*, 2003; Lane *et al.*, 2006). Thus, using the e-diary for profiling the relevant stakeholders could simplify the process of stakeholder profiling.

3.5.2.2 Linking the e-diary to other ICT tools

Regarding links to other ICT tools, the e-diary has so far been linked to another application called "MAAIF E-GRM" which is locally built on the same platform. This was via the GRM (Grievance Redress Mechanisms) command button created on the interface of the field agents. The MAAIF E-GRM is being developed by MAAIF to enable the public to report on Grievances arising out of agricultural extension projects. By linking the e-diary to MAAIF E-GRM, the field agents can obtain beneficiary feedback via the e-diary once the MAAIF E-GRM is implemented. This could further be linked to the supervisors' interfaces such that they, too could access the beneficiaries' feedback on the different agricultural projects. Studies by Jarvis *et al.* (2015) and Gilberds *et al.* (2016) have shown that beneficiary feedback obtained from the use of ICT tools has the potential to enhance the impact of agricultural projects. Thus,

linking the e-diary to the beneficiary feedback could be an incentive for the field agents to use the e-diary.

The e-diary could also be linked to the "E-extension and Advisory system for MAAIF", another tool built on the same platform, which is designed to generate and disseminate agricultural information to beneficiaries. Linking the E-extension and Advisory system to the e-diary will enable the field agents to have easy access to the generated agricultural information, which they can refer to while conducting field activities.

The e-diary could also be linked to other relevant platforms outside MAAIF. This can be via Application Programming Interface-API which facilities automatic communication between the e-diary and other platforms. For example, through collaborations between MAAIF and the meteorology center, the e-diary could be linked to weather forecast platforms, and that would enable the field agents to access weather data which they can use to guide the beneficiaries' activities. The e-diary could also be linked to market information platforms, which would enable the field agents to get easy access to market information such as market prices. This information can be used by the field agents to guide the beneficiaries on where to sell their produce.

3.6 Conclusion

Weak accountability is one of the major challenges of public agricultural extension systems. Public extension systems often deploy large numbers of field agents in remote and widely dispersed geographic areas, thereby making supervision difficult to undertake. Moreover, the supervisors are often constrained by time, underdeveloped transport infrastructure, insufficient financial resources and lack of robust supervisory tools. In this study, a smartphone application called the "e-diary" was developed and assessed for its potential to strengthen accountability in the public agricultural extension services. The experience with the "e-diary" indicates that smartphone applications have the potential to address the challenge of weak accountability. The study shows that smartphone applications enable remote supervision of the field agents, thereby reducing the time and costs of supervision. Smartphone applications also allow real-time reporting which facilitates near real-time supervision. The study, however, reveals that successful implementation of a smartphone application for strengthening accountability requires incentives such as recognition of best field agents based on the reports generated within the application. Other incentives could arise from expanding the e-diary by modifying

it with additional features and linking it to other ICT tools essential in extension services. The implementation of the e-diary also requires training of the intended users before implementation especially that some users have limited experience with the use of smartphones. The use of the e-diary also requires the use of solar charges or power banks to enable the charging of phones in areas with limited access to electricity. Recommended for further research is to design an automated mechanism within the e-diary that allows the beneficiaries to rate the quality of services received. Overall, the “e-diary” demonstrates the new opportunities of using ICT tools to strengthen accountability in the public sector. The findings are therefore also relevant for other public services such as health and education, where supervision of field agents is constrained by time and costs of travel.

4 ANALYSING THE PERFORMANCE OF AGRICULTURAL EXTENSION MANAGERS IN UGANDA

Abstract

Many developing countries have undertaken several reforms to establish functional agricultural extension service delivery systems. However, most reforms have focused on governance structures and advisory methods. There is hardly any empirical study examining the factors influencing the performance of the managers of the agricultural extension services. This paper provides an assessment of the performance of the agricultural extension managers in Uganda according to indicators established by the Ministry of Agriculture, Animal Industry and Fisheries, and the factors influencing it. A quantitative research approach using secondary data sources was used to collect data, while analysis was conducted using descriptive statistics and econometric models. The findings indicate that the majority of the managers were not able to meet the performance requirements based on the indicators. Further, the amount of extension grant to the district and the ratio of extension workers to households are the key factors influencing the performance of the managers. There is a recommendation to improve the performance of the managers through capacity building, especially in management, and setting up a strict performance monitoring system. It is also recommended that the government increases funding to the districts and increase the extension workers to household ratio.

Keywords: Performance, performance determinants, management, agricultural extension managers, Uganda

4.1 Introduction

The significance of agricultural extension in the transformation of agriculture, especially in the agrarian economies, has been widely acknowledged (Anderson & Feder, 2007; Davis 2008; Swanson and Rajalahti 2010). Agricultural extension facilitates the delivery of information and technologies to the farmers, thus enhancing productivity and agricultural development (Anderson & Feder, 2004; Ragasa *et al.*, 2016). However, in many developing countries, agricultural extension services still face the challenge of establishing a well-managed and effective system (Birner & Anderson, 2007). Hence governments worldwide have undertaken several reforms to improve agricultural extension service delivery (Rivera & Alex, 2004).

Just like other developing countries, Uganda has had its share of agricultural extension reforms. These reforms have particularly focused on governance structures and extension delivery methods. The governance structural reforms can be traced to the 1990s with the decentralization of the public extension services (Anderson & Van Crowder, 2000; Bashaasha *et al.*, 2011; Barungi *et al.*, 2016). Subsequently, was the privatization and out-sourcing of the extension services under the National Agricultural and Advisory Delivery System (NAADS) in 2001 (Rivera, 2004; Bahiigwa *et al.*, 2005; Bukenya, 2010; Joughin & Kjær, 2010; Benin *et al.*, 2011; Okoboi *et al.*, 2013; Rwamigisa *et al.*, 2018; AfranaaKwapong & Nkonya, 2015, Mukembo & Edwards, 2015; Ilukor *et al*., 2015). In 2015 however, there was a switch from NAADS back to the public system, which is referred to as the Single Spine Extension System (MAAIF, 2016a). Similarly, a wide range of agricultural advisory methods has been implemented. These include; the coercive approach, progressive farmer approach, Training and visit, Farmers' Field Schools and other Participatory Extension Approaches (Semana, 1998; MAAIF, 2016b).

Despite the long history of the reforms, the focus has been on the structures and the methods, with the most recent literature investigating the appropriateness of the new Single Spine structure and public expenditure governance under this structure (Barungi *et al.*, 2016; Kuteesa *et al.*, 2018). There is hardly any empirical study examining the performance of the managers of the agricultural extension services. Yet, their performance is also crucial for establishing a well-managed and effective agricultural extension system. Moreover, also elsewhere, studies that have delved into the performance of agricultural extension services have focused on the performance of extension organisations or/and field agents and not the extension managers (Khalil *et al.*, 2009; Ifenkwe, 2012; Okwoche & Asogwa, 2012; Ragasa *et al.*, 2016).

An important stride, though, has been the construction of performance indicators for the extension managers under the new Single Spine system. The Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) has developed measurable indicators to evaluate the performance of the extension managers based on their expected roles and responsibilities. This study was therefore undertaken to analyse the performance of the agricultural extension managers according to those established measurable indicators, and the factors associated with it. The objectives of the study included:

i. To analyse the performance of the agricultural extension managers based on the established measurable performance indicators.
ii. To determine the factors influencing the performance of the agricultural extension managers in relation to these indicators.

The findings are important for guiding the establishment of a well-managed and effective agricultural extension system as well as contributing to the body of knowledge on the performance of agricultural extension staff. Since the study was based on secondary data, the study also contributes to innovative methods of using secondary data to evaluate performance, which could also be utilized in other fields and other countries.

4.2 Literature Review

This section consists of three parts: The first subsection presents the functions of management, which are important in explaining the role of the agricultural extension managers. The second subsection presents the measures of performance while the third, the factors influencing performance.

4.2.1 Functions of management

Management is the process of coordinating people, resources and tasks to effectively achieve organizational goals (Swanson *et al.*, 1998). The basic functions of management are planning, organizing, leading and controlling (McDonald, 2010). Planning is the fundamental function of management, as it is usually where the direction of the organization is established (Schraeder *et al.*, 2014). Through planning, the organizational goals and strategies to achieve the goals are developed (Olum, 2004). Organizing is the coordination of people and resources critical for the achievement of the organizational goals (Swanson *et al.*, 1998). Leadership entails the motivation, communication, and influence of employees towards the achievement of the organizational goals (Howell & Costley, 2006). The fourth basic function of management is

control, which focuses on ensuring the achievement of the intended goals through monitoring of progress and performance (Costa & Bijlsma-Frankema, 2007).

Other functions of management are; staffing, budgeting, and reporting (Swanson *et al.,* 1998; Olum, 2004). Staffing is about filling and keeping filled-in the required positions in the organization structure. It involves recruitment, training, motivation, and rewarding of organisational employees (Olum, 2004). Budgeting focuses on fiscal planning, accounting as well as revenue, and expense controls. It is about identifying the items required to meet the goals, finances required to meet each item and possible sources of revenue. On the other hand, reporting focuses on the ability of the manager to keep those who are responsible informed on what is going on in the organization (Swanson *et al.* 1998).

4.2.2 Measurement of performance

Performance in the context of an organization can be defined as the ability to implement tasks to a certain standard and in line with the organizational goals (Asamani *et al.*, 2015). In this study, Birner *et al.*'s (2009) conceptual framework for the design and analysis of agricultural advisory services was adapted for the assessment of the performance and the factors influencing the performance of the agricultural extension managers (Figure 12). Box F of the conceptual framework shows performance, which is explained by different factors.

The measures of performance of agricultural extension managers are scarce in the literature. Studies that have analysed performance in the agricultural extension services have focused on the performance of agricultural extension field agents or extension organisations (Khalil *et al.*, 2009; Ifenkwe, 2012; Okwoche & Asogwa, 2012; Ragasa *et al.*, 2016). There is hardly any study on the performance of the managers of the agricultural field agents. Nonetheless, the existing studies highlight a wide range of indicators that have been used for measuring performance. For example, Ifenkwe (2012) measured performance by requesting agents to indicate the level of importance, either low, medium, or high attached to twenty competencies, considered to be the necessary attributes for effective field performance of the agents. In another study, Ragasa *et al.* (2016) collected output indicators and used them to measure performance. In particular, the performance of agents was measured in terms of whether agents: disseminated any technology, monitored the number of farmers who had adopted the promoted technologies and monitored the impact of technologies. Performance of the extension organizations was measured in terms of whether the organization: disseminated any

technology, organized training and visits, conducted farm demonstrations, and promoted training materials. In the conceptual framework adopted for this study, Birner *et al.* (2009) noted that the indicators used to measure the performance of agricultural extension services depend on the goals of the service. That these indicators may refer to different dimensions, including; accuracy and relevance of the content of the advice given, timeliness of the advice, outreach of the advice, quality of the partnerships established, feedback effects formed and efficiency of service delivery. Using similar dimensions, Okwoche & Asogwa (2012) measured the performance of extension agents using a supervisors' rating scale based on six dimensions of performance. The dimensions included; quality of work, quantity of work, dependability, feedback activities, attendance to activities, and client satisfaction. Similarly, Khalil *et al.* (2009) used the same dimensions of performance, but instead of supervisors rating, there was self-rating by the agents.

For comprehensive performance measurement, it would be important to collect data on all the dimensions. However, this is difficult on a routine basis since it requires different methods and different data sources, including also getting feedback from the clients. In this study, therefore, the indicators used for analysing the performance of agricultural extension managers were not able to capture all the dimensions. The performance was measured based on the dimension of timeliness, which from a central management perspective is easier to generate and to measure. The indicators used were constructed by MAAIF based on the expected functions of the agricultural extension managers. They included; responsiveness to staffing, responsiveness to planning and responsiveness to reporting. Responsiveness to staffing was based on the number of staff recruited against the number of staff that the manager was approved to manage as per the time of the study. Responsiveness to planning was based on the submission of the annual work plans, whether the manager submitted annual work plans and whether the submission was in the required time. Responsiveness to reporting was based on the submission of reports, whether the manager submitted reports and whether the submission was within the required time frame.

4.2.3 Factors influencing the performance of agricultural extension managers

A fundamental step towards improving performance is analyzing the factors that influence it. In Figure 12, boxes A to E illustrate how the different factors interact to influence performance. These are grouped into capacity and the contextual factors in which the extension services are

delivered. Capacity is further broken down into individual characteristics and organizational capacity.

4.2.3.1 Individual characteristics

A significant influence of individual characteristics such as age, experience, education, and training, on performance, has been widely reported (Miron *et al.*, 2004; Shultz and Adam, 2007; Shaffril & Uli, 2010; Saleem & Imran, 2014; Sikul *et al.*, 2015). However, the characteristics are born of contention of whether they have a positive or negative relationship with performance. Regarding age, Shaffril & Uli (2010) indicated that it had a significant and positive relationship with performance. A similar relationship was also observed in other studies (Sikul *et al.* 2015; Ifenkwe 2012). Older workers are likely to have more experience and, therefore more knowledgeable about the tasks as compared to their younger counterparts. On the contrary, Saleem & Imran (2014) found that younger employees performed better than their older colleagues.

Experience is another individual characteristic that can influence performance (Kolz, 1998). Shaffril & Uli (2010); Ifenkwe (2012), Saleem & Imran (2014) found that employees with longer length of service performed better. Experience creates exposure and develops knowledge and skill, which, in turn, enhances performance. However, Kotur & Anbazhagan (2014) contended that though the performance of the employees gradually increases with experience, it later becomes lower. This was attributed to boredom resulting from employees' loss of interest in the work after having done it for a long time. Surprisingly, Babalola (2016) discovered that working experience had a negative influence on performance. The author attributed it to management's emphasis on the educated rather than experienced employees, as many of the experienced workers might not have been highly educated.

Education is another factor found to increase performance (Ifenkwe, 2012; Babalola, 2016). Education contributes to increase in knowledge, skills, and an appropriate attitude for performance. It also facilitates the advancement of management capacity as critical skills such as planning, organizing, resource mobilization, financial management, leadership, and control are harnessed by managers. On the contrary Kotur, & Anbazhagan (2014) found that the workers' performance declined with increasing educational qualifications. However, since the study was conducted for laborers and not the white color professionals, it provided an exception

to the general rule. Other studies like Sikul *et al.* (2015); and Ariss & Timmins, (1989) did not find a significant relationship between employee's level of education and job performance.

Training has also been found to have a positive and significant influence on performance (Guest 1997; Krueger 1998; Appiah 2010; Ifenkwe 2012; Nassazi, 2013; Sikul *et al.* 2015; Khan *et al.* 2017 and Handajani *et al.* 2017). According to Naris & Upkere (2009) and Sikul *et al*. (2015), training is vital in the acquisition and upgrading the pre-requite skills and knowledge, which in turn enhances performance. It plays a key role in the building of competencies of new, as well as current personnel to perform their jobs more effectively (Elnaga & Imran, 2013). Ragasa *et al.* (2016) who assessed the factors affecting the performance of the agricultural extension system and found that extension officers who received training were 6-18% more likely to perform better than those who did not receive any training.

4.2.3.2 Organizational capacity

The organizational capacity focuses on the organizational factors that influence performance. These include; the number of staff in the organization, organizational resources, including both financial and physical resources and the organization reward system. These are shown in box E of the conceptual framework.

Adequate staffing has been reported to improve performance (Aiken *et al.*, 2011; Abbass, 2012; Everhart *et al.*, 2013; McHugh & Chenjuan Ma, 2014). The number of staff is associated with workload, i.e. the amount of work assigned to an employee within a specified period (Dasgupta, 2013). In order to ensure good performance, the staff members need to be assigned an acceptable workload (Asamani *et al.*, 2015). Studies by Shah *et al*. (2011), Cox-Fuenzalida *et al.* (2004), Szalma *et al.* (2004) and Asamani *et al.* (2015) highlighted that performance significantly decreased by extreme levels of workload (both very low and very high). Extremely high workload levels are like to generate a feeling of helplessness and burnout, which could make employees give up on their efforts. Indeed, McHugh and Chenjuan Ma (2014) agree that an excessive workload exhausts workers' energy and makes recovery a problem. Alternatively, extremely low workload levels may create contentment, which could lead to underperformance (Asamani *et al.*, 2015). In regards to agricultural extension, studies by Olatunji *et al.* (2015) and Nwanade *et al.* (2017) reported the inadequate ratio of agricultural extension agents to farm families as a major constraint to the effective delivery of agricultural

extension services. Hence recruitment of more extension officers was recommended to attain an adequate extension staff number to farm families. However, Ragasa *et al.* (2016) in their study assessed factors affecting the performance of the agricultural extension system in the Democratic Republic of Congo and found no conclusive evidence to show that the number of agricultural extension staff is a statistically significant factor in explaining good performance in terms of extension service provision. Rather it was more to do with the quality of staff, especially in terms of formal education and technical training. The lack of a significant relationship of staff numbers could have been because the Democratic Republic of Congo has among the highest agent-to-farmer ratio or lowest farmer-to-agent ratio compared to other countries, as reported within the study.

The financial resources that are available to agricultural extension are also an important capacity variable (Birner *et al.*, 2009). Several studies, Davis *et al.* (2009), Byekwaso (2006), Barungi *et al.* (2016), Ragasa *et al.* (2016) and Nwanade *et al.* (2017) found that inadequate funding is a major constraint to efficient provision of agricultural extension services. As noted by Swanson (2008), most government agencies have inadequate financial resources to adequately cover extension operational costs, especially at the field level, as operational budgets are routinely cut. Furthermore, even with availability, there is an untimely release of the funds. According to Bitzer (2016) and Zwane *et al.* (2014), limitation in operational funds, as well as lack of funds for equipment, transport, communication, and information facilities, diminishes the agricultural extension officers' capacity, morale as well as the motivation for high performance. On the other hand, Caillier (2010) found that public employees reported higher performance levels when they believed that their agencies received enough funding to fulfill their goals. Indeed, Agwu *et al.* (2017) opine properly motivated extension workers to have the enthusiasm to carry out their work effectively. Successful agricultural extension, therefore, requires appropriate funding modalities (Barungi *et al.*, 2016).

The provision of adequate physical resources needed to undertake the required tasks is also key to achieving high performance (Asamani *et al.*, 2015). Physical resources such as; physical infrastructure (office space and furniture), means of transport (vehicles and motorcycles), as well as equipment and tools (computers, machines, and other tools), provide adequate conditions for timeliness, effectiveness and efficiency. However, in most developing countries, especially within agricultural extension services, most workers do not have sufficient access to the required physical resources. This is common to means of transport as most are not

facilitated with vehicles or motorcycles required for fieldwork. In the end, most use public transportation, which is inefficient in terms of time management (Swanson 2008; Davis *et al.*, 2009). A study by Ragasa *et al.* (2016) cited the miserable state of transportation infrastructures and lack of access to means of transportation as major hindrances to the performance of the national extension system.

The presence and enforcement of rewards systems is an important strategy to increase the achievement of a high-performance culture in an organization (Armstrong, 2010; Nzuve & Njambi, 2015); Ndungu, 2017; Mabaso, & Dlamini, 2018). The expectancy theory suggests that employees are likely to be motivated to perform when they believe that their efforts will be rewarded (Vroom, 1964). The rewards could vary from monetary where performance is rewarded through pay (increases in basic pay, cash bonuses, and allowances) as well as employee benefits like insurance cover or non-monetary such as employee recognition, career development and operational resources (Bitzer, 2016; Armstrong, 2010). In a study on how to motivate employees, Herzberg (1968) noted that recognition for achievement is one of the important motivators for employee performance. In another related study that assessed the factors affecting the performance of the agricultural extension systems, Ragasa *et al.* (2016) noted that agricultural extension organizations with a system of rewards and sanctions were 36% more likely to perform better than those without. Similarly, Bitzer, (2016) observed that incentive failure is one of the key challenges to the performance of agricultural extension service systems in developing countries. This is as a result of few rewards, scanty prospects of promotion based on performance, and low recognition for agricultural extension officers leading to lack of motivation and morale. The author recommends that improved performance-based incentives like increased official recognition and training opportunities are critical and therefore need to be institutionalized especially in the public extension systems.

4.2.3.3 Contextual factors

Contextual factors look at the external environment in which the extension services are provided. Just like other managers, agricultural extension managers are situated in an external environment, which has a multiplicity of political, economic and social-cultural influence. As noted by Njoroge *et al.* (2016), the external environment has a significant influence on performance. This can either be a direct influence on performance or an indirect influence through capacity. Boxes A, B, and C of the conceptual framework highlight the different contextual factors that influence performance.

As shown in box A of the conceptual framework, the policy environment in which an individual or organization operates influences their performance. The policy environment encompasses the political system as well as prevailing policies and strategies. According to Mangheni *et al.* (2003), instability of the political system can significantly undermine the provision of extension services, as professionals flee the country and leave unskilled personnel to manage agricultural extension. In regards to policies, the agricultural policies and strategies, as well as the performance targets, determine the vision and commitment to agriculture extension (Ragasa *et al.*, 2016). They define the government priorities, especially in terms of the proportion of the budget allocated to the agricultural sector and thus, the scope and performance of extension services (Birner *et al.*, 2009). Improvement in agricultural extension performance, therefore, requires the creation of an enabling policy environment, as it facilitates the extension officers to effectively carry out their duties. Furthermore, the enabling policy environment systematically enhances access to financial resources, information, training, and the provision of improved technologies, infrastructure and markets, which are major determinants of performance (Emmanuel, 2012).

The production system and market access, as represented in box B of the conceptual framework, also influence performance (Birner *et al.*, 2009). Regarding agricultural extension, the production system comprises; the agronomic potential of the areas in which the agricultural extension managers operate (the agri-ecological zones) as well as the type and nature of agricultural commodities (popular and potential crops, livestock and fish) produced. On the other hand, market access includes; the location, accessibility as well as distance to both input and out markets.

The community aspects, as shown in box C, also influence performance. They provide the value system in the society in which the agricultural extension manager operates. Community aspects include; social norms, beliefs, mindsets, gender roles and responsibilities, land size and distribution, literacy levels, population density, number of households and collective action. Communities with high literacy levels, high levels of social capital and robust governance structures that support collective action like the formation of farmer groups and higher farmer organizations tend to have a comparative advantage. This is because they usually have higher bargaining power and capacity to demand extension services (Birner *et al.*, 2009; Andrews and Brewer, 2014). This increases the chances of extension managers to perform better.

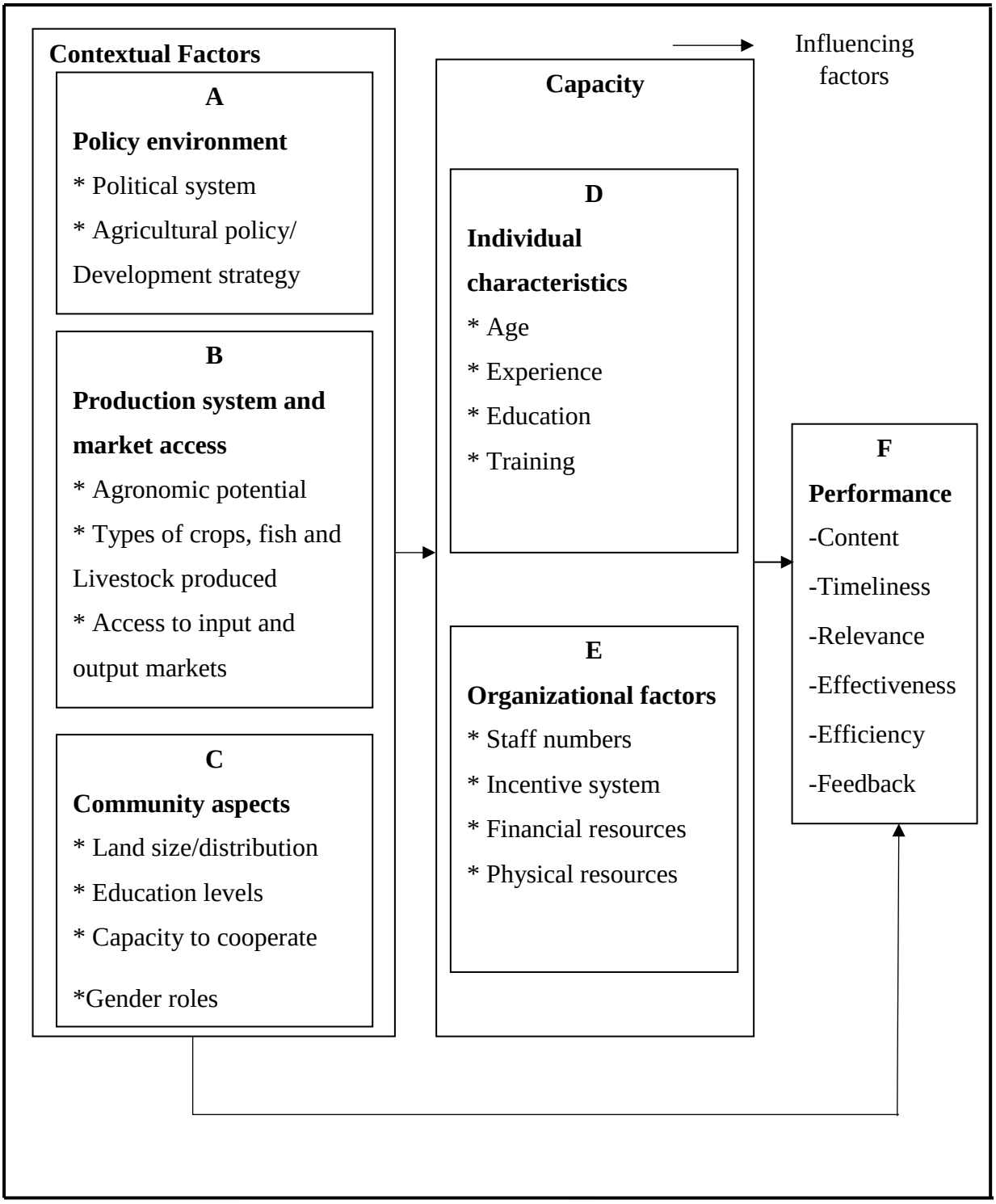

Figure 12: Conceptual framework for assessing the performance of Agricultural extension managers

Source: Adapted and modified from Birner *et al.* (2009).

4.3 Methodology

The section presents the research design and the methods of data collection and analysis.

4.3.1 Research design

A quantitative research approach was used to determine the performance of the agricultural extension managers according to the established measurable indicators, and the factors associated with it. The unit of study is the agricultural extension manager at the local government (district) level. These are referred to as the District Production and Marketing Officers (DPMOs). The District Production and Marketing Officers technically report to the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) through the Directorate of Agricultural Extension Services, but administratively responsible to the Chief Administrative Officer under the decentralized arrangement (See Uganda's agricultural extension structure in Figure 1). They are responsible for the management and coordination of all agricultural extension services within the local government (district). They carry out supervision of the delivery of agricultural extension services up to farm level; Technical backstopping to sub-counties; Monitoring, Evaluation and Reporting; Capacity building of sub-counties; Planning and budgeting for agricultural extension; and Collate agricultural statistics from sub-counties (MAAIF, 2016a).

In this study, the performance of the agricultural extension managers was measured based on indicators constructed by MAAIF. A total of 111 extension managers was selected out of the existing 122 by the time of the study. The selection of the 111 managers was based on the districts with available district statistics as at the time of the study. It should be noted that ten out of the 122 districts were newly created and therefore did not have existing statistics. Additionally, the capital city district was eliminated due to outliers. The statistics used were secondary data sources from MAAIF, Uganda Bureau of Statistics (UBOS) and Uganda Electro Commission. This involved using internal data sets, statistical abstracts and online sources.

4.3.2 Data collection

Data on the indicators of performance was generated within the agricultural extension management system of MAAIF, where it was regularly collected and compiled. The indicators used included; responsiveness to staffing, responsiveness to planning, and responsiveness to reporting.

Data for responsiveness to staffing was based on the staffing status for the district for which the manager was in charge. This was as per the year 2017/2018. Due to the various reforms in the extension services in Uganda, many agricultural production staff had resigned from the public extension system. However, upon restoration of the public system (now referred to as the Single spine), MAAIF supported districts and also released funds to the districts to recruit and deploy agricultural production staff within the districts. Following this support, MAAIF captured the staffing status of each district in order to track their progress in regards to recruitment. Data captured included; the approved number of staff to be recruited in each district, the current number of staff recruited and the staffing gaps.

Data for responsiveness to planning was based on the submission of the annual work plans by the extension managers to MAAIF. After the government shifted the agricultural extension service delivery back to the public system, MAAIF allocated a conditional agricultural extension grant to the district local governments in order to support the delivery of agricultural extension services within the districts. Consequently, MAAIF requested the agricultural extension managers to submit an annual work plan for the activities to be conducted that year. The first financial year for which the grant was allocated was 2017/2018 (From 1st July 2017 to 30th June 2018) and therefore, data on submission of work plans was captured starting with the annual work plans of 2017/2018. Since the study period was up to November 2018, only data for the submission of the work plans for the financial year 2017/2018 was provided. The data captured included extension managers who had submitted the annual work plans of 2017/2018 and the date on which these work plans were submitted.

Responsiveness to reporting was based on the submission of reports. MAAIF developed a reporting matrix that captures information on the submission of the district reports including those who submitted and the date of submission. Reporting is done quarterly since annual work plans are divided into quarters and operational funds are released quarterly. Data were available for the financial year 2017/2018 because this was the year that money was first released to carry out extension services in the district ever since the creation of the new public extension system. In addition, data was available beginning quarter two because the first tranche of money was released beginning the second quarter.

In addition, on the factors associated with the performance of the extension managers, statistics as of November 2018 were obtained from secondary data sources. The data included the individual characteristics of the extension managers and the district characteristics in which

they operate. The district characteristics were mainly obtained from the Uganda Bureau of Statistics. These were extracted from the National Population and Housing Census 2014 reports. The data included; total population, land area, population density, and literacy status for people of 18 years and above, total number of households, number of sub-counties and regions. Other district characteristics were obtained from other sources. Voter turn-out for the most recent presidential election is from the Electoral Commission (Electoral Commission 2016). Distance on roads from the district to the capital city and distance to the nearest regional capital town were from Google Maps. The number of farmer organisations per district was obtained from MAAIF (2017). The year in which the district was created (district age) and data on the individual characteristics of extension managers (year of appointment, and year of birth) were obtained from internal MAAIF data sources.

4.3.3 Data analysis

Descriptive statistics and econometric methods were used for the data analysis. Objective one of analysing the performance of the agricultural extension managers was addressed using descriptive statistics including percentages and means. Objective two of determining the factors influencing the performance of the agricultural extension managers was analyzed using econometric models.

4.3.3.1 Data analysis for factors influencing performance in regards to staffing

Data on staffing captured the approved number of staff for recruitment, the current number of staff recruited and the staffing gap. This data was used to compute responsiveness to staffing, as shown in equation (1).

$$Responsiveness\ to\ staffing = \frac{Number\ of\ staff\ recruited}{Approved\ number\ of\ staff} \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Although continuous, the resultant dependent variable is a proportion, taking values between zero and one. Hence, handling of data with such a distribution requires consideration of its bounded nature (Baum, 2008). The use of linear regression models for fractional responses can violate assumptions of the linear models such as normality, linearity, and values predicted can be outside the interval range (Chen *et al.*, 2017). To properly deal with fractional response variables, a functional form of the response variable that imposes a [0 1] constraint on the conditional mean of the dependent variable is used (Ramalho *et al.*, 2011). Papke and

Wooldridge (1996) proposed any cumulative distribution function that constraints the conditional mean of the dependent variable into the [0 1]. Since, in this study, the values of staffing ratio are greater than zero and less than or equal to one, a fractional logit model was adapted to estimate determinants of responsiveness to staffing. The fractional response model can be specified as shown in equation (2).

$$E(y_i|x_i) = G(x_i\beta) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where, $G(.)$, is a known function satisfying $0 \leq G(.) \leq 1$ to ensure that the predicted values of y lie in the (0 1) interval (Papke and Wooldridge, 1996). The empirical model estimated for the determinants of response to staffing was specified as shown in equation (3).

$$E(y_i|x_i) = \beta_0 + \beta_1 Age + \beta_2 Expnce + \beta_3 Regn + \beta_4 Horgans + \beta_5 Grant + \beta_6 Subc + \beta_7 Voter + \beta_8 Disage + \beta_9 ZARDI + \beta_{10} Dist + \varepsilon_i \ldots\ldots\ldots. (3)$$

Where,$E(y_i|x_i)$, is the expected value of responsiveness to staffing conditional on explanatory variables. βs, are the parameters to be estimated. A description of the explanatory variables for responsiveness to staffing and their expected signs are as shown in Table 9.

Table 9: Description of variables used to determine factors influencing performance in regards to staffing

Variable	Description of the variable	Expected sign
Dependent variable: y_i, is the ratio of staff recruited to approved staff		
Age	Age of the extension manager(years)	+/-
Regn	Regional variable (1=Central, 2=Eastern, 3=Northern and 4=Western)	+/-
Horgans	Number of higher-level farmer organizations in the district	+
Grant	Amount of extension grant received by the district (UGX)	+
Subc	Number of sub-counties in the district	-
Voter	Voter-turn up in the 2016 presidential elections (%)	+
Disage	Age of the district (years)	+/-
ZARDI	District hosts a Zonal Agricultural Research and Development Institute - ZARDI (1=Yes)	+
Dist	Distance from the district to the regional capital (Km)	-

4.3.3.2 Data analysis for factors influencing performance in regards to planning

As noted under data collection, starting financial year 2017/18, districts were allocated an extension grant and requested by MAAIF to submit their annual work plans. The extension managers were given a time frame to submit their annual work plans. In the data, some

submitted within the required time frame, some submitted after the deadline and others never submitted. These three categories formed a basis for assigning performance scores for responsiveness to planning. Extension managers that submitted within the required time were assigned a score of two, those who submitted passed the deadline were given a score of one and those that never submitted scored zero.

Data exploration showed a somewhat evenly distributed number of responses for all three categories. As such, an ordered dependent variable was constructed. Ordered models (probit/logit) are used when the dependent variable has more than two categorical dependent variables and the values of each category have meaningful sequential order (Greene & Hensher, 2010). The ordered response model can be expressed as shown in equation (4).

$$y^* = \beta_1 x_1 + \cdots \ldots \beta_k x_k + \varepsilon \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (4)$$

Where $x_1 .. x_k$ are independent variables,$\beta_1 .. \beta_k$ are regression coefficients,ε is the error term $and y^*$, is a latent variable. $y^*$is not observed but the choices are observed according to the equations below;

$$y = 0 \ \ if \ \ y^* \leq \alpha_1$$
$$y = 1 \ \ if \ \alpha_1 < y^* \leq \alpha_2$$
$$y = 2 \ \ if \ \alpha_2 < y^*$$

Where,α_s, are cut off points such that: $\alpha_1 < \alpha_2$.

The empirical model estimated for determinants of response to planning was an ordered logit model and is shown in equation (5).

$$P(y_i = i|X) = \beta_0 + \beta_1 Age + \beta_2 Regn + \beta_3 Grant + \beta_4 Disage + \beta_5 DistC + \beta_6 Extratio + \varepsilon_i \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots .. (5)$$

Where,$P(y_i = i|X)$, is the probability of response to category i. $i = 0$ (never submitted work plan), $i = 1$ (submitted but not on time) and, $i = 2$ (submitted on time). Description of the explanatory variables used to explain responsiveness to planning and their expected signs are shown in Table 10.

Table 10: Description of variables used to determine factors influencing performance in regards to planning

Variable	Description of the variable	Expected sign
Dependent variable: $y_i = 0,1,2$. $i = 0$, never submitted work plan, $i = 1$, submitted but not on time and, $i = 2$, submitted on time.		
Age	Age of the extension manager	+/-
Regn	Regional variable (1=Central, 2=Eastern, 3=Northern and 4=Western)	+/-
Grant	Amount of extension grant received by the district (UGX)	+
Disage	Age of the district (years)	+
DistC	Distance from the district to the capital city (Km)	-
Extratio	Ratio: Number of extension workers divided by the number of households in the district	+

4.3.3.3 Data analysis for factors influencing performance in regards to reporting

It can be noted that reports are submitted quarterly, and therefore the extension managers are expected to submit four quarterly reports annually. However, data was only available for three quarters and therefore, the analysis was based on the three quarters. For each quarter, there were extension managers who submitted reports within the required time, those who submitted after the deadline and another category that never submitted any quarterly report. Using the time of submission and whether the managers submitted a report or not, performance scores were assigned. For each quarter, a score of two was assigned to the extension managers who submitted in the required time, one to who submitted passed the deadline and zero to who did not submit. Therefore, for the three quarters, managers that submitted all the three reports within the required time got a maximum score of six, whereas those who never submitted any quarterly report scored a zero.

Exploring the performance using descriptive statistics showed that 41.44% did not submit any report in any quarterly report and the rest submitted at least a quarterly report. As a result, a binary dependent variable composed of managers that never submitted any report versus those that submitted at least one report was developed. The Probit and logit models are best suited to analyze such binary dependent variables (Hoetker, 2007; Cameron and Trivedi, 2009). Binary response models can be specified as shown in equation (6) (Wooldridge, 2013).

$$P(y_i = 1|X) = G(\beta_0 + \beta_1 x_1 + \cdots \ldots \ldots + \beta_k x_k)$$
$$= G(\beta_0 + x\beta) \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (6)$$

Where, y is the binary response variable, X, is a set of explanatory variables, $G$is a function taking on values strictly zero and one (Wooldridge, 2013). In the logit model, G is the logistic function whereas, in the probit model, G is the standard normal cumulative distribution function. To estimate the determinants of performance regarding reporting, a logit model was used. The empirical model that was estimated is shown in equation (7).

$$P(y_i = 1|X) = \beta_0 + \beta_1 Age + \beta_2 Expnce + \beta_3 Regn + \beta_4 Horgans + \beta_5 Sgap + \beta_6 HHDs + \beta_7 Grant + \beta_8 Subc + +\beta_9 Voter + \beta_{10} Disage + \beta_{11} ZARDI + \beta_{12} DistC + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where, $P(y_i = 1)$ is the probability that the manager submitted a report in at least one quarter. βs, are the parameters to be estimated. Description of the explanatory variables for responsiveness to reporting and their expected signs are shown in Table 11.

Table 11: Description of variables used to determine factors influencing performance in regards to reporting

Variable	Description of the variable	Expected sign
Dependent variable: $y_i = 1$ if a manager submitted at least one report during the three quarters		
Age	Age of the district extension manager	+/-
Regn	Regional variable (1=Central, 2=Eastern, 3=Northern and 4=Western)	+/-
Horgans	Number of higher-level farmer organizations in the district	+
HHDs	Number of households in the district	-
Grant	Amount of extension grant received by the district (UGX)	+
Subc	Number of sub-counties in the district	-
Voter	Voter-turn up in the 2016 presidential elections (%)	+
ZARDI	A district hosts a Zonal Agricultural Research and Development Institute- ZARDI (1=Yes)	+
Literacy	Literacy percentage of the district	+

4.3.3.4 Data analysis for factors influencing the aggregated performance from all indicators

To obtain aggregated performance, a score was generated from a summation of scores accumulated from the three indicators, as shown in equation (8).

$$Aggregated\ score = staffing\ ratio + responsiveness\ to\ planning\ score + responsivness\ to\ reporting\ score \ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Hence, a maximum score of 9 could be obtained (maximum of 1 from the staffing ratio + maximum of 2 from responsiveness to planning + maximum of 6 from responsiveness to reporting).

In order to generate the dependent variable for the aggregated performance model, the aggregated score was divided by the expected maximum score, as shown in equation (9).

$$Aggregated\ performance = \frac{Aggregated\ \ score}{Maximum\ obtainable\ score} \dots \dots \dots \dots \dots \dots (9).$$

Using equation (9), a dependent variable was generated for aggregated performance. Since the dependent variable is a fraction with values between zero and one, a fraction logit model was adapted to estimate determinants of aggregated performance. Fractional regression models are used when the dependent variable is greater than or equal to 0 and less than or equal to 1 (Papke and Wooldridge, 1996). The fractional response model can be specified, as shown in equation (10).

$$E(y_i|x_i) = G(x_i\beta) \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (10)$$

Where, $G(.)$, is a known function satisfying $0 \leq G(.) \leq 1$ to ensure that the predicted values of y lie in the (0 1) interval (Papke and Wooldridge, 1996). The empirical model estimated for the factors influencing the aggregated performance of the extension managers is specified as shown in equation (11).

$$\begin{aligned} E(y_i|x_i) = \beta_0 + \beta_1 Age + \beta_2 Regn + \beta_3 Horgans + \beta_4 Grant + \beta_5 Subc + \beta_6 Voter \\ + \beta_7 Disage + \beta_9 ZARDI + \beta_7 Extratio + \beta_8 Litracy + \beta_{10} Dist \\ + \varepsilon_i \dots \dots \dots . (11) \end{aligned}$$

Where,$E(y_i|x_i)$ is the expected value of aggregated performance conditional on explanatory variables. βs are the parameters to be estimated. A description of the explanatory variables used to explain aggregated performance and their expected signs are as shown in Table 12.

Table 12: Description of variables used to determine factors influencing aggregated performance

Variable	Description of the variable	Expected sign
Dependent variable: y_i is the aggregated performance		
Age	Age of the district extension manager (years)	+/-
Regn	Regional variable (1=Central, 2=Eastern, 3=Northern and 4=Western)	+/-
Horgans	Number of higher-level farmer organizations in the district	+
Grant	Amount of extension grant received by the district (UGX)	+
Voter	Voter-turn up in the 2016 presidential elections (%)	+
Disage	Age of the district (years)	+/-
Extratio	Ratio: Number of extension workers divided by the number of households in the district	+
Literacy	Literacy percentage of the district	+
Subc	Number of sub-counties in the district	-
ZARDI	A district hosts a Zonal Agricultural Research and Development Institute- ZARDI (1=Yes)	+
DistC	Distance from the district to the capital city (Km)	-

4.4 Results

This section presents the results of the performance of agricultural extension managers and the factors influencing it.

4.4.1 Performance of the extension managers

This subsection presents descriptive statistics of the performance of the agricultural extension managers under each of the indicators, as well as the aggregated performance. As already noted, performance regarding staffing was based on the number of agricultural production staff recruited in the districts. The extension managers were asked to fill-up the required staff positions and the percentage of the filled positions was used as a performance indicator. The results indicated a minimum level of 15%, a maximum of 100%, a median of 55% and that on average 56% of the positions were staffed.

The performance indicator for planning was based on the submission of the annual work plans by the extension managers; whether the manager submitted annual work plans and whether the submission was in the required time. As shown in table 13, only 16% of the managers submitted the annual work plan within the recommended time and about 41% never submitted.

Table 13: Performance of extension managers in regards to planning

Performance category	Frequency	Percentage
Never submitted	45	40.54
Submitted but not on time	48	43.24
Submitted within the required time	18	16.22

The performance in regards to reporting was based on the submission of three quarterly reports. Performance scores were assigned depending on whether the manager submitted reports and whether the submission was within the required time. As shown in Table 14, the results indicated that more than 41% of the extension managers never submitted any quarterly report, and less than 1% submitted all the three quarterly reports on time.

Table 14: Performance of extension managers in regards to reporting

The score for responsiveness to reporting	Frequency	Percentage
0	46	41.44
1	22	19.82
2	20	18.02
3	17	15.32
4	4	3.6
5	1	0.9
6	1	0.9

The aggregated performance was based on scores aggregated from the three indicators. The results indicated a minimum aggregated performance of 2.78%, a maximum of 96.7%, a median of 27.77% and an average of 28.78%.

4.4.2 Factors influencing the performance of agricultural extension managers

This subsection presents the results of the factors influencing the performance of the extension managers across the different indicators as well as the aggregated performance.

4.4.2.1 Factors influencing performance in regards to staffing

Results in Table 15 of the fractional logit model show that the performance of extension managers in regards to staffing is positively influenced by; the number of higher-level farmer organizations in the district and distance from the district to the regional capital, and negatively by voter turn-up. When the number of higher-level farmer organizations increases by a unit, the staffing ratio increases by 0.7%. An increase in distance from the district to the regional capital by 1 km increases staffing ratio by 0.1%. On the other hand, a 1% increase in voter turn-up reduces the staffing rate by 0.8%.

Table 15: Fractional logit model results for determinants of performance regarding staffing

Independent variables	Marginal effects	Standard errors	P-value
Age of district extension manager (years)	-0.004	0.004	0.331
Eastern region vs. Central	-0.052	0.059	0.385
Northern region vs. Central	0.051	0.053	0.332
Western region vs. Central	-0.013	0.058	0.819
Number of higher-level organizations in the district	0.007**	0.003	0.023
Amount of extension grant received (UGX)	0.022	0.051	0.664
Number of sub-counties in the district	0.000	0.008	0.984
Voter-turn up in the 2016 presidential elections (%)	-0.008**	0.004	0.030
Age of the district (years)	0.002	0.002	0.385
District hosts a ZARDI (1=Yes)	-0.027	0.051	0.597
Distance from the district to the regional capital (Km)	0.001*	0.000	0.085
Number of observations	111		
Prob > chi2	0.0113		
Log pseudo-likelihood	-74.700		
Pseudo R2	0.0177		

** and * represent 5% and 10% significance level, respectively.

4.4.2.2 Factors influencing performance in regards to planning

Results in Table 16 indicate that the age of the manager significantly influences performance in planning. An increase in the age of the extension manager by one year reduces the probability of poor performance by 1.9% and increases the probability of good performance by 1.1%. An increase in the age of the district by one year increases the probability of poor performance by 0.7% but reduces the probability of fair and good performance by 0.3% and 0.4%, respectively. Increasing the amount of extension grant by 1 unit significantly increases the probability of good performance by 7.2% and reduces the probability of poor performance by 11.6%.

Table 16: Ordered logit model results for determinants of performance regarding planning

Independent variable	Poor performance Marginal effects	SE	Fair performance Marginal effects	SE	Good performance Marginal effects	SE
Age of manager	-0.019**	0.008	0.007**	0.004	0.011**	0.005
District age (years)	0.007**	0.003	-0.003*	0.001	-0.004*	0.002
Distance to capital city (km)	0.001	0.001	0.000	0.000	0.000	0.000
Extension grant (UGX)	-0.116**	0.056	0.044*	0.025	0.072*	0.036
Extension worker to Household ratio	0.007	0.018	-0.003	0.007	-0.004	0.011
Eastern vs. Central	-0.052	0.138	0.022	0.062	0.030	0.077
Northern vs. Central	-0.170	0.185	0.047	0.059	0.123	0.134
Western vs. Central	0.068	0.181	-0.036	0.094	-0.032	0.088
Number of observations	111					
Prob>Chi2	0.096					
Pseudo R2	0 .058					

** and * represent 5% and 10% significance level, respectively.

4.4.2.3 Factors influencing performance in regards to reporting

Table 17 shows the results for the determinants of performance regarding reporting. It can be seen that three variables (amount of extension grant received, number of higher-level farmer organizations and a district that hosts a Zonal Agricultural Research Institute- ZARDI) positively and significantly influence performance in terms of reporting. On the contrary, four variables (number of households in the district, number of sub-counties in a district, voter turn-up and literacy percentage) negatively and significantly influence performance regarding reporting.

A unit increase in the amount of extension grant received by the district significantly increases the probability of submitting at least a quarterly report by 35.4%. Districts that host ZARDIs are 35.9% more likely to submit a quarterly report to MAAIF compared to districts that do not host ZARDIs. An increase in the number of higher-level farmer organizations in the district by a unit increases the probability of reporting by 1.5 %. A one-unit increase in the number of households in the district decreases the probability of reporting by 0.1%. An increase in the number of sub-counties in the district by one reduces the likelihood of reporting by 3.9%. An

increase in voter turn-up by 1 percent reduces the probability of reporting by 2 %. An increase in voter Literacy percentage by 1 percent reduces the likelihood of reporting by 0.7 %.

Table 17: Logit model results for determinants of performance in regards to reporting

Independent variables	Marginal effects	Standard errors	P-value
Age of extension manager (years)	-0.014	0.009	0.119
Eastern region vs. Central	0.041	0.149	0.783
Northern region vs. Central	-0.047	0.151	0.755
Western region vs. Central	0.018	0.141	0.901
Number of higher-level organizations	0.015*	0.009	0.098
Number of households in the district	-0.001**	0.001	0.013
Extension grant received (UGX)	0.354**	0.132	0.008
Number of subcounties	-0.039*	0.020	0.052
Voter turn up in 2016 presidential elections (%)	-0.020**	0.009	0.030
District hosts a ZARDI (1=Yes)	0.359*	0.185	0.053
Literacy percentage	-0.007*	0.004	0.091
Number of observations	111		
Prob > chi2	0.0447		
Pseudo R2	0.1331		
log likelihood	-65.280		

** and * represent 5% and 10% significance level, respectively.

4.2.4.4 Factors influencing the aggregated performance of the extension managers

The results of the model for the aggregated performance of the extension managers are shown in table 18. The results indicate that the aggregated performance of the extension managers is influenced by the ratio of extension workers to households in the district and the amount extension grant received by the district. A one percent increase in the ratio of extension workers to households in the district significantly increases the aggregated performance of the extension managers by 55.6%. An increase in the amount of extension grant to the district by one unit increases the aggregated performance of extension managers by 9.4%.

Table 18: Fractional logit model results for factors influencing aggregated performance

Independent variable	Marginal effects	Standard errors	P-value
Age of the district extension manager (years)	0.000	0.004	0.940
Age of the district (years)	-0.001	0.002	0.493
Amount of extension grant received by district (UGX)	0.094**	0.043	0.030
The ratio of extension workers to households in the district	0.556**	0.253	0.028
Number of higher-level organizations in the district	-0.003	0.004	0.423
Eastern region vs. Central	0.060	0.068	0.376
Northern region vs. Central	0.006	0.082	0.943
Western region vs. Central	0.030	0.068	0.651
Number of subcounties	-0.009	0.007	0.180
Voter-turn up in the 2016 presidential elections (%)	-0.005	0.003	0.171
Literacy percentage of the district	-0.002	0.001	0.206
District hosts a ZARDI (1=Yes)	0.019	0.055	0.732
Distance to capital city (Km)	0.000	0.000	0.784
Number of observations	111		
Prob > chi2	0.0000		
Pseudo R2	0.0145		
log likelihood	-65.655		

** represents a 5% significance level.

4.5 Discussion

This section presents the discussion of results for the study.

4.5.1 Performance of the extension managers

This subsection discusses the performance of the extension managers for the different indicators and aggregated performance.

4.5.1.1 Performance of extension managers in regards to staffing

Organizations employ staff to help them achieve their strategic objectives (Olum, 2004). Hence, most districts having a staffing gap approximately half of the required staff implies that most managers do not have adequate staff to effectively deliver extension services. The insufficient number of staff in an organization leads to increased workload leading to poor performance (McHugh & Chenjuan Ma, 2014). Studies by Olatunji *et al.* (2015) and Nwanade *et al.* (2017) have reported inadequate staffing of agricultural extension agents as a major constraint to the effective delivery of agricultural extension services.

4.5.1.2 Performance of extension managers in regards to planning

Planning is the key function of a manager and is usually where the direction of the organization is established (Swanson *et al.,* 1998, Schraeder *et al.*, 2014). As noted by Elbanna *et al.* (2015), the effort of a public service manager to plan is important for the successful implementation of the organizational strategy. Hence, planning by the extension managers can significantly contribute to the achievement of MAAIF objectives. Consequently, if only 16% of the extension managers submitted the annual work plans within the required time and about 41% never submitted, MAAIF may have challenges to achieve its strategic extension objectives.

4.5.1.3 Performance of extension managers in regards to reporting

A good manager should be able to keep those who are responsible informed on what is going on in the organization (Swanson *et al.,* 1998). With less than 1% of the extension managers submitting all the quarterly reports on time and almost half of them not submitting any report, it makes it hard for the ministry to track which activities have been implemented and to measure the progress on the planned targets.

4.5.1.4 Aggregated performance of extension managers

The results indicate that extension managers' aggregated performance based on the three indicators was low compared to the expected, with an average performance of 28.78%. This could be attributed to the fact that the data available was for the first financial year for which a new reform (single spine) was operationalized. It was in this first year of the reform that the districts started to recruit extension staff, and this could explain the staffing gaps. It is also in this year that the districts received the first tranche of the agricultural extension grant under the new reform thereby necessitating them to submit work plans and reports. This could explain the low response across all domains and therefore low aggregated performance, which is a summation from all domains. According to Rivera & Alex (2004), new approaches usually take time to become fully institutionalized as they may require new capacities. The authors further state that the reform of extension services essentially demands capacity building particularly in management and establishment of national and local government work plans and budgets in line with the new extension policies and strategies.

4.5.2 Factors influencing the performance of the extension managers

This subsection discusses the results of the determinants of performance of the extension managers for the different indicators and aggregated performance.

4.5.2.1 Factors influencing performance in regards to staffing

The positive relationship between the number of higher-level agricultural organizations and performance in regards to staffing implies that extension managers from districts with more higher-level agricultural organizations are likely to fill-up all their staff positions. As noted by Birner *et al.*, (2009), communities that support collective action like the formation of farmer groups and higher-level farmer organizations usually have higher bargaining power and capacity to demand extension services. This could compel the extension managers together with the district service commission to respond to their request by recruiting sufficient staff. This result is consistent with Andrews & Brewer (2014), who also, through statistical analysis found a positive relationship between social capital and performance.

The positive influence of distance from the district to the regional capital on the staffing ratio was unexpected. Instead, a negative influence was expected since being near the regional capital improves access to infrastructure services like transport and communication, creating a favourable environment to attract extension officers. The probable explanation for this unexpected result is that the further away the district is from the regional capital, the more the importance attached to agriculture. Hence, the demand to recruit staff.

Another unexpected result is the negative influence of voter turn-up on response to staffing. It would be expected that higher voter turn-up is associated with a high demand for accountability by the citizens (Akramov *et al.*, 2008). However, the results exhibited the reverse. The negative influence of higher voter turn-up could have been triggered by vote-buying, which is reported to be a common practice in Uganda (Commonwealth Observer Group, 2011; Blattman *et al.*, 2019). Vote-buying tends to undermine accountability and the delivery of public services (Robinson and Verdier, 2013; Khemani, 2015).

4.5.2.2 Factors influencing performance in regards to planning

Performance of extension managers in regards to planning is positively influenced by the age of the extension manager and the amount of extension grant received by the district, and

negatively by the age of the district. The findings imply that older extension managers are likely to perform better than the younger ones in regards to planning. This is likely because older age is associated with more different past experiences in regards to management. Experience creates exposure and develops knowledge and skills, which in turn, enhances performance (Kolz, 1998). The older managers could hence have more experience in the preparation and submission of works plans. The results are consistent with the findings of Shaffril & Uli (2010), Sikul *et al.* (2015) and Ifenkwe (2012), who also found a positive relationship between age and performance. However, Saleem & Imran (2014) found the contrary.

The positive relationship between the amount of extension grant received and the performance of the extension managers is likely because higher extension grant motivates extension managers to plan and submit their work plans on time. Indeed Bitzer, (2016) notes that the operational funds available can influence the agricultural extension officers' capacity, morale as well as the motivation for high performance.

The negative correlation between district age and performance in regards to planning was unexpected as older districts were expected to have more experience in regards to the submission of work-plans for the government programs. The probable reason for the unexpected finding could be that the newer districts could have tried to prepare and submit their work plans on time such that they could conduct their activities on time, and this would help them to catch up with the older districts.

4.5.2.3 Factors influencing performance in regards to reporting

The positive effect of the amount of extension grant received by the district on the likelihood of reporting suggests that the grant is a motivating factor for the extension managers to report on time. Indeed Bitzer, (2016) agrees that the operational funds available can influence the agricultural extension officers' capacity, morale as well as the motivation for high performance. One of the challenges that cause inefficiency in the delivery of extension services is an inadequate flow of funds, which is likely to hinder the extension manager to work and thereafter report in time (Barungi *et al.*, 2016).

The positive influence of hosting a ZARDI on the probability of reporting can be attributed to the stronger research extension collaborations in ZARDI hosting districts that support field activities and lead to faster reporting. As noted by Van Crowder & Anderson (1997) and

Aflakpui (2007), strong linkages between research and extension improve the performance of agricultural technology transfer systems while weak linkages cause setbacks.

The positive influence of the number of higher-level agricultural organizations on the likelihood of reporting is probably because higher-level organizations tend to increase the demand for accountability. This increases the likelihood of conducting and reporting activities. In line with this finding, Birner *et al.* (2009) noted that communities that support collective action, such as the formation of higher farmer organizations tend to have a higher capacity to demand extension services.

A higher number of households in the district is associated with a lower possibility of submitting reports by the extension managers, likely because the more the number of households in the district, the more staff time is demanded for field activities instead of time for writing reports. This is especially because regardless of the number of households in the sub-county, the extension structure is designed to accommodate the same number of extension officers in each sub-county. Studies by Olatunji *et al.* (2015) and Nwanade *et al.* (2017) reported the ratio of agricultural extension agents to farm families to influence the delivery of agricultural extension services. Lower extension agent to farmer-ratios is associated with high workloads, thereby reducing the effectiveness in the execution of duties. This may have a negative effect on the performance of the district managers leading to lower reporting rates.

District extension managers from districts with more numbers of sub-counties are associated with a lower possibility of reporting, probably because they coordinate more extension staffs that come with more sub-counties. Since they coordinate more extension staff, it may be hard for them to compile and submit reports. Indeed Amah *et al.* (2013) argue that small organizations may be easier to manage since managers can easily control most things, but large settings may call for more complex control mechanisms.

Voter turn-up is a key aspect of ensuring government accountability (Akramov *et al.*, 2008). It was therefore expected that managers in districts with a higher voter turn up would ensure that they conduct and report activities for visibility. However, the findings showed a negative relationship, which could have been triggered by vote-buying (Commonwealth Observer Group, 2011; Blattman *et al.*, 2019). Vote-buying tends to undermine accountability and the delivery of public services (Robinson and Verdier, 2013; Khemani, 2015).

A higher literacy percentage in the district is associated with a lower likelihood of reporting, likely because districts with higher literacy percentage are more engaged in off-farm rather than on-farm activities, thereby directing efforts to other sectors outside agriculture. The extension managers are, therefore likely to have less pressure to report as compared to the districts with lower literacy rates. Contrary to this finding, Birner *et al.* (2009) state that communities with high literacy levels tend to have a comparative advantage as they tend to have a higher capacity to demand extension services, and therefore, managers are expected to perform better.

4.5.2.4 Factors influencing the aggregated performance of the extension managers

The results imply that the aggregated performance of the extension managers is positively influenced by the ratio of extension workers to households in the district and the amount of extension grant received by the district.

A higher extension worker to household ratio lowers the workload to extension workers, which in turn positively influences the performance of the managers. This is because the manager works with more extension staff for the same number of households. This finding is in line with studies by Olatunji *et al.* (2015) and Nwanade *et al.* (2017), who reported that inadequate ratio of agricultural extension workers to farm families is a major constraint to the effective delivery of agricultural extension services.

The positive relationship between extension grant and aggregated performance is likely because the extension grant is important for facilitating the smooth running of extension activities. Limited funding hinders the recruitment of adequate number of staff and leads to poor facilitation of extension service delivery (Barungi *et al.*, 2016).

4.6 Conclusion

Results indicate that the majority of the extension managers were not able to meet the requirements of the MAAIF in regard to the indicators. However, since the indicators used in the study were based on data for the first financial year for which a new reform was made, one important step is to monitor these indicators over time. This will show if there is an improvement as the reform becomes fully institutionalized. Nonetheless, central management can improve the performance of the extension managers through capacity building, particularly in management, in line with the new extension reform policies and strategies. In addition,

central management needs to set-up a strict performance monitoring system to ensure that managers perform their functions as expected. The factors that influence performance provide insights into why the performance of some managers is better than others. Hence, targeted interventions that address the key factors influencing the performance are also recommended. For example, the positive relationship between the amount of extension grant to the district and the performance of the extension managers implies that the government should prioritise funding of extension services. This is likely to motivate and facilitate the extension managers to perform their work more effectively. Interventions to increase the ratio of extension workers to households are also recommended, based on the positive influence of the ratio of extension workers to households and the performance of district managers.

A major contribution of this study is that it measures the performance of the agricultural extension managers, which is barely done in the current literature. The study reveals that measuring the performance of the extension managers using these indicators is an important step because it is not only feasible but also provides insights on important aspects of performance. The fact that the extension managers were not able to meet the requirements in regards to these indicators shows how important it is to capture and track performance in this regard. As such, the study shows that similar indicators could also be useful in measuring the performance of managers in other public sectors which also have decentralised managers, such as education and health.

However, since this study does not capture all the dimensions of performance, further studies into other dimensions of performance would be worthwhile. Future qualitative studies would be needed to understand the quality of the work by the managers. For example, the quality of work plans and reports. Such studies will show if the submitted work plans and reports match the district priorities and how effective the managers are in implementing the work-plans in the field. Further studies would also be needed to assess the correlation between the dimensions of performance captured by the indicators in this study and other important dimensions recommended for further research, such as quality of work. This is because the dimensions captured by the indicators in this study are relatively easier to capture and measure. Hence, if found correlated, they could be good proxies for overall performance.

5 DISCUSSION AND CONCLUSIONS

This thesis was motivated by the need to strengthen accountability in the public agricultural extension services in developing countries. This was against the background that a well-managed and accountable agricultural extension service delivery system is one of the primary drivers of agricultural production. However, for the majority of the developing countries, establishing an accountable system remains a challenge. The public agricultural extension system, in particular, is highly criticized for the weak accountability of the field agents to both their supervisors (upward accountability) and beneficiaries (downward accountability). Public systems often deploy large numbers of field agents in geographically dispersed, remote areas, which makes supervision difficult. Typically, there is also a lack of resources and of robust mechanisms to enable both the supervisors and beneficiaries to adequately follow up the activities of the field agents and provide feedback, which contributes to problems of absenteeism of field staff. Due to resource constraints, central managers also face challenges to supervise the agricultural extension managers, who are the supervisors of the field agents.

Against this background, a diary for agricultural field agents was developed and assessed for its potential to strengthen accountability in the public agricultural extension services taking a case of Uganda. The diary for agricultural field agents, which was designed both in the paper (p-diary) and electronic (e-diary) formats, enabled field agents to report their daily activities, supervisors to follow up on the field agents' reported activities, and beneficiaries to verify and provide feedback on the reported activities. In addition to assessing the potential of the diary for agricultural field agents, the performance of the agricultural extension managers was analysed and the factors that influence it were determined.

Accordingly, this chapter presents a summary of the main findings. It further discusses the contribution of these findings to the literature, outlines the limitations of the study and future research areas, and highlights the opportunities for further development of the diary, the recommendations for policy as well as the conclusion.

5.1 Summary of the main findings

This subsection summarizes the key findings under each chapter.

In chapters 2 and 3, a tool for strengthening accountability in public systems: a Diary for Agricultural Field Agents was developed in both the paper (p-diary) and electronic (e-diary) versions. The diary was assessed for the potential to strengthen accountability in the public agricultural extension services. A qualitative participatory research approach using a combination of focus group discussions and individual face-to-face interviews was employed to collect data, and the content analysis method was applied.

The results revealed potential opportunities of using the diary in fostering accountability in the public agricultural extension services. The opportunities included; improved planning, reporting, monitoring and evaluation, reduction in absenteeism and integrated beneficiary feedback. The findings further revealed that the electronic version of the diary was more effective for strengthening accountability compared to the paper version. This was mainly due to its Global Positioning System (GPS), which tracked the actual geographical location for which a particular data entry was made. This minimised forgery, thereby increasing compliance to the e-diary as compared to the paper diary. The electronic diary was also reported to facilitate remote supervision which not only makes supervision more convenient but also reduces the time and costs of travel associated with the physical supervision of the field agents. The electronic version was also reported to be faster in regards to reporting of extension activities. Unlike the p-diary, where reporting was done every month, the e-diary generated reports in real-time. Thus, enabling the supervisors to monitor and verify the extension activities on a more frequent basis. However, the results also revealed that some of the users were apprehensive about the e-diary because it required ICT skills. The e-diary was also criticized for being limited by inaccessibility to electricity, given that it operated on mobile phones which required charging. Moreover, most of the field activities are conducted in the rural areas were inaccessibility to electricity is common. Furthermore, it was also reported to be susceptible to unreliable mobile network connectivity although this was addressed by introducing an offline component at the point of recording daily activities. The results also revealed that open recognition of the field agents that reported the daily activities more consistently alongside open querying of those who were inconsistent or not reporting at all increased the rate of reporting. This implies that the implementation of the e-diary requires incentives.

In chapter 4, the performance and the factors influencing the performance of agricultural extension managers were analysed based on indicators established by the MAAIF. The indicators were based on the extension managers expected functions, and they included: responsiveness to staffing, responsiveness to planning and responsiveness to reporting. A quantitative research approach was employed and secondary data sources used. Data was analyzed using descriptive statistics and econometric methods.

The results found the agricultural extension managers' aggregated performance based on the three indicators lower than the expected. The results further revealed that the aggregated performance of the extension managers is associated with the ratio of extension workers to households in the district and the amount of extension grant received by the district. An increase in the ratio of extension workers to households in the district results in an increase in the aggregated performance of the extension managers. Similarly, increasing the amount of extension grant to the district increases the aggregated performance of extension managers.

5.2 Contribution of the study to the literature

This subsection discusses the contribution of the findings to the existing debates and knowledge gaps on the mechanisms for strengthening the accountability of public agricultural extension services and performance measurement in the agricultural extension services.

5.2.1 Potential of the diary for strengthening upward and downward accountability

Chapters 2 and 3 contribute to the literature on the mechanisms for strengthening accountability in the delivery of public services. In these chapters, an accountability tool; a diary for agricultural field agents was developed both in paper and electronic versions, and assessed for its potential to strengthen accountability in the public agricultural extension services. Studies assessing the use of diaries for strengthening accountability in the agricultural extension services are scarce in the existing literature and therefore, this is a major contribution of this thesis. The current literature on the use of diaries in agriculture has focused mainly on capturing agricultural production statistics (Deininger *et al.*, 2012) and analysing time and labour allocation among farming households (Apis *et al.*, 2013; Daum *et al.*, 2018). Only a few agricultural extension systems have documented examples of diaries for agricultural field agents (MACO, 2011; MAIWD, 2016). Moreover, studies assessing their potential to strengthen accountability in the public agricultural extension services are rare. Furthermore, the literature also shows that the existing diaries for agricultural field agents are in paper form.

However, technological advancements have enabled the application of electronic versions of diaries in other fields (Stone *et al.*, 2003; Jamison, 2001; Hufford *et al.*, 2002; Bolger *et al.*, 2003; Quinn *et al.*, 2003; Palermo *et al.*, 2004; Nyholm *et al.*, 2004; Green *et al.*, 2006; Sife *et al.*, 2007; Lane *et al.*, 2006; Dale & Hagen, 2007 & O'Connor *et al.*, 2016). Thus, the findings in these chapters uniquely contribute by highlighting the potential of both paper and electronic diaries in strengthening accountability in the public agricultural extension services.

The results revealed that the diary for agricultural field agents has the potential to strengthen both upward and downward accountability. The diary was reported to strengthen upward accountability through its precise structure, which simplified planning, reporting, monitoring and evaluation, all of which resulted in easier supervision of extension activities. This finding corroborates previous studies that found that systematic supervision using a checklist of clearly defined indicators in a format that encouraged follow up led to increased accountability (Loevinsohn *et al.*, 1995; Taylor, 2007). The diary also captured the phone numbers of the visited beneficiaries, and this enabled the supervisors to verify the reported activities by making phone calls to the beneficiaries. Thus, making supervision easier and cheaper. This confirms earlier suggestions that mobile phones can be used to verify agents' visits thereby increasing the accountability of extension services (Aker, 2011; Aker *et al.*, 2016). The diary was also commended for its potential to reduce absenteeism given that the field agents are expected to record at least activity on each person-day and, therefore, answerable for days when no activity is recorded. In line with this finding, Duflo and Hanna (2005) found that daily monitoring of teacher attendance was effective in reducing absenteeism.

On the other hand, downward accountability can be achieved through the beneficiary feedback mechanism embedded within the diary. The beneficiary feedback mechanism was reported to create an opportunity for the beneficiaries to evaluate and provide feedback on the services received. This improves accountability to the beneficiaries since the field agents put into account the needs of the beneficiaries while delivering services. Bitzer (2016) also agrees that establishing feedback systems between field agents and beneficiaries creates incentives to focus on the priorities and needs of the beneficiaries.

The results also revealed that the electronic version of the diary is more effective in strengthening accountability as compared to the paper version. The electronic diary has a higher level of compliance as compared to the paper diary since the entries cannot easily be forged. This is due to the Global Positioning System (GPS) technology embedded in the

electronic diary, which was reported to enable the tracking of the actual geographical location for which a particular extension activity was reported. This finding supports much of the existing literature which found electronic diaries to have a higher level of compliance than paper diaries (Straka *et al.*, 1997; Jamison, 2001; Hufford *et al.*, 2002; Stone *et al.*, 2003; Palermo *et al.*, 2004; Nyholm *et al.*, 2004 & Dale & Hagen, 2007). Contrary to this finding, Green *et al.* (2006) did not find significant differences in compliance between the two types of diaries.

The electronic diary was also reported to facilitate remote or distant supervision, which not only makes supervision more convenient but also reduces the time and costs of travel associated with the physical supervision of the field agents. Due to the GPS that provided evidence of the activities conducted, the supervisors did not have to supervise the field agents physically. They could just log into the system from any location and track the activities of the field agents conducted in different locations. Furthermore, the activity photo feature of the electronic diary was reported to provide additional evidence for the type of activity conducted as also reported by Duflo and Hanna (2005) and Henry *et al.* (2016).

The electronic diary was also reported to be faster in reporting and consequently, supervision. Unlike the paper diary, were reporting was done monthly, the electronic diary enabled real-time reporting of the daily activities by the field agents. Consequently, the supervisor could monitor and verify the extension activities at the end of each day rather than having to wait for the end of the month as is the case with the paper diary. This finding corroborates studies by Hufford *et al.* (2002); Quinn *et al.* (2003) and Lane *et al.* (2006) who found that data can be collected and analysed more quickly using electronic than paper diaries. As noted by Omisore (2014), daily reporting facilitates regular supervision which allows subordinates to receive immediate feedback, rather than waiting for monthly reviews.

However, the results also indicated that some of the users were initially apprehensive about the e-diary due to their limited experience with the use of smartphones. Consequently, training of the users before the implementation of the e-diary was useful for overcoming this phobia. This finding is in line with Daum *et al.* (2018), who also found it essential to train participants before implementing a data collection smartphone application in Zambia. The results further revealed that the implementation of the electronic diary could be constrained by inaccessibility to electricity since it operates on mobile phones, which require charging. This finding is in line with Tiplady *et al.* (1997) and Broderick (2008), who found the electronic diaries susceptible

to battery problems. It was also found that poor mobile network connectivity is a likely challenge for implementing electronic diaries, and therefore, it is important that the recording of field activities is done offline. Poor network connectivity has also been reported by Sife *et al.* (2007) and O'Connor *et al.* (2016) as a major impediment to operationalizing mobile phone technologies in developing countries.

It was also revealed that incentives motivate the field agents to use the electronic diary for reporting. The results showed that open recognition of the field agents that reported the daily activities more consistently along with open querying of those who were inconsistent or not reporting at all led to an increase in the rate of reporting. The incentive could be higher if the open recognition could be coupled with rewards for those reporting more consistently and sanctions for those not reporting. Such rewards could include; employee awards of recognition, promotion opportunities, career development, and financial benefits such as bonus payments (Bitzer, 2016; Armstrong, 2010). The expectancy theory suggests that staffs are likely to be motivated when they believe that their efforts will be rewarded (Vroom, 1964). This finding is in line with Duflo & Hanna (2005) and Cilliers *et al.* (2013) who found that coupling monitoring with incentives increased teacher's attendance.

5.2.2 Performance measurement in agricultural extension services

Chapter 4 contributes to the literature on performance measurement in the agricultural extension services. In this chapter, the performance of agricultural extension managers was empirically analysed and the factors influencing it were determined. This chapter complements the agricultural extension services performance literature that has mainly focused on the performance of either agricultural extension field agents or extension organisations (Khalil *et al.*, 2009; Ifenkwe, 2012; Okwoche & Asogwa, 2012; Ragasa *et al.*, 2016). The unique contribution of this chapter is that the performance of the managers of the agricultural field agents was measured, which is barely done in the current literature. In addition, the performance was measured based on unique indicators that have not been applied to any study measuring the performance of staff in agricultural extension services. These indicators were constructed based on the expected functions of the agricultural extension managers and they were; responsiveness to staffing, responsiveness to planning and responsiveness to reporting.

The results showed that the agricultural extension managers' aggregated performance from the three indicators did not meet the performance requirements. This was attributed to the fact

that the indicators used were constructed based on data for the first financial year for which a new reform was operationalized and therefore, managers needed new capacities in the new approaches under the reform. This finding supports the claim by Rivera & Alex (2004) that the reform of extension services essentially demands capacity building, especially in management and establishment of national and local government work plans and budgets in line with the new extension policies and strategies. The results also revealed that the amount of extension grant received by the district positively influences the performance of extension managers. This is mainly because the extension grant is important for facilitating the smooth running of extension activities. These findings support the argument that the financial resources available to agricultural extension are an important capacity variable for the performance of extension services (Birner *et al.*, 2009; Barungi *et al.*, 2016). It was further revealed that the performance of the agricultural extension managers is also positively influenced by the ratio of extension workers to households in the district. A higher extension to household ratio lowers the workload to extension workers, which in turn positively influences the performance of the managers. This finding is in line with past observations that inadequate ratio of agricultural extension agents to farm families is a major constraint to the effective delivery of agricultural extension services (Olatunji *et al.*, 2015; Nwanade *et al.*, 2017).

5.3 Limitations of the study and future research

Despite the major contributions, the study was also faced with limitations. In this subsection, the limitations of the study are presented and the areas for future research are highlighted. In Chapters 2 and 3, a diary for agricultural field agents was developed both in paper and electronic versions, and its potential for strengthening accountability in the public agricultural extension services was assessed. However, the assessment was conducted only in a few districts and for a few months. Furthermore, only a qualitative approach was employed for both the data collection and analysis. Future research may, therefore, consider to analyse the impact of the diaries in the whole country, over a longer period and using a mixed-methods approach. The specific areas of consideration could include analyzing the impact of the diary on; the efficiency of the services provided, the number of reductions in service delivery costs and the number of reductions in absenteeism. The diary was also limited in that, it focused more on whether or not the field agents conducted activities and less on the quality of the activities conducted. Thus, future studies could incoporate a mechanism that could enable the beneficiaries captured in the diary to rate the quality of services received.

In Chapter 4, the indicators used to measure performance did not capture all the dimensions of performance. The performance was measured based on the dimension of timeliness, which from a central management perspective is easier to generate and to measure. However, for comprehensive performance measurement, it would be essential to consider all the dimensions of performance including the quality of work done and feedback from the beneficiaries of the extension services. Thus, future studies would be needed to assess the quality of the work (work plans and reports) by the managers. Such studies would demonstrate whether the submitted work plans and reports match the district priorities and how effective the managers are in implementing the work plans in the field. Further studies may also be needed to assess the correlation between the dimensions of the performance captured by the indicators in this study and other important dimensions recommended for further research, such as quality of work. This is because the dimensions captured by the indicators in this study are relatively easier to capture and measure. Hence, if found correlated, they could be good proxies for overall performance.

5.4 Opportunities for further development of the e-diary

The findings revealed that the e-diary is more effective for strengthening accountability. In this section, therefore, the opportunities for further developing the e-diary beyond the function of accountability are presented. The opportunities are grouped into two; (i) Modifying the e-diary to accommodate other functions and (ii) Integrating the e-diary with other ICT tools that enable the field agent better deliver extension services.

5.4.1 Modification of the e-diary for other agricultural extension functions

In this regard, the e-diary can be modified with extra features useful in supporting service delivery. For example, a new command button of a stakeholder profile could be created under the area profile in the e-diary. This would enable the field agents to register important stakeholders in their area of jurisdiction, for example, the non-state agricultural extension service providers, input dealers and farmer groups in their sub-counties. As at the time of the study, the existing farmer groups in each sub-county had been manually profiled and manual registration for the new groups was still ongoing (MAAIF, 2017). However, electronic systems have been found to be simpler and more timely in terms of data receipt, data management and formation of databases (Hufford *et al.*, 2002; Quinn *et al.*, 2003; Lane *et al.*, 2006). Thus, using the e-diary could simplify the stakeholder profiling process.

It is also possible to add a new interface for the financial office to access the budgets of the different activities in the work plans and follow up with the financial accountability for the different activities reported in the e-diary. As at the time of the study, field agents were submitting paper receipts of the funds spent under each activity alongside a paper-based report to the financial office for accountability. The e-diary can simplify this process by enabling the field agents to upload scanned copies of receipts under each daily activity via the same mechanism used to upload daily activity photos. Thus, simplify the flow and management of the agricultural extension funds.

The e-diary could also be embedded with a crisis surveillance mechanism that could enable field agents to report disasters. This could be in the form of alert notifications by which field agents inform supervisors about crises such as pest and disease outbreaks and natural disasters such as floods and landslides. A similar mechanism by which the field agents send daily activities could be explored such that the field agents send photos of the crises and the GPS location automatically captured. A study by Quinn *et al.* (2011) demonstrated that camera phones could be useful in monitoring the spread of pests and diseases.

The e-diary could also be expanded to enable the beneficiaries to rate the quality of services received within the system. As highlighted under the limitations, the e-diary mainly focuses on whether or not the field agents conducted activities and less on assessing the quality of the services provided. In the current e-diary, the names and phone numbers of the beneficiaries that are visited are captured. Hence, the supervisor can call the beneficiaries to verify the activities and in addition obtain feedback on the quality of services received. However, there is no standard format on how the supervisor can use this feedback to assess the quality of the services. Thus, an automated system could be incorporated in the e-diary in this regard. This could be in the form of an SMS based system by which SMS messages are automatically sent to the beneficiaries requesting them to rate the services received from the field agents. At free of charge, the beneficiaries can rate the services based on a scale that measures the level of satisfaction. This could be in combination with a voice response system, which allows the beneficiaries to leave a voice message. The system can then automatically generate an aggregate rate for each field agent, which is received by the supervisor in addition to the voice message. Automated response systems were found to provide near real-time feedback and were more cost-effective for monitoring compared to traditional methods (Jarvis *et al.*, 2015; Gilberds *et al.*, 2016).

5.4.2 Integrating the e-diary with other ICT tools for extension services

In addition to modifying the e-diary, it can be linked to other ICT tools that facilitate extension service delivery. For example, the e-diary has so far been linked to another application called "MAAIF E-GRM" which is locally built on the same platform. This was via the GRM (Grievance Redress Mechanisms) command button created on the interface of the field agents. The MAAIF E-GRM is being developed by MAAIF to enable the public to report on grievances arising out of agricultural extension projects. By linking the e-diary to MAAIF E-GRM, the field agents can obtain beneficiary feedback via the e-diary once the MAAIF E-GRM is implemented. This could further be linked to the supervisors' interfaces such that they, too could access the beneficiaries' feedback. Studies by Jarvis *et al.* (2015) and Gilberds *et al.* (2016) have shown that beneficiary feedback obtained from the use of ICT tools has the potential to enhance the impact of agricultural projects. The e-diary could also be linked to the "E-extension and Advisory system for MAAIF," another tool built on the same platform. This advisory system is designed to generate and disseminate agricultural information to beneficiaries. Linking the E-extension and Advisory system to the e-diary would enable the field agents to have easy access to the generated agricultural information via the e-diary, which information they can refer to while conducting field activities.

The e-diary could also be linked to other relevant platforms outside MAAIF. This can be via Application Programming Interface-API which facilities automatic communication between the e-diary and other platforms. For example, through collaborations between MAAIF and the meteorology center, the e-diary could be linked to weather forecast platforms, and that would enable the field agents to access weather data which they can use to guide the beneficiaries' activities. The e-diary could also be linked to market information platforms, which would enable the field agents to get easy access to market information such as market prices. This information can be used by the field agents to guide the beneficiaries where to sell their produce.

5.5 Recommendations and Conclusion

In light of the major findings, a number of recommendations to strengthen accountability in the public agricultural extension services and to improve the performance of the agricultural extension managers are proposed below.

The results from chapters 2 and 3 suggest that using diaries, in particular, electronic ones can strengthen accountability in the public agricultural extension services. However, the successful implementation of the electronic diaries requires training of the users on the electronic system and the use of ICTs in general. Additionally, electronic diaries are susceptible to problems of inaccessibility to electricity, thus promoting the use of solar chargers or power banks in areas with poor electrification is recommended. Furthermore, it is recommended that the implementation of the electronic diary is complemented with incentives like recognition of best field agents. The recognition could be coupled with rewards such as; employee awards of recognition, promotion opportunities, career development and financial benefits such as bonus payments.

Results from chapter 4 indicate that the majority of the extension managers were not able to meet the performance requirements, and this was attributed to the fact that the performance indicators used were based on data for the first financial year of a new reform. Thus, the need to monitor these indicators over time as the reform becomes fully institutionalized. Nonetheless, the performance of the extension managers can be improved through capacity building, particularly in management, in line with the new extension reform policies and strategies. Central management should also set-up a strict performance monitoring system to ensure that the extension managers perform their functions as expected. Additionally, targeted interventions that address the factors influencing the performance are also recommended. One intervention is to give priority to funding of extension activities since the results revealed a positive relationship between the amount of extension grant to the district and the performance of the extension managers. Furthermore, based on the positive relationship between the ratio of extension workers to households and the performance of district managers, interventions to increase the ratio of the extension workers to households are also recommended.

In conclusion, the study indicates that using diaries, in particular, electronic ones, in combination with monitoring systems for extension managers, offers a unique and largely underutilized potential to address the entrenched problems of ensuring accountability in public

services. The thesis also illustrates that new reforms require capacity building especially in the area of management. Furthermore, the amount of funds provided to extension service delivery and the ratio of extension workers to households are important factors influencing the performance of agricultural extension managers. These findings are not only relevant for agricultural extension services but also to other public services, such as health care and education, which face similar problems of managing large numbers of field staff in rural areas, where effective supervision is an inherent challenge.

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