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MOBILISING KNOWLEDGE SHARING IN THE AGRICULTURAL ADVISORY SYSTEM

The case of ICT-facilitated plant doctor chat groups

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Introduction

The cornerstone of a well-functioning agricultural advisory service is the ability to efficiently reach out; diagnose problems; advise; and disseminate solutions, with the end goal of supporting sustainable livelihoods of the farmers served.

These activities represent the front-office interface of the advisory services. To assure high levels of expertise in meeting information demands presented by farmers, advisory staff attend capacity-building and refresher courses to obtain, share, and absorb the latest knowledge. These are considered back-office operations. Informal networks of expert communities and the horizontal exchange of their collective knowledge and gathered experiences therein play a crucial role in developing and strengthening the skills of the advisory staff (Adolwa et al., 2017; Klerkx and Proctor, 2013; Labarthe and Laurent, 2013; Landini, 2020).

When calls are made to improve agricultural advisory service—through crowdsourcing of agricultural data for research or environmental monitoring (Minet et al., 2017), e-agriculture (FAO, 2015, 2019), or ICTs in general (Barber et al., 2016; Tsan et al., 2019)—the implicit aim is often to improve farmer–advisor exchanges. The rural contexts of developing countries in which these front-office advisories operate are characterised by inadequate internet and energy infrastructure, limited device ownership, and expensive internet access, which pose more hurdles than opportunities to harness ICTs (Aker et al., 2016; Mbagwu et al., 2017). At the same time, means to support advisor–expert interactions within back-office operations remains understudied. One of the advocated innovations to enhance backstopping which merits further exploration is the use of social media (Suchiradipta and Saravanan, 2016) and specific applications such as WhatsApp and Telegram that support chat groups. The potential of these platforms to facilitate interaction among geographically widespread actors makes them especially attractive for decentralised collection and sharing of data among agricultural advisory services. Advisors may benefit from the online sharing of resourceful content supporting informal learning (Teo et al., 2017), while discussion with experts may lead to resolution of arising issues and challenges in the field (Saravanan & Vasumathi, 2016). Although ambitions and expectations for the use of chat groups in advisory services are high, research on their actual use remains marginal and anecdotal (Ifejika et al., 2019; Raj et al., 2020; Thakur and Chander, 2017). We therefore share and reflect on the CABI-led Plantwise programme experiences with chat group use to benefit agricultural advisory services and consider how they can be more deliberately used and integrated to support service delivery.

Plantwise: ICT-enhanced advisory services in practice

Plantwise transitioned from a CABI project into a global programme in 2012. Its goal is to strengthen national plant health advisory systems from within, enabling countries to provide farmers with the knowledge they need to lose less crops and feed more people (www.plantwise.org). Plantwise is active in 26 countries worldwide (at the time of writing) and is working closely with national agricultural advisory services. The programme establishes and actively supports the national agricultural ministries of each country through a network of plant clinics, run by two or three national advisory staff who are trained for

an additional job title of *plant doctor*. In these plant clinics, farmers get free practical advice about specific crop pests and diseases and their respective treatments (Bentley et al., 2018; Majuga et al., 2018). Plant clinics are organised near busy rural markets on a rotating basis once every 1–2 weeks, but sometimes also less often. They function like human health clinics, as affected crop samples brought by farmers are diagnosed by plant doctors who then provide evidence-based recommendations on correct treatment/management. Even when they are not running plant clinics, plant doctors use the acquired knowledge to follow up and advise farmers. In case emerging crop problems identified at the clinics show the potential to affect a large numbers of farmers, mass extension campaigns using plant health rallies, radio, video, or mobile messaging are employed to maximize overall outreach.

Having trained 11,000 plant doctors and established 4,500 plant clinics worldwide, Plantwise estimates its direct reach in 2019 alone was around 2.6 million farmers with approximately 27,000 farmer visits to the plant clinics (CABI, 2020), with the remainder reached through mass extension campaigns. Several studies indicate that the initiative is delivering impact at farm level. In Rwanda, plant clinics were able to improve the household food security of the farmers who sought advice, decreasing the food shortage period by a month (Tambo et al., 2019). The clinics have also led to significant yield and income increases—28% and 23% respectively—for maize alone (Tambo et al., 2020). In Zambia, clinic attendees were shown to share clinic advice with friends and neighbours, thus expanding the programme's reach and impact (Danielsen et al., 2020). An evaluation of the Plantwise programme in Kenya (Bonilla et al., 2018) observed that farmers within a 1.5 km radius of a clinic had 9% higher maize yields and net benefits compared to other farmers, estimating returns to investment in the Plantwise programme of 3:1.

To further improve the advisory services of the plant doctors, Plantwise has been integrating tablets into plant clinic operations across several African countries: Kenya, Uganda, Rwanda, Mozambique, Malawi, Zambia, Ethiopia, and Ghana. The purpose of these devices is twofold: first, they provide plant doctors with online and offline access to pest diagnosis and management information within the global Plantwise Knowledge Bank; second, the devices are used by plant doctors to collect data during plant clinic consultations, rapidly uploading them to nationwide databases, providing key information to monitor and manage pests' emergence, and supporting decision-making and policy. To support the rollout stage of the tablet adoption and to troubleshoot any soft- or hardware related issues of the geographically widespread workforce, the tablets came with a preinstalled Telegram¹ chat application. In Uganda, where tablets were not given out, plant doctors use their smartphones to collect data, access the knowledge bank, and participate in Plantwise initiated online chat groups.

On their own initiative plant doctors began to use these chat groups to communicate on a wide range of topics, sharing observations on pest incidence,

seeking advice on treating less-common plant pests, discussing logistics, and also socialising with colleagues. A Plantwise survey in Ghana found that plant doctors adapted the use of the chat groups because they were user-friendly, enabled interaction with otherwise busy colleagues, and facilitated immediate two-way communication in large groups (Munthali et al., 2021). Although varying from country to country, Plantwise adopted the practice of adding new trainees to both dedicated small groups of local trainees and larger national chat groups.

These online spaces facilitating interactions became nationwide peer-to-peer support groups of geographically dispersed plant doctors, with additional input provided by national experts in plant protection and research. To monitor unanswered diagnostic queries and provide additional support CABI's international plant disease experts also joined the chat groups. This further accelerated vertical information flows within national plant health systems.

In 2017 these online communities contributed to the early identification, flagging, and tracking of the fall armyworm (FAW)—an invasive pest feeding on over 80 different crops that first appeared on the African continent in 2016 (Abrahams et al., 2017; Day et al., 2017). Interestingly, although the national government had not yet officially identified the pest, the plant doctor chat groups began communicating on a strange sightings affecting the maize suspecting it to potentially be a case of FAW. Looking at these chat group exchanges, national staff and international experts were quickly able to confirm this to be the case. Once the pest was formally recognised at the country level as FAW, methods for diagnosis and management were rapidly disseminated across the very same chat groups.

Likewise, chat groups raised awareness about regional occurrences of maize lethal necrosis disease (MLND) and the tomato leaf-miner (*Tuta Absoluta*), and more recently the desert locust (*Schistocerca gregaria*). The chat groups have partially also led to an early detection and agile interception at the early phase of these outbreaks contributing to the overall management of pests such as FAW across Kenya, Rwanda, and Uganda (Bundi et al., submitted) and other African countries where Plantwise was active. Furthermore, connections between experts, advisors, and field staff across a national advisory system chat groups can serve as horizontal and vertical information exchange networks, where knowledge sharing supports learning and capacity building of the advisory staff (Adolwa et al., 2017; Klerkx and Proctor, 2013; Labarthe and Laurent, 2013; Landini, 2020). In line with such findings, in Ghana in 2019, knowledge sharing related to pest identification and control across chat groups was accompanied with approximately 20 lectures on relevant pest management topics. Although experts contributed during lectures, interestingly, all but one was prepared and delivered by plant doctors (CABI Internal Communication). However, to structurally embed and to further support the functioning of Plantwise chat groups, more understanding of the social dynamics and roles of Plantwise and related chat groups is needed.

The functioning of chat groups in the agricultural advisory system

In this section, we use scientific literature, the research of Munthali et al. (2021) on chat groups in Ghana's agricultural advisory system, and other insights from Plantwise to reflect on documented Plantwise chat group experiences. These insights are used to consider possible future dynamics and functioning of the Plantwise backstopping chat groups across pluralistic agricultural advisory systems in Africa.

The network of chat groups and their roles

CABI supports plant doctor chat groups in eight of the 12 African countries where Plantwise is active. In each country, there are both large national Plantwise chat groups (230 members in Ghana, 200 in Kenya, and 140 in Uganda) and smaller ones (less than 50) functioning parallel to each other. The Plantwise groups differ in both size and actor composition with larger national Plantwise groups constituted by geographically dispersed frontline plant doctors and their supervisors, who are supported by CABI, other diagnostic experts from various crop protection services, research and teaching institutions, input supply companies, and in some cases, representatives of NGOs and other organisations involved in advisory service delivery (CABI internal reports). In contrast, the smaller Plantwise groups are more homogenous, comprising plant doctors from specific districts or those recently trained, with members of these groups having tighter-knit personal connections (CABI internal reports). Besides these chat groups, plant doctors also participate in District Extension Office (DEO) chat groups of field staff, specialised officers, and district directors (Munthali et al., 2021). Similar to smaller Plantwise groups, the members of the DEO chat group are also relatively homogeneous and highly connected as they work in the same locality and/or organisation.

The size and composition of the chat groups more or less determine the focus and communication dynamics. In Ghana, Munthali et al. (2021) found that the DEO group was ten times smaller than the Plantwise national group ($n=38$ vs. $n=235$) and the interaction was more frequent and egalitarian, with a substantially higher number of social and informal messages (Table 14.1). In comparison, the much larger national Plantwise group, connecting geographically widespread actors, was more task-oriented. Plantwise members were also asked to share social content on alternative, private channels, and the chat group was mainly used for knowledge sharing to creatively solve emerging (new) problems.

In both chat groups, the high average clustering coefficient for receiving messages combined with the lower coefficient for sending messages shows a relative centralised communication structure (Table 14.1). The average degree for sending was considerably higher for the DEO chat group than for the national

TABLE 14.1 Type and frequency of messages in the DEO and National Plantwise chat group in Ghana, 2018

	<i>District Extension Office chat group (n = 38, July 2017–June 2018 = 11 months)</i>	<i>National Plantwise chat group (n = 235, April 2017–June 2018 = 14 months)</i>
Types of messages		
Social messages	372 (61%)	5 (1%)
Work notifications	166 (27%)	114 (24%)
Knowledge sharing for problem solving	45 (7%)	295 (63%)
Knowledge dissemination	15 (2%)	23 (5%)
Pest/disease monitoring	7 (1%)	32 (7%)
Total number messages	605 (100%)	469 (100%)
Average number messages per month	55	33.5
Average number messages per month, per person)	1.4	0.14
Clustering coefficient of receiving messages*	>0.6	>0.6
Clustering coefficient of sending messages*	0.51	0.13

Source: Munthali et al (2021)

*Clustering coefficients show the extent to which actors connect to each other. Measuring involves establishing for each actor (the ego) the actors it is linked to (neighbours), calculating the ratio to which the ego's neighbours are connected to each other. If the node's neighbours are fully connected the clustering coefficient is 1, whilst 0 means there are no connections among neighbours and they are pendant to the ego. The coefficient can be measured in terms of in-coming connections (receiving messages) and out-going connections (sending messages)

Plantwise group, indicating a more egalitarian communication structure. The average number of messages per month, per person, was also much higher (1.4 against 0.14). Although Colfer and Baldwin (2016) suggest that heterogeneous actors from different organisational backgrounds tend to have less restrained interactions as they are less susceptible to follow the institutional hierarchies of a specific entity, Plantwise data suggests the opposite.

When we look at the group structures that emerged from the members' interactions in the DEO and national Plantwise chat group, the former tends to display more *bonding* social capital and the latter more *bridging* social capital. Bonding social capital is associated with strong ties: long-term relationships within relatively homogeneous networks, characterised by trust and informal collaboration and access to similar information and resources (Claridge, 2018). Bridging social capital is associated with weak ties: relationships between heterogeneous actors or communities that lack a sense of belonging but have access to broader information and resources (Claridge, 2018; Putnam, 2000). These distinct chat group

characteristics enable the groups to play different but complementary roles in knowledge sharing: local chat groups, displaying strong bonding, focus on routine practices and advice; while the national chat groups can be characterised as ‘bridging,’ with a high diversity of knowledge for creative problem solving. The different group structures enable both bridging and bonding social capital to be used in fulfilling different, complementary roles in knowledge sharing (Cofré-Bravo et al., 2019; Klerkx and Proctor, 2013).

Findings from Munthali et al. (2021) show that in Ghana the local and national chat groups did indeed play active complementary mutual supporting roles in the advisory system. Local chat groups were primarily used in coordinating ‘the last mile’ extension—logistics, plant clinic organisation, and other agricultural department announcements. The local and practical orientation of the smaller groups also makes them useful for maintaining adequate knowledge, for routine problem solving, and for operational effectiveness. The national Plantwise chat groups with a higher number of members, including experts with specific types of experiential and scientific knowledge, served as a rich source of guidance for non-routine problem solving. Data showed that the local chat groups provided an overview of pest/disease occurrences in their area, and when forwarded to the national chat group, provided a timely overview of the situation, enabling national plant health staff to determine threats and knowledge gaps, and share possible solutions. Furthermore, the act of sharing of information also served to link the actors (mainly plant doctors). Whether other chat groups of local advisory officers across Africa demonstrate similar communication dynamics and roles with respect to the national Plantwise chat groups requires further research.

Motivation and chat group participation

What drives chat group members to participate in the different platforms related to Plantwise, enhancing knowledge sharing? Relatively little is known about the individual motivations for participation. A survey amongst plant doctors in Ghana alludes to the desire to report new problems and also offer viable solutions to problems posted by colleagues—especially in cases of managing new pests, such as fall armyworm (Munthali et al., forthcoming). Similar results by Chaouali (2016) and Huang et al. (2017) demonstrate that participation in institutional chat groups is often based on feelings of being useful, resulting in positive emotions of enjoyment and satisfaction.

However, despite these motivations, it was established that in the national Plantwise group and DEO chat groups relatively few users actively posted content (Munthali et al., forthcoming). A network analysis of the communication patterns for the national Plantwise chat group in Ghana showed that the majority of messages were generated by a few active users, with a significant difference between the number of senders and receivers highlighting a centralised communication structure (Table 14.1). Similarly, looking at hundreds of thousands of Persian chat groups on Telegram, Hashemi and Chahooki (2019) find that

across professional chat groups it is common for fewer users to create the majority of exchanged content—similar to our Plantwise observations. In comparison to the large national Plantwise group, the smaller non-CABI DEO chat group had a higher average number of messages per month and per person, and showed a much more egalitarian communication structure. In terms of content, this group was very active in providing advice and guidance also marked by a much higher number of social message exchanges compared to work coordination and task- and knowledge-related messages (Table 14.1). District agricultural directors and specialised officers coordinating the work were the most active members. In the national Plantwise chat group, participants were asked to share only knowledge-related messages and abstain from posting social messages. Within these same chat groups Subject Matter Specialists—researchers and respected plant doctors—were very active in providing advice and guidance, while ordinary extension officers were of the view that they should mainly listen. It was also noted that when the specialists and researchers were silent or took longer to respond to queries, the number of plant doctor peer-to-peer exchanges increased (Munthali, 2021).

The design and facilitation of an effective knowledge sharing system

Though the functioning of the local and national chat groups may have relied on a few active members, it was observed that there were periods of high activity around new emerging pests and diseases such as FAW, MLND, and the tomato leaf-miner. However, later on chat groups initiated by Plantwise began displaying periods of low activity. For example, in Kenya and Uganda the number of shared messages decreased after a peak in 2018, yet it was also noted that active facilitation of the groups—prompting experts to respond to queries and introducing initiatives such as mini-lectures—had the effect of encouraging overall participation (CABI internal reports).

One question that remains is whether dwindling activity of a national Plantwise group is always an issue for concern. We found that offline and online meetings of DEOs and projects or local Plantwise groups complement and nurture national Plantwise chat groups, enhancing timely, relevant, and effective knowledge sharing systems for creative problem solving. If such localised groups with high levels of social capital and activity, and an interest in pest and disease management exists, it may be opportune for CABI to rely on these group for local level pest monitoring and to further concentrate on supporting national backstopping via online platforms.

As highlighted by Birner et al. (2009) as well as Faure et al. (2016), contextual factors such as the policy environment; agricultural production and market systems; and the farm community aspects define the needs for advisory services. Within this context, a pluralistic advisory service system is shaped by the type of actors providing advice (actors of the state, NGO/farmer organisation, or private sector); the actors' specific mission and funding requirements that they must comply with; their staff and financial capacity; and their internal styles of

management and advisory communication. The various advisory service providers have their internal offline and online communication focus and styles, and they interact with other system actors in offline and online platforms. This leads to a self-organised system of offline and online platforms with specific focuses and interaction patterns; bonding and bridging characteristics, and roles performed within the advisory system.

Domain-specific backstopping chat groups, such as those initiated by Plantwise, need to strategically embed themselves in an existing pluralistic advisory system. Based on our findings, we recommend that national backstopping initiatives should (a) encourage the participation of communicative, responsible actors with strong and relevant local, organisation, or project-related advisory experience in nationwide exchanges; (b) encourage proactive exchange in smaller localised groups while raising unresolved issues to the national groups; and (c) integrate facilitation within all groups, ensuring that all queries get answered.

Regarding the latter, we observe several factors that warrant facilitation interventions over chat groups. We know that in Ghana and Uganda plant doctors are inclined to remain silent in chat groups to create room for expert opinions. Furthermore, it is a natural group dynamic to be active when issues need to be tackled, followed by phases of inactivity (Rybski et al., 2012). Temporary inactivity is not a problem, but group participation might be structurally affected when central users fall silent or leave groups when switching jobs, leading to a sudden drop in content that once was instrumental in catalysing active engagement. Prolonged periods of low activity may also decrease members' alertness or interest to share problems and knowledge in chat groups. Kelly et al. (2017), who studied online social media for agricultural advisory services in India and Australia, therefore concluded that continuous facilitation by experts was key for attaining knowledge sharing and learning.

A moderator can facilitate knowledge sharing and support learning, but needs participants to aggregate and analyse mobilised data and knowledge, adding insights from elsewhere to feedback into the dialogue for learning (Van Paassen et al., 2011). Moderators—as chat group administrators—have been shown to be key in keeping professional chat groups organised, while assuring that shared content meets overall institutional objectives (Hashemi and Chahooki, 2019). A chat group moderator within groups may therefore (a) stimulate sharing field experiences for monitoring of emerging problems; (b) encourage and guide knowledge sharing and learning about pests, diseases, and applied management practices; (c) invite (experiential and science-based) experts and researchers to aggregate the data, analyse, and feedback insights; (d) act as a conduit for anonymous queries or comments where junior staff feel uncomfortable posting on groups including senior staff or experts; and (e) discourage off-topic chats where needed.

With regard to facilitation, it is critical to encourage the more experienced plant doctors to contribute to discussions, as users' interest is often attracted not by content, but who is sharing it (think of social media influencers); this was explicitly reported in the Uganda network. Therefore, identifying influential/central group members within chat groups might be key to ensuring that users

are cognizant of shared content. Likewise, one should consider encouraging participation of subject matter specialists and researchers, providing them with incentives such as remuneration for time spent, capacity-building opportunities, and career advancement/promotions (Bitzer, 2016). Priharsari et al. (2020) also conclude that such a reward system is essential to co-create value, when organisations seek to connect their workforce via online networks.

Conclusion

The experience with the Plantwise chat groups shows that, in contrast to other pre-defined and elaborate ICT apps, agricultural professionals tend to shape chat groups to functions complementary to existing offline (and online) meetings in their locality and/or organisation. More specifically, groups of newly trained plant doctors received tablets to collect data and access the knowledge bank, but soon started to use the chat function for nationwide troubleshooting on diagnosis and management of pests, and to raise awareness and rapidly share information on emerging pests. Recently, formal learning has been expanded to cover areas identified as desired by plant doctors and provided through 'mini-lectures'. More local (e.g. DEO or NGO project-related) chat groups are used, in contrast, for socialising and timely organisation of routine tasks. Hence, chat groups are self-organised, and play useful and important roles within organisations and between different actors in pluralistic advisory systems.

As chat groups proliferate, it is important to know how these platforms can be structurally embedded within organisational practices and how they can be facilitated and managed effectively. Looking at the interaction dynamics of the groups, we noted smaller groups encouraged bonding social capital; they also exhibited less restricted exchanges between group members that were more confident to post to a group of (mainly) peers or well-known individuals in the hierarchy, supporting the organisation of routine tasks. In contrast, large heterogeneous groups encouraged bridging social capital with the potential to access broader expertise outside immediate social groups to flag and timely solve emerging problems.

Facilitation and proper rewarding of experts could help to ensure the dynamism of the groups, encourage sharing of experiences, and the resolution of queries from the group, keeping the groups focused where necessary. In the longer term, guidelines defining official roles and responsibilities may support long-term sustainability and usefulness of groups. Although the value of spontaneous evolution of groups has been recognised, further work is required to understand and effectively support advisory group functions in different geographies and institutional contexts.

Note

- 1 At this time the firmware of the tablets could not support the use of WhatsApp.

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