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Analysing Support towards Inclusive and Integrated Rural Advisory Systems

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Abstract: Public Rural Advisory Services (RAS) have adapted to different socio-economic scenarios in politically diverse countries with the help of the third sector supporting dedicated RAS programmes. The Plantwise (PW) programme, led by the Centre for Agriculture and Bioscience International (CABI) and designed to increase food security in over 30 countries, is a good example of a public/NGO partnership, although recent evaluations have questioned its impacts on gendered agricultural information access. This study aims to investigate Plantwise's gender impacts from individual and institutional viewpoints, interviewing smallholder farmers and extension staff involved in and outside of, the Plantwise programme in Bahawalpur and Jhang district in the Punjab province of Pakistan. This serves to highlight the programme's impacts on systemic processes which ultimately have the potential to contribute to gender-transformative change and a more efficient and sustainable RAS. Results show differences between extension workers in a PW district and a non-PW district and between plant doctors and non-plant doctors in a PW district, though none were significant from a gendered perspective. There were interesting findings highlighting the plant clinic's capacity as an agent of change but the low turnout of women at clinics did not reinforce the clinics' capacity for change from a female perspective. Information from systemic, male and female-specific analyses are important to consider for PW from a practical perspective, such as the importance of spiritual locations. This study into the Pakistani PW initiative also offers an opportunity to contribute to the growing body of academic literature on the individual and institutional impacts of international development programmes, helping to understand wider aspects of international development involvement in RAS. From a practical perspective, this study also enables PW and other international development initiatives to better understand and interpret stakeholders' perceptions, highlighting the importance of design and investment in participatory approaches to enable longer term impacts, especially focused on gender. It will also help the PW programme assess and understand implementation challenges in order to attain impact on the ground and be a driver of positive change in the country.

Keywords: rural advisory services; non-government organisation; monitoring and evaluation; gender; female farmers; extension worker

1. Introduction

National administrations around the world have championed the use of public Rural Advisory Services (RAS)—services that provide information and support to rural populations on a range of different social, economic and environmental subjects (adapted from GFRAS 2016; Leeuwis and Van den Ban 2004; Peterman et al. 2011). These publicly run services have had to adapt to different socio-economic scenarios in many politically diverse countries (Anderson and Feder 2004).

In many commonwealth countries for example, rural advisory services have had to adapt from supporting export crops traditionally favoured by colonising countries, to focusing on serving large populations of smallholder agriculture since their independence to increase subsistence food production (Anderson and Feder 2004). This self-enforced national development engendered new challenges centred around the evolution of innovation diffusion processes and the communication services that support them, as well as a growing awareness of its impacts on society. This change also served to show how badly understood these networks and systems originally were. Indeed, in the mid to late twentieth Century, decision makers' simplistic assumptions surrounding rural communities' access to and need for, knowledge, as well as their poor grasp of sociological theories describing knowledge transfer and technology adoption, often compounded the issues rather than resolved them in the years following decolonisation (Jones and Garforth 1997). This resulted in an increase rather than a reduction in unequal rural knowledge access and opportunities, especially from a gendered perspective (Lamontagne-Godwin et al. 2018). In order to deal with these deficiencies, dedicated RAS programmes were vital to structure and implement specific targets surrounding the diffusion of agricultural innovations and improving agricultural knowledge in society and in the household (Jones and Garforth 1997) and lately, about including and implementing gender empowerment (Farnworth and Colverson 2015). The majority of these public RAS programmes have historically been supported by external organisations collectively known as "the third sector."

The Plantwise (PW) programme, led by CABI and designed to increase food security in over 30 countries, is a good example of a public/NGO partnership (Evidence on Demand 2015). Working in close collaboration with a variety of national and international stakeholders, the programme strengthens capacity and resilience of the national and local plant health systems, enabling them to provide farmers with the knowledge they need to 'lose less and feed more.' It does this primarily through the development of sustainable networks of plant clinics run by existing agricultural extension agents where farmers can find practical science-based plant health advice for any crop and any problem (Majuga et al. 2018). The plant clinic network is supported by an online knowledge platform, the Knowledge Bank, a gateway to actionable plant health information, including diagnostic resources, analytical tools, pest management advice and front-line pest data for effective local, national and regional vigilance (Leach and Hobbs 2013). These two resources form the "Plantwise approach" that strengthens a country's RAS system through a sustainable knowledge and coordination system (Romney et al. 2013).

Recent independent impact assessments of the PW programme approach that encompass a range of different methods to justify the programme's success and impact on the ground have generally been favourable (American Institutes for Research 2018; Evidence on Demand 2015). However, impacts surrounding agricultural information access from a gendered perspective were not as convincing. Recent evaluations have described the need for improved gender specific activities (Evidence on Demand 2015), which can be traced back to poor women attendance of clinics and a disproportionate number of male staff trained in the programme. This may not be due to the programme's lack of efforts but the restrictive and unequal nature of gender norms in a country. In any case, further efforts are needed to understand the role and impact of PW in gender-specific institutional changes (Evidence on Demand 2015).

This study therefore aims to investigate Plantwise's gender impacts from an individual and institutional viewpoint. It focuses on end-users (male and female farmers) and male and female service providers' individual interactions from a gendered perspective. This serves to highlight their impacts on systemic processes which ultimately have the potential to contribute to gender-transformative change and a more efficient and sustainable RAS. Transformative change research (the study of underlying individual or systemic institutional processes that govern individual and systems' interactions) analyses formal institutional processes that frame gender inequality in countries (laws and policies governing access to resources and legal protection) and links them to informal individual beliefs or perceptions

formed in part by traditional socio-cultural norms (Rao and Kelleher 2003; Rao and Kelleher 2005) in order to highlight where change could occur.

This study takes place in Pakistan, a country that has traditionally sought to deal with ethnic and income inequalities rather than gender concerns, a situation that has not been helped by the public sector's gender-blind activities in recent times (Chauhan 2014). Pakistan's lengthy experience with third sector agricultural development programmes makes it an interesting case study. Indeed, since its creation, Pakistan has been supported by the third sector to develop and implement initiatives such as the Village-AID, Rural Works and the Integrated Rural development Programme before the 1970s and more recently with the Training and Visit (T&V) programme in the 1980s and Farmer Field Schools (FFS) in the 1990s (Davidson et al. 2001). As has been shown in the Plantwise programme evaluation, there is very little evidence of past success regarding the improvement of gender inequalities in agricultural information access. The T&V and FFS programmes, which were operational during the rise of the gender debate in the international development community, have rarely managed to provide access to all sections of the populations equally, particularly poor women. FFS do not offer clear results on its gender impact despite the programme running for over 25 years (Davis et al. 2012), whilst the gender bias towards men in project setup and implementation has been exposed in the T&V system (Due 1997).

Research shows women are indeed deprived overall in socioeconomic terms as they have less opportunity for education, training, extension services and technology as compared to men (Hassan et al. 2007; Lamontagne-Godwin et al. 2018). In Pakistan for example, information access between genders is unequal—less than 10% of women access agricultural information from public sources, compared to 25% for men (Lamontagne-Godwin et al. 2017, 2018). This situation is exacerbated by, and indeed a result of, historical patriarchal socio-cultural norms in a country (Harari 2014; Rao and Kelleher 2003), which is particularly the case in Pakistan (Tsegaye et al. 2018). Public and NGO-run agricultural approaches have rarely improved the situation—they have traditionally focused their efforts on men, largely overlooking women and their roles in the agricultural value chain and home consumption—even if globally they represent over half of the total rural labour workforce in agriculture (Puskur 2013). Indeed, even though the international development community has been aware of the inequality of information access amongst genders for some time (UNWCW 1995), activities to address this situation, usually labelled as 'gender mainstreaming' approaches, have not achieved the impact initially hoped for (Moser and Moser 2005). One of the reasons is the international development community's progressive simplification of a complex socio-cultural issue. In order to be successful and drive opportunities for change at a national and local level, transformative approaches must consider a whole range of historical and contemporary socio-cultural contexts that enable and determine socially acceptable gender roles (Farnworth and Colverson 2015). These roles constantly evolve as they are driven by formal and informal agendas and changing institutions that blend systemic practices and individual consciousness (Rao and Kelleher 2005). Overall, agents of change have to navigate complex and non-linear systems, analysing and understanding them before any opportunity for change can be attempted or even suggested (Moser and Moser 2005). Unfortunately, whilst transformative aims have more widespread impacts, they usually take longer to achieve and are harder to define and demonstrate (Farnworth and Colverson 2015).

In the context of short-term funding cycles and resulting impact evaluations, most international development projects have not taken the time to invest in and design the types of studies and development initiatives that can achieve these longer terms, harder to measure, yet more fruitful results. Therefore, the proliferation of short-term project-delineated results are completely disconnected from in-depth transformative approaches that prefer to concentrate on ethnological and anthropological techniques (Moser and Moser 2005; Rao and Kelleher 2003), that contribute to real, institutional change. Consequently, many initiatives consider simple quantifiable gender mainstreaming targets, such as increases in numbers of women professionals trained or reached, as evidence of gender equality impact. As mentioned above, these do not reflect a clear and substantive change in women empowerment.

Contrary to beliefs exposed above, transformative change research has the capacity to analyse these processes through clear and time-sensitive methods. Essentially, transformative research links formal institutional processes to individual beliefs or perceptions formed in part by traditional socio-cultural norms in order to highlight where change could occur (Rao and Kelleher 2003, 2005). This can be studied either through laws and policies and their relationship to socio-cultural norms as designed by Rao and Kelleher (2003) or through a more grounded approach that advocates a clear understanding of bottom-up gender transformative approaches (Farnworth and Colverson 2015) which in turn become sufficiently regular and continuous to be described as institutions (adapted from Turner et al. 2014). Indeed, a recent review highlights the importance of gendered approaches and its long-term impacts on gender equality (Mbo'o-Tchouawou and Colverson 2014).

Plantwise in Pakistan was initiated in 2011 and fully operational by 2012. The consortium of partners are currently running approximately 900 clinics and have trained over 1500 staff to run them. This consortium includes the Ministry of National Food Security and Research and individual Provincial Directorates of Extension in the Punjab, Baluchistan, Gilgit Baltistan and Khyber Pakhtunkhwa. They have an active data management system, which contains information on over 100,000 pest and disease diagnoses, an effective content development process, which has contributed to the development of over 130 plant health documents and a fully functioning Monitoring and Evaluation implementation team. The PW programme is aware of the issues surrounding inclusive agricultural information access, particularly in Pakistan. The programme has indeed focused on gender awareness activities in the last year: for example, they launched five plant clinics run and attended solely by women in Pakistan, from which 377 plant clinic queries were collected (Plantwise 2019). However, the outcomes will be discussed later in the article.

This study attempts to answer the following research questions: has the PW approach contributed to a change of institutional and individual perceptions of public provincial RAS systems? What potential successes and failures do these perceptions highlight? Can these results offer theoretical insights into gender responsive agricultural information access initiatives? The research questions will be answered by an analysis in a PW (test site) and non-PW (control site) district. It will firstly compare smallholder farmers and public extension workers' individual perceptions of gendered agricultural information access, before then attempting to understand and compare institutional perceptions of public RAS stakeholders.

This study into the Pakistani PW initiative offers an opportunity to contribute to the growing body of academic literature on the individual and institutional impacts of international development programmes. It also helps to understand wider aspects of international development involvement in RAS. From a practical perspective, this study also enables PW and other international development initiatives to better understand and interpret stakeholders' perceptions, highlighting the importance of design and investment in participatory approaches to enable longer term impacts, especially focused on gender. It will also help the PW programme assess and understand implementation challenges in order to attain impact on the ground and be a driver of positive change in the country.

This article will briefly review the analytical methods used before presenting key results and resulting discussion points.

2. Methods

Research activities were conducted in the Punjab province of Pakistan between June 2015 and October 2016. Data were collected in Bahawalpur, the first district to establish the PW programme district into its public RAS and Jhang, a non-PW district. Both districts were chosen due to their similar agro-climatic and economic profiles: Bahawalpur's economy is dictated by the cultivation of crops, such as cotton, sugarcane and wheat, as is Jhang's. Both districts have a similar incidence of food poverty in farming households (31% and 35% respectively) (Qureshi and Arif 2001) and have similar family sizes and percentages of illiteracy at the household level (Amjad et al. 2008). Bahawalpur's population is 700,000 whilst Jhang's is 400,000.

A socio-economic and behavioural survey was conducted with 401 randomly sampled smallholder farmers (201 women and 200 men) in Bahawalpur's 24-BC union council and Jhang's Kotla Zareef Khan union council. The survey focused on perceptions of information access, source trust, quality of advice and location convenience (Hassan et al. 2007; Lamontagne-Godwin et al. 2018; Sadaf et al. 2006). This group was disaggregated by sex in the first instance and then as user/non-user of plant clinics. Large farm holders of over one hectare were excluded from the sampling to correlate with Plantwise definition of smallholders and to be within the range of the average farm size in Pakistan of 3 hectares (Sial et al. 2012) and a female interviewer was used to interview female participants to minimise biased social interactions.

A second survey of 116 staff, five women and 111 men, from the Provincial Department of Extension and Adaptive Research (PDEAR) in Bahawalpur and Jhang was conducted by face-to-face interviews in the field or in office. Participants, 26 actively worked in the PW programme, were asked about their perceptions of rural households' access to information sources. The survey format was identical to the previous farmer survey, making a systematic comparison possible.

A final survey of 111 extension workers involved in different areas of the PW programme was also carried in six plant clinic districts in November 2016. Its aims were to understand extension professionals' perceptions of the PW programme's impacts on individual and systemic RAS activities. In both extension worker surveys, there were not enough female extension interviews to compare responses from male and female respondents. Five-point Likert scales were used in questionnaires to agree, disagree or remain neutral in response to following statements.

Quantitative data analyses were conducted through the IBM^{TM} SPSS 24 statistics programme (Armonk, NY, USA). Due to the categorical nature of the dependent and independent variables in some tests, cross tabulated descriptive statistics and binomial Z-tests were used with a five percent margin of error. Z-tests support a null hypothesis stating there is no difference between two independent population proportions. In this article, this will support analyses of significant differences in access, trust and quality perceptions to information between male and female farmers in a PW and non-PW district and PW and non-PW extension workers.

Six further local group exercises with 18 members of the public RAS system were carried out in Jhang and Bahawalpur districts. The aim was to visualise RAS networks and understand the nature of key rural advisory service stakeholders' relationships in the plant health system in a PW and non-PW district. Unfortunately, many of the female district agricultural officers were occupied in the field during wheat harvest quota inspections, although two women—an agricultural extension agent working for PDEAR and an assistant district director for PDPW—did attend one of the Jhang workshop. The groups were firstly asked to visually interpret farmer-focused RAS organisation in their own district, disentangling stakeholder networks according to their interactions, a concept akin to the Agricultural Innovation System (Klerkx et al. 2006; Manderson et al. 2007) focusing on the actors' interdependence (Klerkx et al. 2010). Secondly, participants were asked to highlight collaborations, strengths and weaknesses of the identified stakeholders, qualifying their interactions. This enables studies to unravel physical structures into systemic and dynamic processes, understand practices and behaviours that create change and deliver knowledge in a local and national setting (Carvalho et al. 2015). The approach also adapts essential network visualisation techniques (Lamontagne-Godwin et al. 2019b; Newcombe 2003) and enables decision makers to gauge a system's capacity to innovate and progress (Samee et al. 2015). The established linkages were ranked according to defined interaction scores: A weak-ranked interaction (dotted lines) was defined as an irregular, ad-hoc interaction. An intermediate interaction was defined through official, regular meetings. Finally, a strong interaction was described specific and regular contact that aim to jointly build and strengthen the rural advisory service innovation system. Interactions between stakeholder sectors were scored and mapped according to pre-defined scores (Lamontagne-Godwin et al. 2019b).

As mentioned earlier in the introduction, transformative change of socio-cultural gender norms not only take a long time to embed and evolve, they are also extremely complex to measure and

evaluate. While this thesis positions certain aspects of its research to identify evidence of socio-cultural change at the institutional and systemic level, the possibility of change over the time of the programme is extremely unlikely. This thesis should be considered as part of a wider, longer term effort to improve the situation of women in Pakistan.

3. Results

The results are separated into two sections. The first focuses on smallholder farmers' perceptions of agricultural information access from a gendered perspective in a PW and non-PW district. The second section concentrates on extension professionals, initially comparing their perceptions to farmers analysed in the first section, before concentrating on the PW programme's impacts on individual and systemic perceptions of the RAS system in their district.

3.1. Farmer Perceptions

An analysis of 200 male and 201 female farmers' perceptions of information source range and convenience, frequency of access and source quality and trust was conducted in a PW and non-PW district. Some interesting differences were identified in Table 1.

Table 1. Perception Differences in Smallholder Agriculture Information Access. Descriptive and analytical statistics of proportion of male and female responses regarding information source range and convenience, frequency of access and source quality and trust. * Slightly significant result at $p < 0.05$; ** significant result at $p << 0.05$. Bold Z-test scores denotes significance.

Analysis	PW District	Non-PW District	Z-Test
Range of sources utilised to access agricultural information			
(analysis based on total number of sources listed as accessed)			
Number of sources male	14	14	z = 0
Number of sources female	8	11	z = −1.03
Frequency of access to agricultural information sources			
(analyses based on proportion of "rarely"/"sometimes"/"frequently"/"exclusively" perception responses)			
Male total access frequency	19.4%	21.65%	z = −0.89
Male frequency of access to PDEAR	86%	42%	**z = 6.48** **
Male frequency of access to Agrodealers	71%	40%	**z = 4.48** **
Female total access frequency	2.21%	9.53%	**z = −9.04** **
Female frequency of access to Female neighbour/friends	15%	52%	**z = −5.71** **
Female frequency of access to Agrodealers	3%	14%	**z = −2.89** *
Female frequency of access to PDEAR	7%	18%	**z = −2.37** *
Female frequency of access to PDAI	1%	16%	**z = −4.60** **
Female frequency of access to Lead female farmers	1%	18%	**z = −4.41** **
Female frequency of access to Lead male farmers	1%	14%	**z = −3.51** **
Female frequency of access to Village leader	1%	10%	**z = −2.81** **
Trust of sources utilised to access agricultural information			
(analyses based on proportion of "mostly"/"completely" perception responses)			
Male total source trust	44.6%	33.9%	**z = 2.50** **
Female total source trust	52.6%	56.9%	z = −0.64
Quality of advice provided by agricultural information sources			
(analyses based on proportion of "good"/"very good" perception responses)			
Male total quality of advice	76.4%	78.7%	z = −0.78
Female total quality of advice	89.4%	91.7%	z = −0.42
Female quality of advice of Female neighbours/friends	12%	54%	**z = −6.13** **
Location convenience			
(analyses based on proportion of "good" and "very good" perceptions)			
Male convenience of Administrative locations	57.6%	85%	**z = −4.94** **
Male convenience of Marketplace	69%	89%	**z = −3.92** **
Male convenience of Field locations	66%	63%	z = 0.44
Male convenience of Domestic locations	45%	52%	z = −0.99
Male convenience of Spiritual locations	23%	29%	z = −0.5
Female convenience of Administrative locations	20.3%	11.5%	**z = 2.71** **
Female convenience of Marketplace	56%	66%	z = −0.99
Female convenience of Field locations	69%	76%	z = −1.21
Female convenience of Domestic locations	56%	53%	z = 0.99
Female convenience of Spiritual locations	100%	97%	z = 0.3

3.2. Information Source Range

Overall, there were no significant differences between the variety of sources utilised by both men and women in each district. Indeed, women in a PW district consulted eight sources, compared to eleven sources in a non-PW district ($z = 1.03$; $p = 0.29 > 0.05$), while men consulted fourteen sources in both districts ($z = 0$; $p = 1 > 0.05$).

3.3. Information Access Frequency

Participants in the non-PW district accessed information significantly more often than their counterparts in a PW district ($z = 5.31$; $p << 0.05$). This included results for men, whose access was higher (but not significantly so ($z = 0.89$; $p = 0.3 > 0.05$)) in the non-PW district than in the PW one, as well as for women ($z = 9.04$; $p << 0.05$). Focusing on individual sources, men in the PW district accessed their two main sources of information, PDEAR ($z = 6.48$; $p << 0.05$) and agrodealers ($z = 4.41$; $p << 0.05$) significantly more often than in the non-PW district. Women in the non-PW district accessed information resources more often than women in a PW district, more specifically female neighbours/friends ($z = 5.71$; $p << 0.05$), PDAI ($z = 4.60$; $p << 0.05$), lead female farmers ($z = 4.41$; $p << 0.05$), lead male farmers ($z = 3.51$; $p << 0.05$), village leaders ($z = 2.81$; $p = 0.004 < 0.05$), agrodealers ($z = 2.89$; $p = 0.04 < 0.05$) and PDEAR ($z = 2.37$; $p = 0.02 < 0.05$). Women in a PW and non-PW district all the while still access relatively little information compared to men in both the PW and non-PW districts (two percent and nine percent compared to nineteen and twenty-two percent).

3.4. Source Trust

Overall, 53% of women in a PW district and 57% in the non-PW district (an insignificant difference; $z = 0.64$; $p = 0.52 > 0.05$) rated their trust of overall information providers as 'mostly' or 'completely' trusted. However, men in the PW district trusted information resources significantly more (44% compared to 34%; $z = 2.50$; $p << 0.05$) than their non-PW district counterparts, although the only significant difference when comparing individual sources were male neighbours/friends ($z = 2.1$; $p = 0.04 < 0.05$). No other individual information sources are perceived as more of less trustworthy by either men or women in both districts. It is interesting that public RAS bodies are not perceived differently in the PW and non-PW district, a point that shall be discussed further below.

3.5. Quality of Advice

The single significant difference in perceptions of quality of agricultural advice between participants in a PW and non-PW district was women's perceptions of female neighbours/friends' quality of advice: women in the non-PW district perceived the advice from female neighbours to be of higher quality than women in the PW district ($z = 2.82$; $p = 0.005 << 0.05$). Again, it is important to note the lack of differences to perceptions of advice quality for public RAS bodies in the PW and non-PW district.

3.6. Convenience of Information Access

Fifty seven percent of men in the PW district and over 80% of men in the non-PW district believed administrative locations to be positive ('good' or 'very good') locations to access information, a significant difference ($z = 4.94$; $p << 0.05$). Although the majority of women in both districts still perceived administrative locations to be negative ('bad' or 'very bad') locations to access information, significantly more women (20.3% compared to 11%) in the PW district believed administrative offices were positive ('good' and 'very good') locations to access information ($z = 2.71$; $p << 0.05$). There were no significant differences between men and women's perceptions of access to information in the field and in domestic location, as both genders in both districts found them to be a convenient location. There were no significant differences between women in their perceptions of accessing information in the homestead (53% in the non-PW district and 56% in the PW district): both female groups believe that the homestead is a positive location to access information. Men and women in both districts

had similar views regarding spiritual locations: all women in the PW district and 97% of women in the non-PW district rated spiritual locations positively. For men, 82% in the PW district and 91% in the non-PW district rated spiritual locations as "ok" or "good." Men in the non-PW district believed accessing information in the marketplace was a significantly better option than men in the PW district (89% compared to 69%; z = 3.92; $p << 0.05$). However, there were no statistically significant perception differences for women: 56% in the PW district and 66% in the non-PW district stated the market was mainly "good."

Clearly these results are extremely important for the future of information access strategies, a point to be revisited in the discussion. The study now focuses specifically on plant clinic use, as opposed to simply looking at PW and non-PW districts.

4. Comparison Between Male Plant Clinic Users and Non-Plant Clinic Users in PW and Non-PW District

Eleven percent or 22 of the 201 participants, interviewed in the PW district had accessed information through plant clinics. Twenty-one were men and one was a woman. All male plant clinic users were household owners, three quarters could read and write and three were in a leadership position.

Results in Table 2 enable comparison of male plant clinic users (n = 21) firstly with non-clinic male participants (n = 179) in both districts and secondly with male non-plant clinic users (n = 79) in the same PW district. The study compares their information access frequency, variety of information sources they consult and their perception of location convenience to access agricultural information.

Table 2. Plant clinic users and non-plant clinic users' perceptions of information access in Plantwice (PW) and non-PW districts.

Analysis	N (x)	N (y)	Z Score	Comments
Comparison in PW and Non-PW District				
Total access frequency between plant clinic users (x) and non-plant clinic users (y)	21	179	z = 1.25	*Male plant clinic users do not access information more often than non-plant clinic users*
Access frequency to PDEAR between plant clinic users (x) and non-plant clinic users (y)	21	179	**z = 3.2** **	*Male plant clinic users access information more often than male non-plant clinic users*
Access frequency to agrodealers between plant clinic users (x) and non-plant clinic users (y)	21	179	**z = 3.2** **	*Male plant clinic users access information more often than male non-plant clinic users*
Field location convenience between plant clinic users (x) and non-plant clinic users (y)	21	179	**z = 3.68** **	*Male non-plant clinic users find the field more convenient than plant clinic users*
Variety of information sources between plant clinic users (x) and non-plant clinic users (y) in both districts	21	179	z = 0.42	*No significant difference between results*
Comparison in PW District				
Total access frequency between plant clinic users (x) and non-plant clinic users (y)	21	79	z = 0.99	*Male plant clinic users do not access information more often than non-plant clinic users*
Access frequency to PDEAR between plant clinic users (x) and non-plant clinic users (y)	21	79	**z = 2.05** *	*Male plant clinic users access information more often than male non-plant clinic users*
Variety of information source between plant clinic users (x) and non-plant clinic users (y)	21	79	z = 0	*No significant difference between results*
Field location convenience between plant clinic users (x) and non-plant clinic users (y)	21	79	**z = 3.6** **	*Male non-plant clinic users find the field more convenient than plant clinic users*

* Slightly significant result at $p < 0.05$; ** significant result at $p << 0.05$.

4.1. Male Plant Clinic Users and Non-Plant Clinic Users in Both Districts

Male plant clinic users do not access a wider variety of sources than non-plant clinic users in both districts (z = 1.25; $p = 0.2 > 0.05$) but access individual sources such as PDEAR (z = 3.2; $p = 0.001 << 0.05$) and agrodealers (z = 3.2; $p = 0.001 << 0.05$) significantly more often than non-plant clinic users (Table 2). There were no significant differences in plant clinic users and non-plant clinic users' perception of location convenience for accessing information regarding district, tehsil and village

offices, the market, the homestead and spiritual locations. However, non-plant clinic users rated the field as a more convenient location than plant clinic users ($z = 3.68$; $p << 0.05$).

4.2. Male Plant Clinic Users and Non-Plant Clinic Users in a PW District

The study focuses next on a comparison between male plant clinic users and male non-plant clinic users in the same PW district. Results show that plant clinic users use a single source, PDEAR ($z = 2.05$; $p = 0.03 < 0.05$), 'frequently' and 'exclusively' significantly more often than non-plant clinic users. No other significant differences are found between male plant clinic users and non-plant clinic users regarding information access frequency, the variety of information sources used or advice quality. Moreover, there is only one significant difference in plant clinic users and non-plant clinic users' perception of location convenience: the field. Male plant clinic users believe the field was an average location to access information, compared to male non-plant clinic users' perceptions that the field is a good location ($z = 3.6$; $p << 0.05$). There are no differences when considering administrative offices, the market, the homestead and spiritual locations.

It is clear from these results that clinic use does not affect users' perceptions of source trust and advice quality. However, results surrounding the frequency of access to PDEAR are particularly interesting to look into more details. There is also a difference in the perception of convenience of the field as a place to access information between male plant clinic users and non-plant clinic users. This may be because non-clinic users do not use clinics because they do not find their location convenient or it may be possible that plant clinics affect users' perceptions of location convenience.

Having explored farmers' perceptions of information access in a PW and non-PW district, this study focuses now on the service provision; more specifically the direct providers of information, the extension workers working under the public rural advisory service body, PDEAR.

4.3. Extension Worker Perceptions

One hundred and eleven male extension workers from six different PW districts (Dera Ghazi Khan (DG Khan), Khanewal, Multan, Muzaffar Garh, Pakpattan and Sahiwal) involved in the PW programme were interviewed to understand their views regarding farmer information access. Twenty-six were plant doctors in the PW district, physically attending and giving advice to farmers in their area, while the remaining 85 (of which 40 were in the PW district and 50 were in the non-PW district) were not (Table 3).

Table 3. Plant doctors and non-plant doctors' perceptions of farmers information access in PW and non-PW districts. Comparing Plant Doctors and Non-Plant Doctors' Perceptions of Male Farmers' Information Access.

Analysis	N (x)	N (y)	Z Score	Comments
In PW and Non-PW District				
Perceptions of farmers' overall access frequency between plant doctors (x) and non-plant doctors (y)	26	85	**z = 7.94 ****	*Plant doctors think farmers access information more regularly than non-plant doctors*
Perceptions of farmers' access frequency to agrodealers between plant doctors (x) and non-plant doctors (y)	26	85	**z = 4.37 ****	*Plant doctors think farmers access agrodealers information more regularly than non-plant doctors*
Perceptions of farmers' access frequency to radio between plant doctors (x) and non-plant doctors (y)	26	85	**z = 8.38 ****	*Plant doctors think farmers access radio information more regularly than non-plant doctors*
Perceptions of farmers' variety of information sources between plant doctors (x) and non-plant doctors (y)	26	85	z = 1.45	*No significant difference between results*
In PW District				
Perceptions of farmers' access frequency to PDEAR between plant doctors (x) and non-plant doctors (y) in PW district	26	40	**z = 6.06 ****	*Male farmers access more information in general according to plant doctors*
Perceptions of farmers' variety of information sources between plant doctors (x) and non-plant doctors (y) in PW district	26	40	z = 1.45	*No significant difference between results*

** Significant result at $p << 0.05$.

4.4. Comparing Plant Doctors and Non-Plant Doctors' Perceptions in Both Districts

When comparing perceptions of the 26 male plant doctors to male extension workers who were not involved as plant doctors in both a PW and non-PW district ($n = 85$), plant doctors believe male farmers access information sources significantly more often ($z = 7.94$; $p << 0.05$), particularly from agrodealers ($z = 4.37$; $p << 0.05$) and radio ($z = 8.38$; $p << 0.05$). Interestingly, there are no significant differences regarding PDEAR. Plant doctors also believe male farmers access a wider variety of information sources when compared to non-plant doctors (17 compared to 15) although this difference is not statistically significant ($z = 1.45$; $p = 0.14 > 0.05$).

4.5. Comparing Plant Doctors and Non-Plant Doctors' Perceptions in PW District

When results from extension workers in a non-PW district are removed from the study and the 26 male plant doctors are compared to 40 other non-plant doctors in a PW district, results are similar to the previous analysis. Again, plant doctors believe that male farmers utilise information sources significantly more often than non-plant doctors do ($z = 6.06$; $p << 0.05$), although there are no significant differences when the study focuses on individual sources of information. There are no significant differences between the two groups regarding the variety of sources that male farmers access ($z = 1.45$; $p = 0.14 > 0.05$).

Results suggest that the presence of the PW programme and active participation in plant clinic activities can be linked to a change of perception, particularly surrounding information access frequency. Further qualitative analyses will be needed to better understand these differences in perceptions. In the next section, the study reviews RAS providers' perceptions of the programme's impact on their individual duties and the national and local RAS network.

5. Measuring Extension Professionals' Individual Perceptions of Plantwise Impact On RAS

A survey of male and female extension professionals working for PDEAR and involved in the PW programme was also conducted to understand their perceptions of the PW programme's impacts on ownership, linkages in the RAS system and their personal contact with other professionals and end-users (Table 4). The interviews targeted different job positions: 57 field assistants, 49 agricultural officers, four agricultural inspectors and one sales officer. Eighty-five participants ran a regular clinic, twenty assisted in the running of the clinic, three were in charge of entering the data and three validated the data. An equal gender disaggregation and statistical analysis between two independent populations was not possible for this particular study as only five women were interviewed for 106 men. A qualitative gender disaggregation will however be conducted.

Results show that participants perceived the national and provincial administrations to have strong ownership of PW activities, with staff interviewed demonstrating a clear understanding of the programme's aims and objectives. Indeed, 91% of participants believed plant clinic systems are owned and regulated by public institutions, notably PDEAR and all participants stated the ultimate plant clinic beneficiaries were rural households. The remaining nine percent believed plant clinics were exclusively run and owned by the PW programme. This could be due to the consideration of non-plant clinic related activities, such as the data management and analytical processes in the Knowledge Bank run by data managers/validators, although there were no significant correlations between these answers and the professional position the participants held or their role in the PW programme. Moreover, 85% of participants involved in the programme agreed that "an extension worker is a plant doctor," rather than "a plant doctor is an extension worker." This suggests that plant doctor designations are an attractive notion to extension workers and could perhaps mean more to them than the traditional "agricultural extension worker" designation.

A large proportion of participants (89%) believed PW had positively changed how official public extension departments and extension workers accomplish their duties. This is certainly true of their capacity to interact with other sectors of RAS networks: 90% of participants agreed that PW

enabled them to have more opportunities to discuss issues with other stakeholders, such as pesticide dealers or university researchers and other extension professionals. Moreover, participants felt the programme enabled a greater interaction with producers of agricultural information, such as research. However, they did not feel the programme helped support better links to other providers of agricultural information. This directly contradicts the above statements about the improved linkages to pesticide dealers.

Table 4. Male and female extension worker perceptions of the PW programme. Individual and Institutional Perceptions of PW Impacts.

Statements		***Likert Scale n = 111 (106 Male and 5 Female)***				
The programme …	*Gender*	*Do not agree at all*	*Do not agree*	*Neutral*	*Agree*	*Agree very much*
… has increased contact with external organisations who provide advice	*Male*			102	4	
	Female			5		
… has increased contact with external organisations who produce advice	*Male*		1	9	96	
	Female				5	
… has increased my contact with other extension professionals in my department	*Male*			9	97	
	Female				5	
… has positively changed how the extension departments are accomplishing their duties	*Male*			10	96	
	Female				5	
… has positively changed how extension workers are accomplishing their duties	*Male*			11	95	
	Female				5	
… has increased communication with male extension workers	*Male*		1	8	97	
	Female				5	
… has increased communication with female extension workers	*Male*		95	10		1
	Female		5			
… has increased communication with male farmers	*Male*	1		8	98	2
	Female				5	
… has increased communication with female farmers	*Male*	1	4	101		
	Female			5		
… has increased contact with private extension companies	*Male*			11	95	
	Female				5	
… has increased contact with the academic sector	*Male*			10	96	
	Female				5	

NB: negative statements are available but have not been inputted for ease of reference. they mirror the positive statements found in the table above.

In the majority of these results, women participants' answers mirrored the perceptions of their male colleagues. However, results of individual interactions from a gendered perspective tell a different story: while 92% of all participants believed the programme has contributed towards an increased interaction between fellow male extension workers and male smallholder farmers, 89% of men and all six women believed the programme did not increase their interactions with female extension workers. Similarly, 96% of men and all six women considered the programme's efforts to increase female farmer contacts as "neutral." The programme has certainly improved or increased certain interactions at the institutional and individual levels but has not improved gendered interactions over time. It may be worth considering further analyses as to why this may be the case.

The next section considers the programme's effects on systemic processes, asking key stakeholders to visualise and quality their perception of RAS networks in terms of farmer advisory services.

6. Plantwise Impacts on Perceptions of Systemic Processes

Six group exercises were conducted, three in a PW district and three in a non-PW district. The groups were composed of field assistants, agricultural officers, deputy/executive district officers and assistant directors. Only one group (X5) was female. Results are visualised in Figure 1.

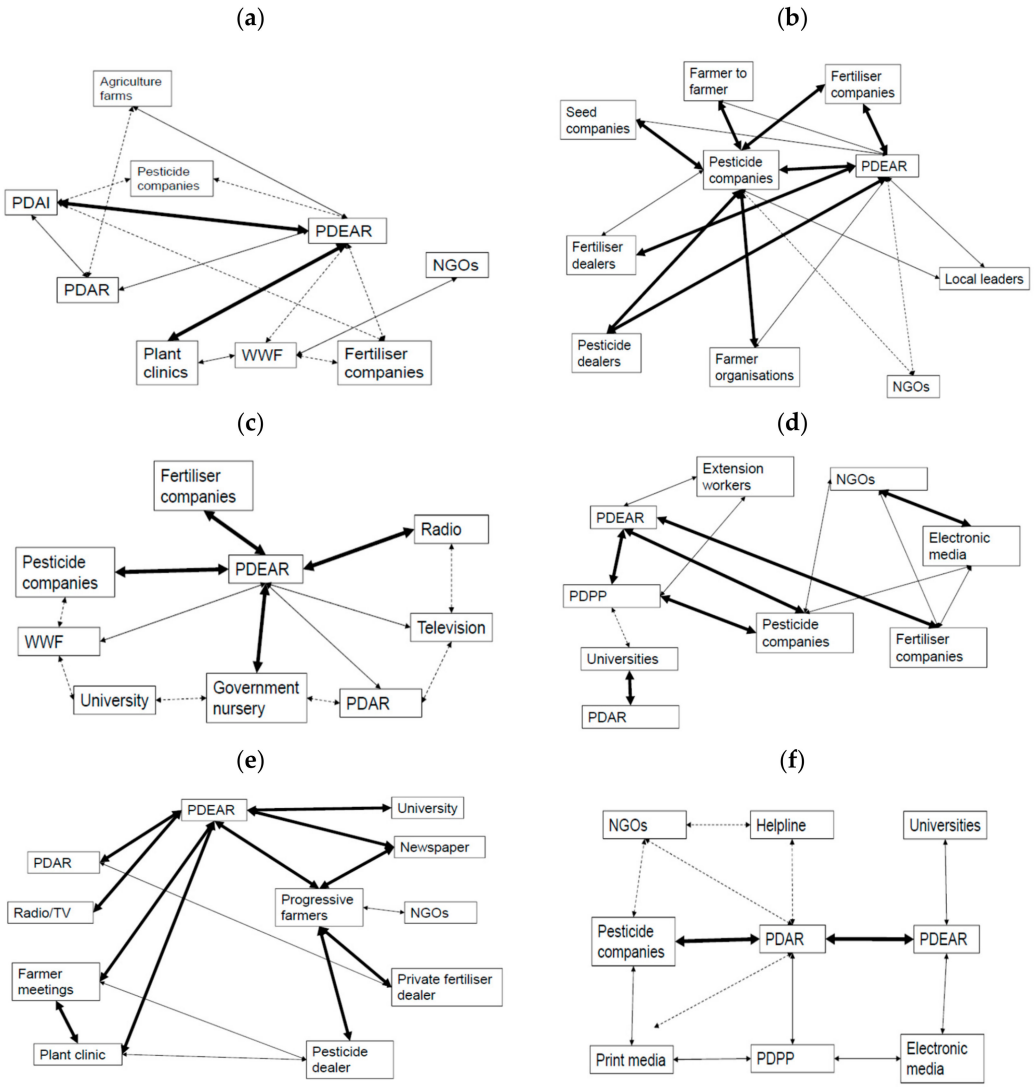

Figure 1. Rural advisory services' systems visualisations from a PW and non-PW district administration. (**a**) X1 Bahawalpur, (**b**) X4 Jhang, (**c**) X2 Bahawalpur, (**d**) X5 Jhang (female), (**e**) X3 Bahawalpur, (**f**) X6 Jhang.

Results in Table 5 indicate the three groups in the PW district adjudged PDEAR to possess the highest interaction scores in all three network diagrams (interaction scores of 7.5_{X1}, 11_{X2} and 14_{X3}). Public bodies, such as agricultural research (PDAR) were also well connected, being linked to public, communication and private sector entities (interaction scores of 5.5_{X1}, 5_{X2} and 3_{X3}) whilst others were less so: The Provincial directorate of Agricultural Information (PDAI) is mentioned only once in the entire exercise. The private sector was perceived to be on the fringes of RAS networks in PW district focus groups (interaction scores of 2.5_{X1}, 4.5_{X2} and 7_{X3}). Interestingly, two groups mentioned "plant clinics" separately to PDEAR (interaction scores of 3_{X2} and 5_{X3}) that have strong and medium linkages with other stakeholders, especially PDEAR. This relationship is based on "knowledge sharing, cooperation, collaboration and feedback mechanisms." Plant clinics were also seen to interact with NGO programmes, such as the World Wildlife Fund (WWF), the private sector through pesticide dealers and with community-based services—through farmer meetings for example.

Table 5. Interaction scores between stakeholders in a Rural Advisory Service (RAS) network in a PW and non-PW district administration.

District	Group	Group Composition	PDEAR	Private Sector RAS	Other Public Bodies	NGOs	Electronic or Print Media	Universities	Plant Clinics	Farmer Organisations	Farmer to Farmer	Local Leaders	Agriculture Farms	Helplines
Bahawalpur	X1	4 agricultural officers from PDEAR	**7.5**	2.5	5.5	4.5			3				1.5	
	X2	1 deputy district officer and 1 agricultural officer	**11**	4.5	5	2	4	1						
	X3	4 agricultural officers from PDEAR	**14**	7	3	0.5	6	2	5	5	8.5			
Jhang	X4	3 agricultural officers from PDEAR	12	**27.5**						3	3	2		
	X5 female	1 deputy district officer and 1 agricultural officer	9	**10**	7	4	4	2.5						
	X6	1 assistant director and 2 agricultural officer from Pest Warning Department	4	3.5	**9.5**	1.5	4	1						1

(Assumptions:' PDEAR' includes 'extension workers'; 'Other public bodies' include 'government nurseries,' 'PDAR,' 'PDPP,' 'PDAI'; 'NGOs' includes 'WWF'; 'Farmer organisations' includes 'farmer meetings'; 'Farmer to farmer' includes 'Progressive farmers').

In the three non-PW district groups, interaction scores show a different story. The private sector stakeholders were more prevalent, leading the interaction scores (interaction scores 27.5_{X4}, 10_{X5} and 3.5_{X6}) in two of the three groups. Indeed, its representation was shown by multiple stakeholders: pesticide dealers, fertiliser dealers and seed companies. They shared the principal role in the system and interacted with, PDEAR (interaction scores 12_{X4}, 9_{X5} and 4_{X6}), which itself interacted regularly with other public sector bodies through regular plant health information sharing. PDAR and PDPP were also perceived to have an important place in the network.

It seems there is a more equal share of responsibilities in the non-PW district compared to perceptions of participants in the PW district. Indeed, it seems that the PW programme might be influencing perceptions of public extension services' capacity, visualising a more public service centric model, away from the trends of increasingly privatised extension models in the Punjab province of Pakistan. Although these visualisations are interesting to interpret, it is hard to accurately gauge a difference in systematic organisation purely through small group exercises, although these might be useful initially to highlight potential differences.

7. Discussion

The sustainable and long-lasting integration of RAS initiatives into existing systems requires on the one hand organisational, logistical and administrative inclusion and on the other a conscious openness to socio-cultural change in formal and informal gendered interactions. The following discussion focuses on the study's research questions: has the PW approach contributed to a change of institutional and individual perceptions of public provincial RAS systems? Secondly, can the study's results offer theoretical insights into gender-responsive agricultural information access initiatives? This enables the study to reflect on clear prospective strategies that link the PW programme activities to impactful, gender-focused transformative change.

7.1. Perceptions of Plantwise Organisational Impacts

Specific non-gendered analyses focusing directly on the influence of PW—utilising plant doctors and non-plant doctors in both districts and then conducting a comparison in the PW district only—did uncover some interesting results: plant doctors in a PW district felt farmers accessed information more often than extension workers in a non-PW district and a further analysis focusing on plant doctors and non-plant doctors' perceptions of farmers' information access in the same PW district showed that plant doctors felt that farmers were accessing more information through PDEAR.

As with the farmer-based results, this extension worker study also does not clearly show that active participation in plant clinics is contributing to a change in their perceptions of farmers' information access. However, a correlation between PW involvement and increased perception of the preponderance of PW in RAS does exist. This correlation is apparent as the study considers the RAS network perception results: indeed, while respondents in the non-PW district perceived there to be a more equal share of responsibilities between the public and private sector in RAS, in the PW district, PDEAR and other public services were perceived to be the most important stakeholder RAS network.

Could PW be contributing to a positive perception of PDEAR's capacity to deliver RAS? As the PW programme indeed works exclusively with PDEAR in three provinces in Pakistan and all plant doctors and system operators reside in public offices, this seems a plausible explanation. This is corroborated by the results from perceptions of extension workers who are working in the PW programme. Moreover, preliminary findings surrounding the programmes' impacts on institutional perceptions are overwhelmingly positive: individuals state there are more opportunities to interact and higher quality exchanges, with the private sector and academia regarding farmer advisory services; moreover, extension staff also have a clear understanding of programme ownership and its aims in the community.

7.2. Perceptions of Plantwise Institutional Impacts from a Gendered Perspective

Understanding the programme's impacts on socio-cultural institutions such as the empowerment of women are very hard to directly quantify. Even though the study's preliminary results are consistent with previous findings regarding men and women's choice of information sources and the frequency of their access (Hassan et al. 2007; Lamontagne-Godwin et al. 2018), general comparisons between datasets in a PW and non-PW district did not produce substantial evidence of PW impacts on male and female farmer perceptions of information access, location convenience, source variety, trust and perception of advice quality.

However, certain male-focused analyses did provide some interesting findings, worth discussing in more detail. Where PW has had the opportunity to have more influence due to male farmers' attendance at clinics, we find some interesting correlations. Men in a PW district access PDEAR and agrodealers significantly more often than men in a non-PW district. Moreover, men specifically interacting with plant clinics also access PDEAR and agrodealers significantly more often and also dislike accessing information from domestic locations—a more traditional extension method (Rivera 2011)—more than non-plant clinic users in a PW district. These specific results suggest that plant clinics could be enabling male farmers who are interested in receiving information from public services outside of the more traditional home or field visits. A plant clinic could therefore possibly be viewed as an agent of change, as clear links exist between PW initiation and plant clinic use and an enhanced interaction between male farmers and public RAS actors. Clearly, some specific qualitative research activities, such as focus groups and key informant interviews would help bring a greater understanding, particularly regarding perceptions to education and perceptions of access.

Regarding female related analyses, it would perhaps be unrealistic to assume that PW would have any effects on women's perceptions of access, trust, quality and convenience given their low turnout to plant clinics and current prohibitive socio-cultural norms (Lamontagne-Godwin et al. 2019a; Tsegaye et al. 2018). There are also some further discouraging signs from extension worker perspectives: for instance, while male extension workers working in the PW programme believed they interacted more than before with men from other departments and from men in rural households (namely through plant clinics), their interactions with women in professional settings (i.e., with women in other public departments) and with female farmers did not improve. This further reinforces the evidence that men in RAS involved with PW are not indicating any changes to their gender-based interactions in a professional capacity. Again, some further focus group discussions would improve our understanding of the situation and help policy makers with clear guidance, specifically to identify the reasons in more detail that prevent men professionals to work with women.

How do these male and female-specific findings relate to the PW programme attempts to create opportunities for gender transformative change? Clearly, improved information access for both genders is important and a key aim of the programme. From a male perspective, some key elements should be reviewed: men in a PW district believe that the marketplace and administrative locations are less convenient locations to access information than men in a non-PW district. This is important to note, considering that many plant clinics are held at or near marketplaces in the Bahawalpur district (Plantwise 2019). Moreover, the overwhelming acceptance of spiritual location by both genders as an acceptable place to access information should also be seriously considered. These findings could significantly improve the efficiency of plant clinic services and help test long-held assumptions.

However, this study cannot categorically state that the active participation in plant clinics is contributing to a change in farmers' perceptions of information access, much less from a gendered perspective: indeed, the fact that plant clinics are hardly visited by women makes it extremely hard to investigate gendered perceptions of agricultural information access when it comes to the role of clinics. In 2018, Plantwise took the steps to increase women's participation in the programme, developing women only plant clinics in Pakistan (Plantwise 2019). Over 377 plant health queries were recorded. In order to better understand the impacts and provide a clearer gender aware strategy in Pakistan it will be important to analyse this specific initiative in more detail from a variety of angles. Firstly, what type

of issues did the women bring to the clinics and are they reflective of the roles they have in agriculture (Doss 2002)? Secondly, were the recommendations they were given to deal with the plant health problem gender aware, an issue highlighted in previous studies (Lamontagne-Godwin et al. 2017). Finally, are clinics' being held at locations and timings suitable to women's schedules? These activities and the gender-specific findings in this study—the attractive nature of spiritual locations or indeed the significantly greater activity of women's agricultural information access in a non-PW district—should be supported by further in-depth quantitative and qualitative analyses of the socio-economic factors that influence women's access to agricultural information (Lamontagne-Godwin et al. 2018). These would provide the programme with a deeper understanding of the influence of socio-cultural norms have on female information access behaviours and a clearer strategy on how to provide gender responsive RAS.

8. Conclusions

The study helps to highlight an initiative's impacts on systemic processes which ultimately have the potential to contribute to gender-transformative change and a more efficient and sustainable RAS. Using an established and dynamic programme can offer some interesting insights, as well as the opportunity for the programme to take findings on board in the future.

While it is clear that plant clinics as a technology offers some useful access for a certain population in rural areas, its development into a specific tool has also limited it access to another group in society. Indeed, Plantwise has achieved a great deal in Pakistan since its inception in 2011. Its organisational impacts on RAS networks are clear to see, as well as its impacts on individuals working within the programme. However, it is vital to analyse the programme from a gendered perspective in order to learn important lessons and aim for longer-term transformative change and move away from simplistic project-delineated outputs which focus on erroneous socio-economic assumptions. Some further qualitative analyses would be extremely useful in this respect.

Whilst the programme may have some good organisational impacts as mentioned, it must improve its understanding and application of gender-responsive activities at all levels of programme implementation. The lack of female presence from an end-user and extension practitioner's perspective is symptomatic of current gendered socio-cultural and professional norms. The programme should focus on actively understanding these and how it can offer an opportunity for equal access to agricultural information. In more practical terms, it should also develop opportunities to integrate a higher proportion of female professionals within its programme, thinking creatively and piloting potentially gender transformative schemes, such as the women only plant clinics or other schemes identified in other gender literature.

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