Australian Government

Australian Centre for International Agricultural Research

Final report

Project full title	**VIA business models in Pakistan**
project ID	WAC/2020/180
date published	07 February 2024
prepared by	Simon Dyer
co-authors/ contributors/ collaborators	IWMI Pakistan, Haji Sons, RBDC Pvt Ltd
approved by	Dr Neil Lazarow, Research Program Manager, Water
final report number	FR2024-031
ISBN	978-1-923261-22-8
published by	ACIAR GPO Box 1571 Canberra ACT 2601 Australia

Contents

1 Acknowledgments

The Virtual Irrigation Academy would like to acknowledge ACIAR for their support not only in funding this activity, but the assistance provided by the Pakistan office to conduct the activities under the project. Local collaboration with IWMI Pakistan and NUST was highly beneficial to the outcome of the project. Finally to the teams at Haji Sons and RBDC Pvt Ltd for their dedication to assisting farmers, willingness to adopt new technology and the persistence to incorporate it into their businesses.

2 Executive summary

Background
Irrigated cropping is critical to Pakistan's economy and food security. Affordable and accessible technologies are needed to assist farmers in Pakistan to improve productivity and water use efficiency. Virtual Irrigation Academy Ltd (VIA Ltd) is an Australian not-for-profit company whose primary purpose is to provide relief of disadvantage to smallholder farmers in low- and middle-income countries. One way they do this is through the manufacture of effective and accurate tools for monitoring soil water and solute levels. This research activity sought to test and validate business models for the distribution of these tools in Pakistan that are both financially viable and beneficial to farmers.

Methodology
Using a 'Grand Challenge' methodology the project engaged local private organisations to test implementation models with a wide variety of farmers facing challenges such as water scarcity, salinity and the inequitable distribution of water. Overall, 147 locations, across 9 districts, were reported as participating in the activities covering over 1715 Ha of crop land. Despite strong local evidence of the benefits of the tools from previous projects, participants noted initial reluctance from farmers to use the tools. This adoption barrier was overcome through engagement with existing customer bases, the incorporation of upfront training and capacity building activities and ongoing user support and advisory services. The project locations included sites operated in collaboration with IWMI, to provide further analysis on the benefits of the products and to field test the newly developed 'salt chameleon card'.

Results
The private sector collaborators, Haji Sons and RBDC Pvt Ltd, found that simple wholesale distribution models appear to be ineffective. Demand for VIA products appears to be directly linked to the ability for organisations to deliver peripheral support, training and advisory services. Once this adoption barrier is overcome, farmers can see financial benefit in using the tools. IWMI documented the cost savings of 45 farmers in total, with notable crop results being 10% to 16% for cotton (n=3), 16% to 20% for wheat (n=33) and 27% for maize (n=5). Results indicated that the VIA products provided a positive cost to benefit outcome for over 70% of locations. Based on the findings and feedback from collaborating organisations, a user decision matrix was developed to assist organisations and customers in determining best fit product and service solutions for the VIA products. This can then be used as a guide for future implementation.

Recommendations
VIA Ltd should enter into formal partnership agreements with 2 of the participating organisations, Haji Sons and RBDC Pvt Ltd, for the ongoing distribution of tools in Pakistan. This would include additional capacity building activities to allow these organisations to diagnose, service and repair VIA products. Further development of the user matrix should be conducted to increase its usefulness as a guide to organisations seeking to deploy VIA tools both within Pakistan and elsewhere. Local production of the Wetting Front Detector should be investigated to reduce cost to farmers and remove complexity in importation of these items. Ongoing support from public sector and research institutions will be crucial to providing the credibility, advocacy and networks needed to expand the use of the products into new markets. Ongoing financial investment will be required to establish local manufacturing operations and to subsidise the cost of entry for farmers, particularly smallholders, wishing to adopt the tools. If this investment includes

adoption of the tools by public institutions for use in donor and public irrigation development projects, it will assist to increase awareness and drive demand for the products into the future.

Background

Irrigated cropping is critical to Pakistan's economy and food security. Rapid population growth and increasing water scarcity mean that effective management of the country's irrigation is an urgent priority for both national and provincial governments, as well as farmers, but has proved to be an intractable problem. A 2019 World Bank report entitled *Pakistan: Getting more from Water* concluded that:
At the basin-scale irrigation is estimated to be more than 80 percent efficient, ... The problems in irrigation are more to do with inefficient and unfair distribution of the water, and low productivity in terms of the yield and value of crops at unit of water used.
The report identified *installing real-time data acquisition systems for improved operation* as an urgent priority.

These are exactly the issues that the VIA is designed to address. The VIA links novel research in soil water and solute sensors to digital platforms, so that data can be captured, visualized, shared, and analyzed. This underpins a process of social learning designed to transform the small-scale irrigation sector. The value of the data for irrigation management at farm to scheme level has been clearly demonstrated in southern Africa (LWR 2014 085 and LWR 2016 137), and more recently in Pakistan (LWR 2014 074).
In Pakistan, the Farmer Learning project (LWR 2014 074) community facilitation teams have worked with farmers in 49 locations to explore the use of VIA soil moisture sensors (Chameleon and Wetting Front Detector (WFD)) to improve farmer irrigation skills.

Results from LWR 2014 074 indicate significant benefits in terms of irrigation profitability, labor, water and energy efficiency and social capital of farming households (Fatima, et al, 2022). As shown in Figure 1 below all farmers decided to give their Monitored plot the same or less water than the Control and obtained the same or higher yield.

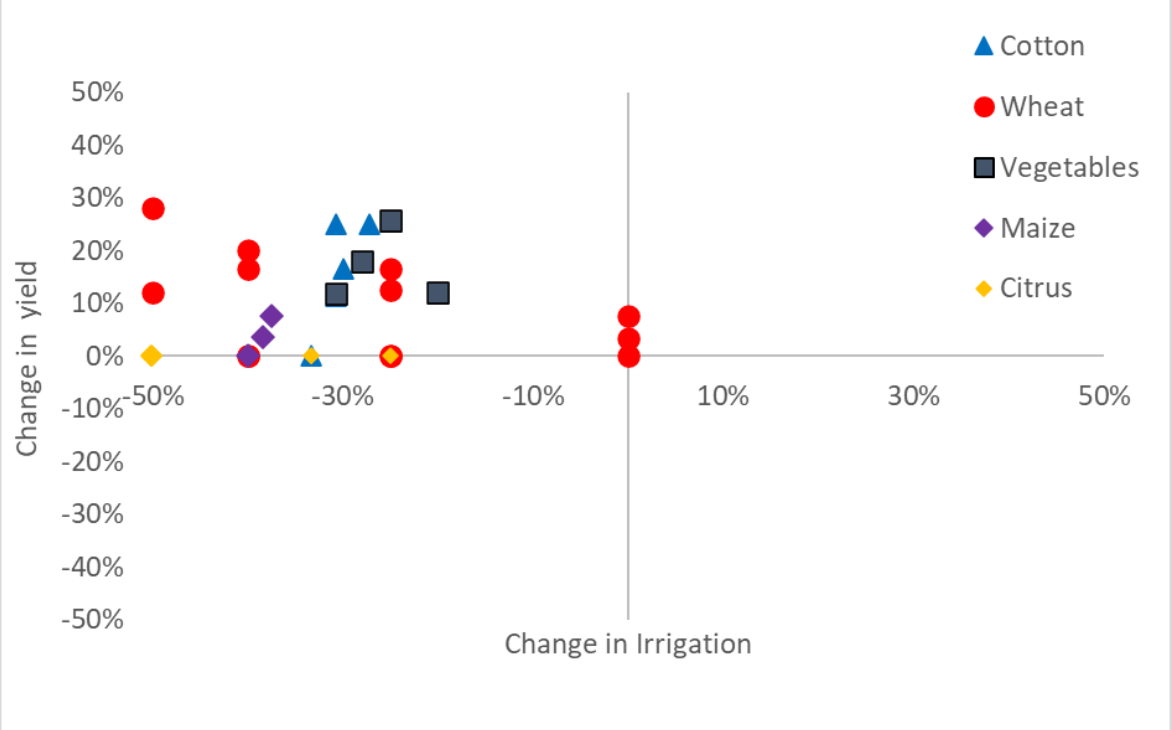


Figure 1. Percentage change in irrigation plotted against percentage change in yield for individual farmers in year 2 of LWR 2014 074 project.

The success of the sensors in LWR 2014 074 attracted attention from farmers, irrigation managers, researchers and government officials and there is significant interest to disseminate the sensors beyond the current project sites. The Federal Minister for Science and Technology through the Chairman of Pakistan Council of Research in Water Resources (PCRWR) has requested ACIAR CEO investigate with CSIRO opportunities to deploy Chameleon sensors more widely in Pakistan, and feasibility of producing the sensors in Pakistan under license. This formal government request, attached as Appendix 1, was the catalyst for this activity. During the period between the request being made, ACIAR developing a concept note for the SRA and the final proposal being developed, VIA was spun out of CSIRO through their Innovation Accelerator Program. It was determined by all parties that given the business centric nature of the proposed activity, the newly formed VIA company would be a more appropriate organization to conduct the research.

Virtual Irrigation Academy Ltd (VIA Ltd) is an Australian not-for-profit company that was created as an outcome of WAC 2018 162; VIA phase 2: From water monitoring to learning to governance. VIA Ltd's primary purpose is to provide relief of disadvantage to smallholder farmers in low- and middle-income countries and they aim to do this through the manufacture of effective and accurate tools for monitoring soil water and solute levels. Under VIA's licence agreement with CSIRO, there exists the rights to sublicence the relevant manufacturing and distribution to third parties, thereby increasing in-country availability of the tools should there be sufficient demand to justify this course of action.

As noted by LWR 2014 074, new water conservation technologies are usually demonstrated to larger farmers, because they have greater capacity to adopt. Yet once small to medium scale farmers became aware of the monitoring tools could save them money, they were keen to engage and to learn from their own experience and other farmers. This project also noted the challenges of implementation, data collection and support for famers spread over wide, rural areas. Even with dedicated project resources and budget the project struggled to get meaningful information from more than 50% of the participating farmers. Similar challenges have been noted by VIA for the implementation in Malawi conducted under VIA Phase 2 (WAC 2018 162). As the local partner organisation scaled their operations to more farmers and new regions the quality of implementation and data collection declined due to local operational factors and the difficulty of travel in rural areas of Malawi.

Another barrier to implementation is disconnect between the end user and the systems for supply, ongoing maintenance, repairs and technical support. Timely and cost-effective shipping of VIA products has been a significant challenge in several previous ACIAR projects in Africa and South Asia. In Southern Africa, LWR 2016 137 found that ongoing engagement with the tools was a challenge when the farmers did not have straightforward, locally based access to product support. The product distribution chain needs to factor in both initial supply of products and the mechanism for those farmers to access help when they need it.

3 Objectives

This project will address the overarching research question*: How can water and solute monitoring equipment be sustainably deployed into the irrigated farming sector in Pakistan?*

The Objectives are:

1. Use multiple approaches to create a VIA user decision matrix and scope out business opportunities for VIA product supply and related services.
2. Develop and deploy a Chameleon Card that identifies saline soils at site.
3. Share data outputs with key Pakistani agencies (PCRWR and Punjab Irrigation Department) to evaluate efficacy of inclusion of VIA data and services into existing management systems, and report on steps to support implementation.
4. Explore the feasibility of producing Chameleon sensor and Wetting Front Detector in Pakistan.

4 Methodology

The aim of the project was to engage start-ups, established agricultural businesses and research and government stakeholders to test different models of scaling the implementation of and creating a financially viable supply and service provision around VIA water monitoring tools.

This was done in 2 ways. For start-ups and agricultural businesses, the project used a 'Grand Challenge or Innovation Challenge approach. This methodology has become popular in recent years because it enables engagement with a wide pool of innovators from different business sectors, educational backgrounds and demographics. The Grand Challenge approach allowed for the testing of multiple models and strategies concurrently, while reducing implementation, administrative and operational costs by placing the primary reporting obligation, in the form of an incentive (more equipment and a potential new business or line of business), on the participants themselves.

Research and government stakeholders were provided equipment under the project to allow them to conduct their own activities. International Water Management Institute (IWMI) was engaged as a formal collaborator in the project. IWMI conducted 3 roles within the project; first was to facilitate the importation and distribution of equipment to all participants, second was to field test the VIA tools, including salt Chameleon sensors, third was to provide data and report on benefits of VIA equipment of 3 crops over a season. PCRWR was provided with Chameleon Wi-Fi kits to enable them to conduct ongoing testing of the products and collection of data for use within the public sector. IWMI was only tasked with the facilitation of import and distribution of the tools when no commercial partners could be found to conduct this activity. As a research organisation, IWMI has the advantage being able to get certain tax and duty exemptions on the importation of equipment. While this assists in maximising the equipment budget for this project, it does not provide an ideal, real world, test of the costs and processes required for import and distribution of these products.

Delivery of equipment was done in a 2-stage process to reduce risk and to facilitate a start as early as possible, without the need to wait for most of the equipment to be manufactured and delivered. For the first phase of the project the equipment used was sourced from existing Chameleon Card kits held at ACIAR office in Pakistan and equipment funded through surplus budget from LWR 2014 074 which had been previously agreed with University of Canberra, ACIAR and CSIRO. Given the strong interest in the VIA tools generated through project, and the request from the Pakistan government for further engagement with the VIA, a strong focus was placed on maximising the amount of equipment that could be made available in the country. VIA negotiated with all parties to gain agreement on utilising these surplus funds as additional equipment for this activity. Table 1 outlines the equipment supplied through budget from LWR 2014 074. This equipment was shipped to Pakistan in May 2022 in preparation for the project commencement.

Item	Qty	Value (AUD)
Chameleon Card starter kits (six sensors)	134	19,966
Wetting Front Detector (pair)	200	19,800
Chameleon Wi-Fi Arrays	100	7,500
Chameleon Wi-Fi Readers	25	4,500
VIA EC meter	50	3,000
Nitrate test strips - 100 pack (Merck)	30	3,300
Total	**539**	**58,066**

Table 1: VIA equipment supplied to SRA from LWR 2014 076 surplus funds.

To assist in the facilitation of the Grand Challenge activities, VIA Ltd engaged National University of Science and Technology (NUST) as a project collaborator. NUST has strong networks in the business and entrepreneurial sectors through their science and technology park in Islamabad. The commencement of this process was delayed by several months due to the national flooding disaster in Pakistan.

On 21st September 2022 a project kick-off meeting was held between VIA Ltd, ACIAR Pakistan, IWMI and NUST to launch the project and begin activates. At the conclusion of this meeting NUST led efforts to promote the Grand Challenge and attract applications from interested organisations. In October 2022, NUST conducted meetings for organisations within the science and technology park and promoted through related business networks. Online resources were provided and a dedicated page on the VIA website (https://via.farm/pakistan_innovation_challenge/) was created to help promote the Grand Challenge, provide additional information to potential applicants and receive applications. The application process and criteria were kept as simple as possible to encourage applications from any background. The requirement for a business plan was removed and replaced with an 11-question application form.

Despite twice extending the application deadline to a final date of 15th December, only 3 complete applications were received. The project team reviewed the submitted applications and determined that all 3 applicants that provided complete information would be selected to participate in the Grand Challenge Program. A summary of the application form questions and received submissions is listed in Appendix 2.

Applicant Summaries

Haji Sons – is an agricultural input and service provider that has been operating across Pakistan since 1996. They have previous experience in the introduction of new technologies to the local market and have been implementing partners in projects funded by World Bank, FAO and others.

Chattha Bio Care – is an agricultural business based in Gujranwala district with 3 years' experience in supply of seeds, fertilisers and other inputs to farmers. The also arrange farmer field days and other gatherings to interact with farmers.

RBDC Pvt Ltd – are based in Karachi and have more than 10 years' experience working with farmers. They also have a not-for-profit arm, Lok Sanjh Foundation, and between the two enterprises they have a network of over 100,000 registered farmers.

In January 2023, the selected participants were invited to complete the VIA's online training course 'The Water School'. At least 1 member of each organisation participated in The Water School. On 24th January 2023 an online webinar was held for the participants where the requirements of the Grand Challenge were outlined, and participants

had the chance to ask any questions regarding the VIA products or the project activities. Each organisation was provided with a copy of the VIA user matrix, shown in Table 3, to assist in the collection of farmer/user data relevant to this activity.

The purpose of this matrix is to collect the information required to understand the value proposition and viability of various VIA solutions for different farmer / user typographies.

User type	Farm size	Irrigation method	Problem to be solved	VIA solution provided	Solution implementation cost	Benefits or improvements realised	Viability of solution
Smallholder, commercial, WUG*, govt	Cropped Ha, total scheme size	Canal, pump, gravity, hand	Water scarcity, salinity, inequitable distribution	Chameleon card or WIFI, WFDs, data systems	Cost to farmer, total cost for scheme	Increased productivity, improved M&E	Cost/benefit analysis, requirement for subsidy

Table 3 User matrix to support VIA business pathway

* Water User Group such as smallholder farmers who have organisaed themselves into an association / co-op.

In February 2023, the 3 participating organisations were invited to collect their designated equipment from IWMI office in Lahore. Given the 3 organisations all had similar farmer bases and networks, each organisation received a similar amount of equipment. The initial distribution of equipment is shown in the table below.

Organisation	Chameleon Wi-Fi Arrays	Chameleon Wi-Fi Readers	Chameleon Card Starter Kits & 3 sensors	Wetting Front Detectors (pair)	Chameleon EC meters	Nitrate Test Strips (pack)
Haji Sons	4	2	24	52	8	2
RBDC Pvt. Ltd.	3	1	22	51	6	1
Chattha Biocare	2	1	20	50	4	1
Total	**9**	**4**	**66**	**153**	**18**	**4**

Table 4. Feb23 distribution to Grand Challenge participants

At this same time, IWMI was provided with an initial supply of equipment to begin their activities for the project. The breakdown of equipment supplied to IWMI in February 2023 is shown below in Table 5.

Organisation	Chameleon Wi-Fi Arrays	Chameleon Wi-Fi Readers	Chameleon Card Starter Kits & 3 sensors	Wetting Front Detectors (pair)	Chameleon EC meters	Nitrate Test Strips (pack)
IWMI 1	35	15	34	30	15	15

Table 5: IWMI equipment received February 2023

Once supplied with equipment, the Grand Challenge participants were encouraged to engage with farmers in any way they saw fit. VIA Ltd, NUST and ACIAR provided technical support and advice on the use of products during this time, but participants were free to implement in any way they chose. Participating organisations reported implementation of the tools across 9 districts in Punjab.

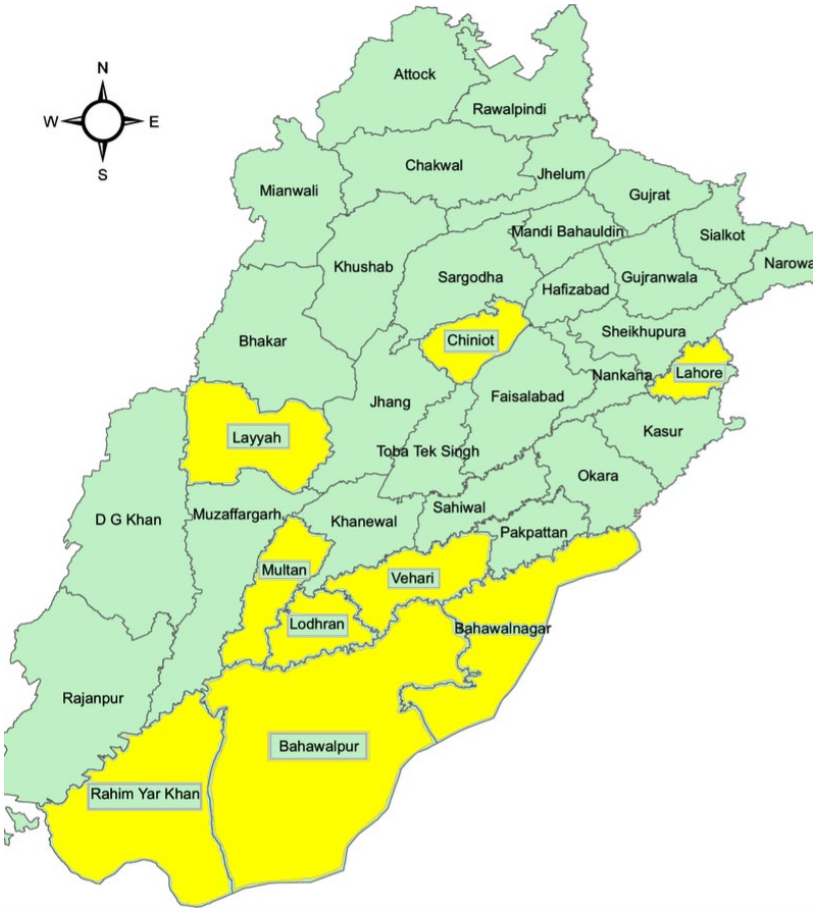


Figure 2: Map of districts where VIA tools were installed.

The supply of additional equipment to participating organisations was determined by 2 factors. First, was the in-country availability of the VIA equipment funded under the SRA. Second, was the submission of activity reports from participants regarding their engagement with farmers using the initial supply of products. VIA Ltd arranged shipping of the equipment and it was collected from the VIA factory in Pretoria South Africa on 5th January 2023 with an expected arrival in Pakistan on 25th February 2023. We believed this was a realistic timeline as the previous shipment in 2022 had taken a similar time, departing on 21 April 2022, and arriving in Karachi on 31 May 2022. However, for unknown reasons, the second shipment took much longer than expected to arrive, with final collection not occurring until 4th May 2023, more than double the expected delivery timeframe. With the delayed start of the project and subsequent shipping delay a request was made for a no-cost extension of the project end date to 31 December 2023, which was approved by ACIAR.

Once the second shipment was confirmed as being available, the Grand Challenge participants were requested to submit activity reports and any updated plans for further deployment of the VIA tools. Two of the participants, Haji Sons and RBDC Pvt Ltd submitted activity reports, which can be found in Appendix 3, and indicated their interest to continue participation in the Grand Challenge. Despite repeated attempts from VIA,

NUST and ACIAR, no reports or information was received from Chattha BioCare and their participation in the project ceased at this point. The equipment provided to them was not able to be recovered. At the request of ACIAR Pakistan, attempts were made to engage a new organisation for the second phase of the Grand Challenge. This organisation, Farmers' Integrated Development Association (FIDA), was a farmers' association who had participated in LWR 2014 074 and indicated interest in creating a business around the VIA tools. Despite receiving information regarding their proposed business model, included in Appendix 8, when attempts were made to contact them to arrange collection of equipment, there was no response. Due to the withdrawal of Chattha BioCare and the inability to contact FIDA, the project equipment was distributed to Haji Sons, RBDC, IWMI and PCRWR. The distributions were completed by September 2023. A summary of the final distribution is listed in Table 6.

Organisation	Chameleon Wi-Fi Arrays	Chameleon Wi-Fi Readers	Chameleon Card Starter Kits & 3 sensors	Wetting Front Detectors (pair)	Chameleon EC meters	Nitrate Test Strips (pack)
Haji Sons	150	30	150	180	60	120
RBDC Pvt. Ltd.	135	30	139	155	45	110
Chattha Biocare	0	0	0	0	0	0
IWMI	55	5	31	15	15	10
PCRWR	70	20				
Total	**410**	**85**	**320**	**350**	**120**	**240**

Table 6: Final distribution of equipment to project participants, June – September 2023

Both Haji Sons and RBDC had tools remaining at the end of the project period, 31 December 2024, but had plans for further deployments to new and existing farms in the first half of 2025 as documented in their individual reports. During this phase, the project team supported PCRWR through the supply of Chameleon Wi-Fi for deployment at PCRWR research and demonstration farms at Sargodha (Citrus) and Quetta (Apples). The intention of this was to build on the outputs of LWR 2014 074 and increase the number of locations collecting data and enabling the project team to better understand the value of collecting data at scale to support decision-making. At the conclusion of the project period, PCRWR had not yet deployed the tools into the field.

This project also introduced a modified VIA product: the "Salt Chameleon Card" as well as updates to the Wi-Fi reader software to identify high salt. This feature was made available on all equipment imported to Pakistan in relation to this project. This additional product feature has been created in response to findings from project LWR 2014 074 and the background work to create these features was done as part of this SRA but before formal commencement of the project. Data from LWR 2014 074 showed that several irrigation sites had soil water EC values >4 dS/m. These sites were identified by measurement of a soil water extract obtained through WFDs. The traditional definition of a saline soil is a soil with saturated extract ECe > 4 dS/m, although many fruit and vegetable crops can be affected at salinities in the range of 2-4 dS/m. A salt sensitivity analysis on the Chameleon sensor was conducted to determine how a Chameleon sensor is affected by salt and to determine appropriate indication thresholds to indicate salinity levels.

The final activity in the project was the evaluation of the various business models and field trail data for effectiveness and sustainability, with the overlay of purchase of products. This evaluation has enable the creation of a VIA user matrix. The matrix breaks the down the various users of VIA under this project, highlight what problem each faces, the solution provided, the product implementation cost and the benefits realised by the user. This matrix, and feedback from participating organisations was then utilised to create a decision tree to identify the appropriate solution for new user.
spacing

Based on VIA Ltd's current product pricing and the freight and importation costs from both shipments related to this project the following price guide, shown in Table 7, has been developed as an indication of per unit wholesale cost in Pakistan.

VIA Tool	Total Qty	Unit Cost (AUD)	Freight Estimate (AUD)	Customs Duty (AUD)	Total Cost (AUD)	Total Cost per Unit (AUD)	Unit Cost (PKR)
Chameleon Card Kit (Card Reader and 3 sensors)	454	100	1,177	346	46,923	103	18,811
Chameleon Wi-Fi Kit (Wi-Fi Reader and sensor array)	605	255	1,254	369	58,023	260	47,271
Wetting Front Detector with EC Meter and Nitrate Strips	990	190	11,830	3,482	77,412	220	40,004
Total	**2049**		**14,261**	**4,197**	**182,358**		

Table 7. Import cost per unit of VIA tools, including freight and customs fees.

In determining viability of the VIA solution to farmers, a comparison has been made between the gross landed cost per item and the indicated gross benefits of 4 crops as reported by LWR 2014 074 as shown in Table 8. The findings from LWR 2014 074 were best case scenarios, taken from a large number of participants, and therefore not representative of all cases. They are useful in their demonstration of the three streams of economic benefit provided by the VIA tools. While not all farmers will realise the full benefit from each stream every season, reported findings from Pakistan and Africa do indicate that the majority of users will gain benefit from at least one stream.

Crop	Saving in irrigation (AUD)	Saving in fertiliser (AUD)	Benefit in high yield (AUD)	Gross benefit (AUD)	Gross benefit (PKR)
Cotton	73	134	158	366	66,552
Wheat	73	149	224	446	81,220
Sugarcane	110	134	1,036	1,281	233,068
Banana	73	134	0	207	37,758

Table 8. Gross Benefits per hectare using Chameleon moisture sensor modified from LWR 2014 074

Viability of the solution has been set at a Net Benefit of AUD150 (PKR27,300) per location. This value has been selected to provide a margin to cover variations in actual benefit realised and provide for any additional costs suppliers may add to the price paid by farmers. This viability figure has been used to help create the decision matrix.

5 Achievements against activities and outputs/milestones

Objective 1: To use multiple approaches to create a VIA user decision matrix and scope out business opportunities for VIA product supply and related services.

no.	activity	outputs/ milestones	completion date	comments
1.1	Engagement with existing and potential in-country partners and prospective entrepreneurs and SMEs regarding VIA tools	Determine level of interest from entrepreneurs and SMEs. Determine locations for operation of grand challenge	31 Oct 2022	Whilst the SRA did not engage with as many SMEs as initially anticipated, and other dropped out in early stages, those organisations who did participate reported keen interest in the tools and both SMEs and farmers saw benefits from their introduction
1.2	Conduct webinar and information session for interested participants	Webinar. Grand challenge webpage. Online training resources. Business plan template. Applicant scoresheet	24 Jan 2023	21/09/22 – project kick off meeting with IWMI, NUST, ACIAR 04/11/22 – meeting with IWMI Pakistan to discuss their role October-December 2022 – NUST led efforts to identify potential SMEs. Webpage created with details and links to additional information and application templates and resources. Online training course and how-to guides provided to all participants. Participating SMEs were given online training and information session on 24/01/2023 Further training and support was provided over email and WhatsApp throughout Phase 1
1.3	Determine Grand Challenge Phase 1 participants and supply with equipment	Submission of applications by prospective organisations	31 Jan 2023	Formal applications were received from 3 organisations, and there were additional expressions of interest received by NUST. The 3 formal applicants all presented strong cases for participation and were supplied with equipment to conduct phase 1 activities
1.4	Review and evaluation of phase 1 participants and supply of equipment to those continuing to phase 2	Submission of progress reports by participating organisations	30 Aug 2023	Progress reports were submitted by 2 SMEs. Both reported strong engagement from farmers and expressed interest in continuing. New equipment was supplied to SMEs through IWMI/NUST.
1.5	Create VIA user decision matrix	User decision matrix	30 Jan 2024	Decision matrix modified to include more service options based on financial viability and farmer preferences highlighted by participants

PC = partner country, A = Australia

Objective 2: To develop and deploy a Chameleon Card that identifies saline soils at site.

no.	activity	outputs/ milestones	completion date	comments

2.1	Pilot assessment of Chameleon sensor response to salt	Mapping of the effect of external salinity on the blue to green switch point and the minimum resistance for Chameleon sensors	Pre project	Complete
2.2	Selection of thresholds to identify saline soils	Thresholds coded into Chameleon operating software and LED colour display determined	Pre project	Complete. A Chameleon Card will flash purple when the soil is wet and the salinity is above 4 dS/m A Wi-Fi reader will display blue on the reader but will display as pink lines over the blue colour on the website
2.3	Salt Chameleon Cards designed and built	Introduction of new firmware to all Chameleon readers built in Pretoria factory	30 June 2023	Complete. All Chameleon readers shipped under this SRA budget included ability to identify saline soils

PC = partner country, A = Australia

Objective 3: To share data outputs with key Pakistani agencies (PCRWR and Punjab Irrigation Department) to evaluate efficacy of inclusion of VIA data and services into existing management systems, and report on steps to support implementation.

no.	**activity**	**outputs/ milestones**	**completion date**	**comments**
2.1	Report to PCRWR regarding in-country demand for VIA products, areas of opportunity, feasibility of in-country assembly of VIA products and the role of VIA data in governance of water	Report to PCRWR	30 Jan 2024	Refer attached report

PC = partner country, A = Australia

Objective 4: To Explore the feasibility of producing Chameleon sensor and Wetting Front Detector in Pakistan.

no.	**activity**	**outputs/ milestones**	**completion date**	**comments**
4.1	Feasibility analysis on Chameleon and WFD production in Pakistan	Presentation to stakeholders	30 Jan 2024	Refer attached presentation

PC = partner country, A = Australia

6 Key results and discussion

The aim of the project was to engage start-ups, established agricultural businesses, research and government stakeholders to test different models of scaling the implementation of and creating a financially viable supply and service provision around VIA water monitoring tools. While the project did not engage the number or variety of organisations it was hoping to those who did participate in the entire project were highly engaged and able to test implementation models with a wide variety of farmers facing a range of challenges. Overall, 147 locations were reported as participating in the activities covering a total of over 1715 Ha (refer Appendix 5).

Deployment of Equipment

The project provided equipment to both the International Water Management Institute (IWMI) and Pakistan Council for Research in Water Resources (PCRWR). IWMI provided the equipment to 40 locations and provided training and support to the farmers and groups. These ranged from very small farmers (less than 1Ha each) to large Water User Groups and commercial holdings operating over 50 Hectares. IWMI has produced a report on the deployment of VIA tools in the project and the data and findings have been incorporated into this report. Their report 'Enhancing Water Resource Management through VIA Soil & Water Monitoring Tools in Pakistan's Agricultural System' is attached to this report. No data was received from PCRWR regarding their deployment of equipment. There are some possible reasons for this. First, key individuals in PCRWR who were familiar with VIA tools through LWR 2014 074 moved into new roles. Second, as no budget or specified roles was allocated to PCRWR as part of the project design, they may not have had sufficient internal resources to conduct this activity.

The 'Grand Challenge' portion of the project was designed to provide the opportunity for both existing agricultural businesses and start-ups or entrepreneurs to engage with the VIA monitoring tools and test deployment strategies with farmers. The start of this process was delayed by several months due to the nationwide flooding disaster in Pakistan. It is also likely that this prevented some potential participants from engaging in the program as they dealt with the aftereffects of the disaster. During October – December 2022, local collaborating organisation, NUST, led a campaign to raise awareness for the challenge and gather applications from potential applicants. It is possible that NUST may not have had the right kind of business connections to support this activity. Their main office is in Islamabad and not close to the main agricultural production areas and the science and technology park did not have the number of agricultural start-ups needed to drive significant interest.

The campaign resulted in 3 organisations, Chattha BioCare, Haji Sons and RBDC Pvt Ltd (operating through the charitable Lok Sanjh Foundation), submitting complete applications and being chosen to participate in the first phase of the challenge. Several other companies and individuals expressed interest in participating but did not complete the application process. These 3 organisations all had existing operations involving farmers and presented strong cases for incorporation of VIA tools into those operations.

During January 2023, participating organisations were provided links to the online 'How-to' videos for each product and were required to have key staff complete VIA's online training course "The Water School'. This provided participants with a background in the use and installation of the tools plus real-world examples and case studies of them being used in different crops and under different conditions. To complete the participants

preparation for the 'Grand Challenge', a webinar was held on 24th January 2023 to outline the activities of the challenge and provide participants the opportunity to ask questions and gain more information on the VIA.

Grand Challenge Implementation

In February 2023, IWMI facilitated the distribution of tools to the participating organisations. Each organisation received approximately one third of the available tools as previously outlined in Table 4. They were then free to engage with farmers in their own way and determine the methods of implementation, support and cost recovery they thought most appropriate.

From the first stages of implementation it was clear that both Haji Sons and RBDC were highly engaged in the activity and were engaging a range of farmers. Haji Sons achieved this by installing tools in their own farm sites and using those as demonstration plots to showcase the tools and train others in their use. This focus on using and understanding the products helped Haji Sons to build capacity within their own organisation and build credibility with farmers as they are not just talking about a new technology, they are promoting something they are using and benefiting from themselves.

Chameleon card demonstration in chilli crop on Haji Sons farm

RBDC focused on training of extension staff and information sharing with small farmers who had little prior knowledge of modern irrigation technologies. Initially, due to timing of the season, this engagement was mostly with farmers growing vegetables before engaging a significant number of cotton farmers in April and May of 2023 as that growing season commenced. One notable challenge during this time was the lack of nitrate test strips, preventing the organisations and farmers from being able to measure nitrate. Given the strong engagement from both Haji Sons and RBDC, additional equipment was delivered to both organisations in September 2023, as previously shown in Table 5, to allow expansion of their activities and fill in equipment gaps from the initial supply of products. Both organisations engaged with new and existing farmers over the final periods of the project term and will continue to do so in the future. Haji Sons supplied tools to another 18 farmers in January 2024 (listed as HS-201 to HS-218 in Appendix 5) and RBDC plans to engage with additional cotton farmers during next sowing period in April 2024. For these organisations, the conclusion of the project does not signify the end of their engagement with farmers and the VIA tools. Both organisations continue to engage with existing users of the VIA tools and will utilise any remaining equipment to supply the tools to new users. Reports on future activities planned by both RBDC and Haji Sons are attached. The conclusion of this project presents the opportunity for these organisations to enter the next phase of their partnership with VIA. No additional equipment was given to Chattha BioCare.

Business opportunities and farmer benefits

Both Haji Sons and RBDC have demonstrated that the VIA tools can be incorporated into and add value to existing agricultural businesses. During the initial stages of the project both organisations have focused on building awareness and demonstrating the benefits of the products to farmers. They deployed tools at no cost to existing customers of their

businesses. These are customers who have previously purchased other products from the companies such as hybrid seeds, irrigation equipment, fertiliser and other farm inputs. Haji Sons did this in Sheikhupura District in conjunction with the deployment at their own farm sites.

RBDC/Lok Sanjh Foundation Business Model

RBDC chose to distribute the tools in the districts of Layyah, Bahawalnagar, and Tehsil Fort Abbas under the operations of their charitable arm, the Lok Sanjh Foundation. This brought the use of VIA tools under the umbrella of their wider provision of technical support and assistance to farmers in the region. Regarding uptake of the tools, RBDC noted;

> "The initial challenge was to convince the farmers about the benefits of the instruments. Many were sceptical about the technology, fearing it would be complicated to use or might not yield significant benefits. The RBDC team conducted several training sessions and demonstrations to alleviate these concerns and show the farmers how to use the instruments effectively."

After capacity building and interactive training was provided, farmers readily adopted the tools and saw significant benefits from their use, which has helped to further promote the adoption of the tools. An example of 1 such farmer states;

> "One of the most notable success stories came from a cotton farmer of PKBN14, Mr. Ijaz Chishti. Before the installation of the WFD, Mr. Ijaz Chishti used traditional irrigation methods, which often led to over-irrigation, water wastage, and sometimes even crop damage due to waterlogging.
> After installation, Mr. Ijaz Chishti was able to monitor the soil moisture levels accurately. He adjusted his irrigation practices based on the data provided by the WFD, which resulted in a significant reduction in water usage. Not only did this save him money on his tube well expenses, but it also led to a healthier crop yield as the cotton plants were no longer subjected to water stress.
> Within the first year of using the WFD, Mr. Ijaz Chishti is expecting a 20% increase in his yield and a 30% reduction in his water usage. This success story served as powerful evidence of the benefits of the WFD instruments, encouraging other farmers in the district to embrace the technology."

These examples highlight the challenge of scaling innovations to smallholder farmers. Even in a country and region where there is previous evidence of the use and benefits of the products, farmers are still reluctant to adopt without seeing them in use first hand. However, once that adoption barrier is overcome, farmers embrace the use of the products and readily share their experiences.

RBDC has over 100,000 registered farmers they have worked with over the past 10 years providing agricultural inputs and advisory services, and if given the opportunity, expect to sell large numbers of VIA products over the coming years. They also collaborate with government extension staff and engage with donor funded projects to further extend their reach and support their work with farmers.

Haji Sons Business Model

Haji Sons initial business model, implemented with the Feb23 distribution of tools, was to provide the equipment to farmers in line with other agricultural inputs they sell such as

hybrid seeds, irrigation systems and fertiliser. They provided basic training and installation support, but the ongoing use of the tools was the responsibility of the farmer. They have now modified this approach noting;

> "On the basis of 1st year results, we had restructured our planning and implementation. During last year we installed systems with famers and farmers were supposed to monitor tools and get benefit from its readings but during evaluation we found that most of farmer had not used data which was provided to them time to time. Some farmers tried to use it but could not translate or get benefit of its outcome. Now we engaged more team in field and the office and revised our action plan. In revised plan, instead of expecting data recording or interpretation of results by farmer, all work will be done by our team."

Under this new approach a Haji Sons Field officer submits Chameleon or WFD reading from mobile though online form of each site with live location and a picture. An in-office coordinator interprets the data into WhatsApp message and sends it to the farmer advising if water or fertilizer needed or not. The data is also shared to other non-beneficiary farmers (users of Haji Sons products in that district) as knowledge sharing with pictures and comments of beneficiary farmer. An example of the online form used by Haji Sons and farmer WhatsApp messages are included in Appendix 4

Under Haji Sons model the cost of services and development activity is added to the equipment price to farmers. All technical support and follow up services are provided at no ongoing cost to farmers. Haji Sons business aims to provide all agricultural services to farmers under one roof and their management believe that supply of VIA tools, to enable efficient water management on farms, will not only benefit their business but farmer productivity and the environment.

The user matrix and participant feedback have also been used to compile a report to PCRWR on the estimated provincial and national demand for the VIA products and the business case for in-country distribution and potentially production of VIA products. Post project and subject to acceptable contractual terms, selected participants will be offered an ongoing supplier agreement with VIA Ltd for the sale and distribution of products. Supply of products, at wholesale prices, will be facilitated by VIA Ltd through its existing manufacturing facilities until such a time as local manufacturing capability is operational, if that course of action is taken. However, VIA Ltd also recognises that SRA outcomes might indicate that no viable business model exists at this time, and is open to this possibility.

Farmer Benefits

From a farmer perspective, purchase and use of the VIA tools should provide a positive financial benefit within the first year of use. Of the 147 locations recorded in Appendix 5, 18 did not have farm size recorded and therefore have been excluded from assessment for solution viability.

In applying the gross solution cost from Table 7 and the potential benefit from Table 8 to each location with farm size listed in the user matrix (Appendix 5), we find that 86% (111 of 129) solutions provided are likely to provide positive financial benefit to the farmer. For locations growing cotton or wheat we have used the gross benefit amount from Table 8. For all other crops a cost benefit amount of AUD210 per hectare has been used to represent the savings in irrigation and fertiliser. While we know from LWR 2014 074 that yield increases are likely for other crops we do not have sufficient data to assign a value to

this benefit stream. Even under this scenario, where no yield benefit is attributed, introduction of the VIA tools appears to be financially viable in the majority of cases.

Four types of farm locations were engaged through the project activities. Table 9 shows a summary of results by location type.

Location type	Number of Locations	Land Area (Ha)	% or locations with likely viable solution
Commercial	64	1,240	95%
Smallholder	54	165	83%
Large Holding/WUG	4	303	100%
Government	7	7	14%
Total	129	1,715	86%

Table 9: Summary of user data and solution viability by type (excludes locations with no farm size recorded)
Note: Eighteen smallholder locations have been excluded due to lack farm size data.

Alternatively if we ignore location type and summarise the results by location size we find that for farms 5Ha or larger, VIA tools provided a positive financial benefit 100% of the time (see Table 10).

Location size	Number of Locations	Land Area (Ha)	Average solution cost per hectare	% or locations with likely viable solution
Under 5Ha	62	149	$120.64	71%
5Ha or over	67	1,565	$26.64	100%

Table 10: Summary of user data and solution viability by farm size

It should be noted that the number of VIA products supplied did not increase in proportion to location size, leading to the solution cost per hectare being much higher for farms under 5Ha, as shown in Table 10. The focus of Haji Sons and RBDC, particularly in the first deployment of tools, was to trial the tools with as many farmers as possible, and they did not focus on designing best fit solutions for individual circumstances. While it is possible farmers in locations over 5Ha could take the data from a small number of monitoring sites and apply it across the entire farm, it is unlikely they would receive the full value of the benefits.

The VIA has been created and built for smallholder farmers and the focus should be on finding viable ways to support these farmers with the tools. 62 of the registered locations had farm sizes of less than 5Ha. For 18 (29%) of these locations, the solution provided is unlikely to be financially viable. All these sites are farms 2Ha or smaller. Most of these sites (15 of 18) were supplied with either the Chameleon Wi-Fi system or multiple products. If the solution provided had been replaced with a single Chameleon Card kit, then 9 of these sites would likely be viable. Consideration of farm size has therefore been

included as part of the decision matrix to assist businesses in finding the right solution options for farmers.

IWMI Findings

The work done by IWMI Pakistan within this project further validates the results of LWR/2014/074, Haji Sons and RBDC. An extract from IWMI's activity report is below.

The implementation of soil moisture sensors has proven to be a judicious investment for farmers cultivating wheat and cotton, exhibiting a noteworthy cost-benefit ratio ranging from 16% to 20% for wheat and 10% to 16% for cotton. These sensors contribute significantly to optimizing irrigation practices, leading to more efficient water usage and subsequent economic gains. The reduction in the number of irrigations required for wheat, cotton, and sugarcane stands as a testament to the sensors' efficacy. Before sensors installation, farmers resorted to 5-6, 18-20, and 9-10 irrigations for wheat, cotton, and sugarcane, respectively. After sensor installation, these numbers decreased to 4-5, 15-18, and 8-9, showcasing a substantial decrease in water consumption. This not only underscores the environmental sustainability of precision agriculture but also underscores the positive impact on farmers' economic viability. Moreover, high farmer satisfaction with the sensors, as they empower growers with real-time data to make informed decisions, enhancing overall agricultural productivity and resource utilization. The water reductions saved up to 18%, 13% and 27% for wheat, cotton and maize respectively (Figure 11).

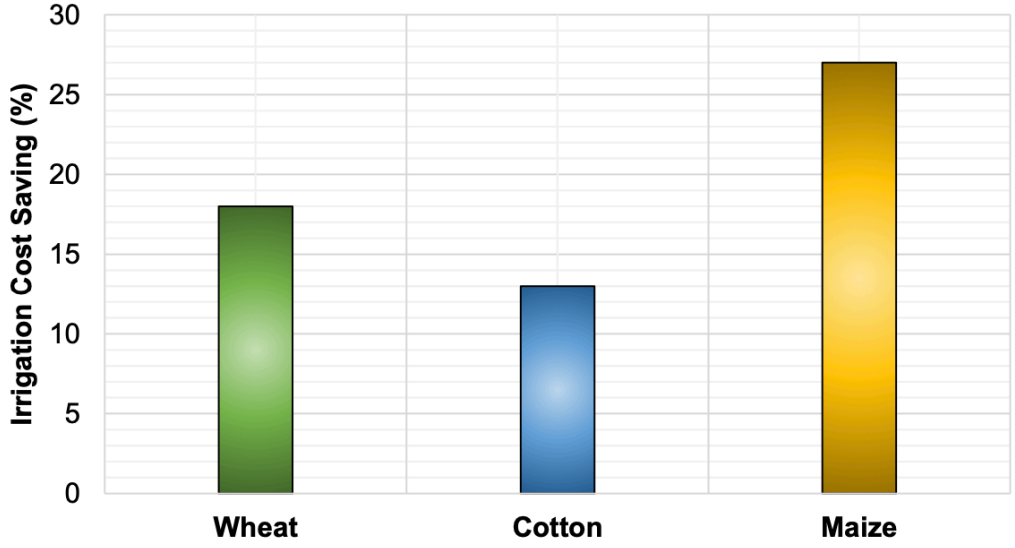


Figure 11: The percentage cost savings in groundwater pumping charges after the introduction of VIA tools. Results are compiled based on farmers feedback for three major crops (Wheat, Cotton, and Maize) in Rahim Yar Khan district.

Economic benefits come after a sequence of changes in irrigation practice and fertilizer management have been established. Many factors are in place to ensure a profitable crop for the farmers including efficient water application, fertilizer management, pest control, and others, but the most important factor in terms of economy is the expense of cost and time incurred due to excessive irrigation. For most progressive farmers, efficient irrigation farming is one source of income; therefore, decreased irrigation frequency makes room for farmers to invest their time in other income streams. Thus, farmers regard time saving through less irrigation as the dominant economic impact of the VIA Sensors.

IWMI Pakistan has continued to be a strong partner and supporter of VIA within the region. They also have their own business model to incorporate the use of VIA tools. IWMI utilises the tools from a research and development perspective to supply services to large scale donor projects. Over the past 2 years IWMI has purchased 300 Chameleon Wi-Fi kits for use in such projects. This presents an additional product supply opportunity for businesses in Pakistan and should be factored in to recommendations regarding both in-country demand and feasibility of local production.

There was a business model that was not able to be tested under this SRA that would be very interesting to understand, which is a 100% service or subscription-based payment model. We had hoped to do this in collaboration with the Farmers' Integrated Development Association (FIDA) who were already familiar with the VIA tools after participating in the LWR/2014/074 project. FIDA presented a business model to test this in advance of the second distribution of tools but when NUST attempted to contact them to include them in the planning for the distribution they were not able to get any response. Given that both Haji Sons and RBDC highlighted the importance of ongoing service and support to farmers as part of their business models, particularly Haji Sons engagement of field officers to do this, it is likely that a 100% service or subscription based business model would be viable. It is unfortunate that it wasn't able to be tested under this project.

There are several factors that need to be considered as part of the development of a user decision matrix to assist suppliers of VIA tools maximise the value proposition and effectiveness of the tools for farmers. These factors include farm size, farm type, technology access and monitoring requirements. An updated decision matrix is shown below in Figure 2. This should be used as a general guide as to how products and services should be delivered but will need refinement for each individual organisation to suit their exact operating model.

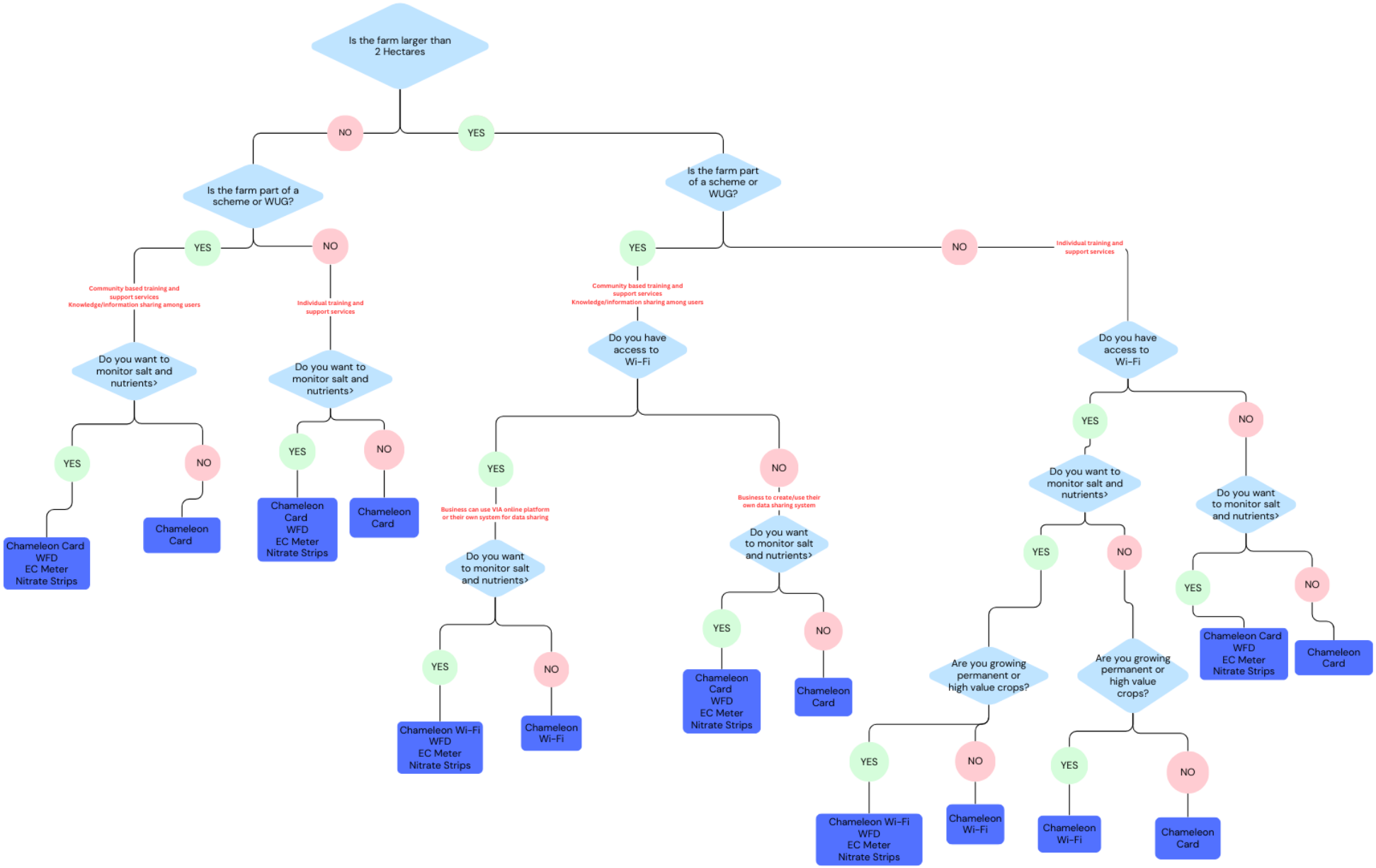


Figure 2. VIA product and service decision matrix for businesses

Salt Chameleon Card

The development and deployment of the salt identification for the Chameleon card and Chameleon Wi-Fi systems was completed as part of this project. The traditional definition of a saline soil is a soil with saturated extract ECe > 4 dS/m, although many fruit and vegetable crops can be affected at salinities in the range of 2-4 dS/m. Since the WFD sample is essentially a saturation extract, it provides a quick and robust indication of the presence of saline soil.

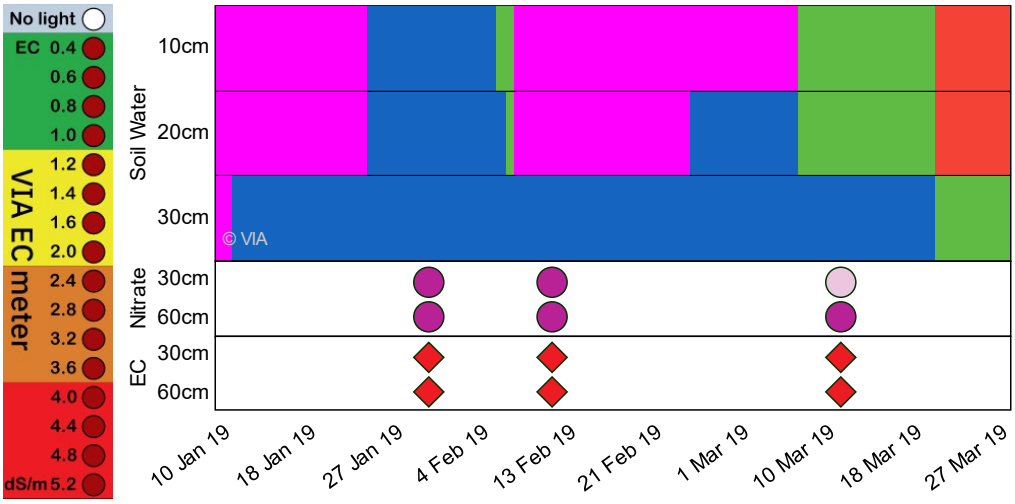


Figure 3. The water, nitrate and salt pattern for a wheat crop in the Punjab. The scale for the EC meter reading is shown on the left.

Figure 3 shows a Chameleon pattern of a wheat crop at Bahawalpur, Punjab, monitored under LWR 2014 074. Chameleon sensors were placed at 10, 20 and 30 cm depth and WFDs at 30 and 60 cm. The purple on the pattern shows when the resistance of the Chameleon sensor was <0.5 KOhm. This would show blue (wet soil) on the Chameleon reader, but on the visualisation we highlight the presence of salt using a pink colour (i.e. in the software). It is important to note that the sensor will still change to green and red as the soil dries, but the accuracy of these readings are affected, to some extent, by salt (see section Methodology section). In the above example, the saline soil identified by the Chameleon sensors is corroborated by soil solution extracts from the WFD.

To refine the calibration of the Chameleon sensors and determine thresholds for salt indication, a batch of 36 sensors was repeatedly calibrated over the 0 to 60 kPa range while increasing salt levels over a three-month period. The salinity in the testing rig was increased from 0.3 to 5.7 dS/m in nine steps. At each salinity step, a full calibration was conducted to evaluate how the change in resistance (hence change in Chameleon colours) was affected by salt.

The blue line in Figure 4 shows the change in the blue to green switch point as the salt levels increase (left axis). At very low salinity, the switch point occurs at 21 kPa. This increases to 25 kPa at 2 dS/m and 30 kPa as we approach 6 dS/m. At the same time the minimum resistance (in the 0-10 kPa zone), falls from around 0.9 KOhm to less than 0.4 KOhm at the highest salinity (right axis). The selected salt threshold (pink colour) of 0.5 KOhm corresponds to the external salinity in the 3 to 4 dS/m range.

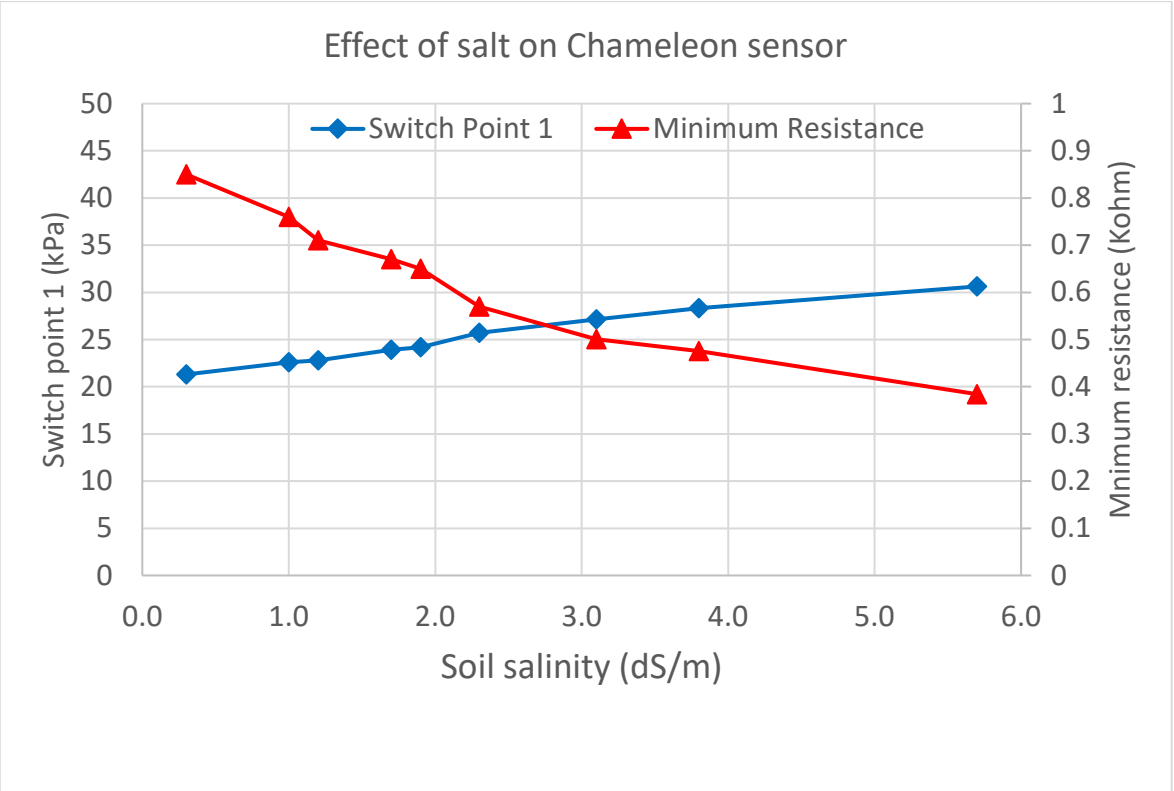


Figure 4. The effect of external salinity on the blue to green switch point (blue) and the minimum resistance (red).

Chameleon card firmware was updated to allow the card LED to display a different colour when the high salt threshold is reached. The card LED will now display a flashing purple light if sensor resistance is under 0.5 KOhm. Guidelines, shown in Figure 5, have been added to the card instructions to assist users in interpreting LED colours with a recommended action should high salt be detected.

LED colour	Meaning
Blue	Wet soil
Green	Moist soil
Red	Dry soil
Flashing purple	High salt warning
Flashing yellow	Sensor wire is not connected or very dry
Flashing red	Replace battery

If LED flashes purple, then the colours need to be interpreted differently. The plant is under more stress in the green than normal. Irrigation may be necessary in the blue zone and definitely in the green zone.

Figure 5. Extract from updated Chameleon card instructions including high salt indicator and recommended actions.

No updates were made to the colours displayed on the Chameleon Wi-Fi reader itself. The Wi-Fi reader will still display a blue light, even at resistances of below 0.5KOhm, however, updates have been made to the farm visualisations on the VIA website to show presence of high salt levels. As shown in Figure 6, pink hatching has been added to the blue colour as indicator of high salt.

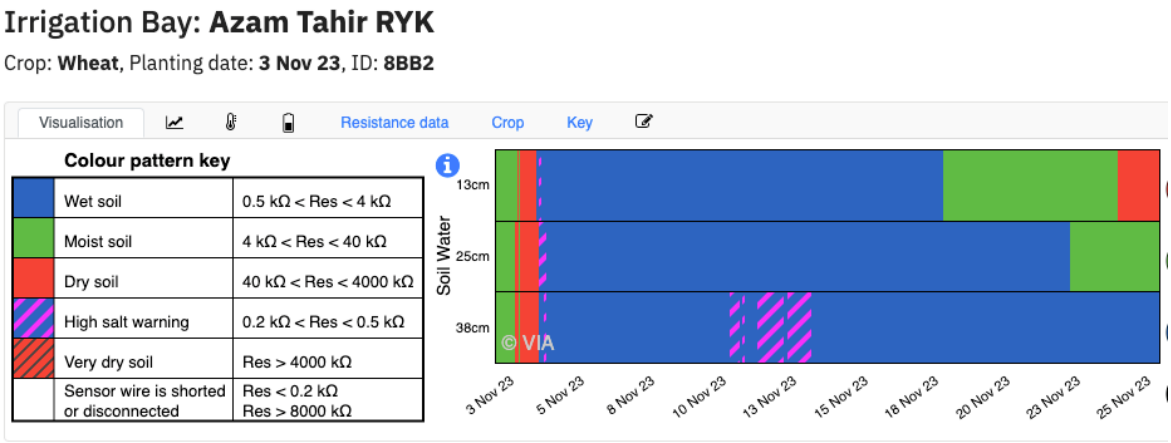


Figure 6. Chameleon pattern for a wheat crop in Mau Mubarik, Rahim Yar Khan, Punjab, Pakistan

Report to PCRWR and PID

The final output of the project was the submission of a report from VIA Ltd to PCRWR and PID regarding the in-country demand for the VIA products, the feasibility of in-country production and the possible role of VIA data in the governance of water.

Demand

The work done by Haji Sons and RBDC show that demand for the VIA products in Pakistan is strong if training and support are provided as part of the implementation strategy. This suggests the products are best suited to existing agricultural businesses who have complementary product suites. There appears to be a strong case for these of these products by farmers growing high value crops such as wheat and cotton. More work is required to fully understand what these products would cost under normal business operations and if that translates into a sustainable business proposition.

In-country production

A way to reduce the local cost of products, and therefore lower that as a barrier to farmer adoption, will be to begin local manufacture of select VIA products. It is suggested that the Wetting Front Detector (WFD) is the first product that should be investigated. WFD production could be outsourced to a local plastics manufacturer and based on importation costs incurred in this project would see a 20% reduction in cost of the product. The WFD is a useful tool for the local market given its ability to be used for both irrigation scheduling and salinity monitoring. Local production of Chameleon products remains an option for the future but would require significant financial investment and time to establish.

VIA data for governance

PCRWR was supplied with Chameleon Wi-Fi systems for them to continue the use of the tools begun under LWR 2014 074 and to investigate public sector applications for the data collected using these tools. During the project period no new Chameleon sensors were recorded as being installed by PCRWR on the VIA website, although some have been

added since the conclusion of the project. Despite this, other useful examples of the potential benefits of VIA data to public institutions are provided by other project collaborators. IWMI monitored the variability of Chameleon sensor data and the differences in soil moistures between monitored sites. They noted premature drying of the soil due to increased temperatures and that, in all but 1 location, irrigation activities were uniformly conducted irrespective of prevailing soil moisture conditions. These observations present useful and actionable information, public extension staff could use to provide targeted advice and support to farmers.

Haji Sons collection of data from Chameleon card users provides a demonstration of how advisory services related to VIA data can be delivered cheaply and effectively. There model also shows that this service could be performed using either Chameleon Wi-Fi or Card systems.

7 Impacts

7.1 Scientific impacts – now and in 5 years

This project has once again highlighted the effectiveness of the Chameleon sensors and Wetting Front Detectors as tools to help farmers improve water use efficiency and management of salinity in irrigated agriculture. It has also demonstrated the challenge faced when taking scientific innovations and applying them to commercial contexts. Both Haji Sons and RBDC reported reluctance from farmers to invest in and adopt the tools without first-hand experience and operational support. Even with documented evidence of their benefit in the local environment, from previous ACIAR project LWR/2014/074, farmers were initially reluctant to adopt the tools. Only after a process of capacity building and demonstration did farmers readily adopt the tools. This highlights the importance of testing scaling methods and adoption preferences during the product development process to create the additional processes and materials necessary. The gap between product deployment under project conditions, where extensive capacity building and user support are typically built in, and commercial deployment needs to be narrowed to assist in timely and cost-effective scaling.

The addition of salinity warning indicators to the Chameleon products will have lasting benefits to VIA users in years to come particularly in areas such as the Indus Basin in Pakistan and the Mekong River Delta in Viet Nam where these products have already been deployed to good effect.

7.2 Capacity impacts – now and in 5 years

This project has contributed to the improved capacity of both farmers and institutional stakeholders across the Punjab region. All participating organisations conducted numerous training and capacity building activities with the farmers and communities where they were operating. Haji Sons conducted an event attend by over 200 leading farmers from the Bahawal pur area where the use and benefits of VIA sensors was presented.

Presentation by Haji Sons to leading farmers in Bahawal pur

RBDC, through Lok Sanjh Foundation, conducted a capacity-building meeting to train farmers on the use of these tools. The meeting was attended by Mr. Usman Zafar (Project Coordinator-ILOKP), Faisal Ishatiaq (Project Coordinator-BCI), Mr. Zia Ur Rehman and Mr. Atif Tabbssam, both Internal Control Inspectors (ICI-ICS01 and ICI-ICS03 respectively), and Mr. Numan Noor (Producer Unit Manager-PKBN14).

Training sessions conducted by RBDC and Lok Sanjh

The training session was designed to equip the farmers with the necessary skills to effectively use the VIA tools and interpret the data they provide. The training covered various aspects of the VIA tools, including their installation, operation, and maintenance. The participants were also trained on how to interpret the data provided by the tools to make informed irrigation decisions. The training was interactive, with participants given the opportunity to ask questions and clarify any doubts.
Lok Sanjh report that the project has been successful in not only providing the farmers with advanced irrigation tools but also in building their capacity to use these tools effectively.
Additionally, IWMI conducted a Stakeholder Consultation Webinar on “WATER PRODUCTIVITY ENHANCEMENT USING VIA SENSOR TECHNOLOGY” in collaboration with Khwaja Fareed University of Engineering and Information Technology and PCRWR.

7.3 Community impacts – now and in 5 years

The introduction of VIA tools into communities across Pakistan has helped to promote efficient, environmentally sustainable and collaborative farming practices. The project has provided the means for organisations to improve the capacity of farmers and increase their understanding of irrigation management and sustainable use of water for farming. Farmers will be able to continue utilising this new knowledge in the future. The project has also highlighted the importance of technological solutions to assist farmers in their work. Many farmers who participated in the project had little awareness of modern technologies and their benefits. A strong focus was put on helping smallholders to understand what these technologies are, how they are used and the benefits they can provide. This should assist farmers in continuing to adopt and use technology in the future to increase productivity and farm more efficiently.
The deployment of VIA tools by IWMI, Haji Sons and RBDC demonstrated the benefits such technologies can have for commercial farmers. The example of a cotton farmer

benefiting from the use of Wetting Front Detectors was highlighted in the Better Cotton Knowledge Network quarterly newsletter as a demonstration to the cotton farming community of the benefits that soil moisture and nutrient monitoring can provide.

7.3.1 Economic impacts

The introduction of VIA tools under this project has resulted in significant economic benefit to farmers. IWMI reports cost-benefit rates of 16-20% for farmers growing wheat and 10-16% for farmers growing cotton. The benefit is primarily driven by the reduction in irrigation frequency and associated cost. Farmers reported irrigation cost savings of 13% for cotton, 18% for wheat and 27% for maize. Similar reductions in irrigation frequency were reported by participants across the project using both the Chameleon sensors and/or Wetting Front Detectors (WFDs). One of the most notable success stories came from a cotton farmer of PKBN14, Mr. Ijaz Chishti. Before the installation of the WFD, Mr. Ijaz Chishti used traditional irrigation methods, which often led to over-irrigation, water wastage, and sometimes even crop damage due to waterlogging.

After installation, Mr. Ijaz Chishti was able to monitor the soil moisture levels accurately. He adjusted his irrigation practices based on the data provided by the WFD, which resulted in a significant reduction in water usage. Not only did this save him money on his tube well expenses, but it also led to a healthier crop yield as the cotton plants were no longer subjected to water stress. Within the first year of using the WFD, Mr. Ijaz Chishti is expecting a 20% increase in his yield and a 30% reduction in his water usage. This success story served as powerful evidence of the benefits of the WFD instruments, encouraging other farmers in the district to embrace the technology. Additionally, it is hoped that Haji Sons and RBDC will be able to receive ongoing economic benefits from the incorporation of VIA tools into their existing product and service suites. While not fully realised at this time, the potential opportunities for ongoing revenue streams from the distribution and possible manufacture of these products is evident.

7.3.2 Social impacts

While this project did not emphasise understanding or reporting of social benefits to farmers, we know through past experience in Pakistan and the consistency of results in this project that by providing the means to manage water more effectively and reduce irrigation frequency farmers report reduce conflict within communities and have more time for other household activities. Haji Sons have adopted a system of information sharing among farmers, where data on a locations soil moisture and nutrient content is not just provided to the farmer at that location but also to neighbouring farmers. Allowing them to benefit from the information, even if they do not have access to the tools themselves.

7.3.3 Environmental impacts

Over 1700 hectares of agricultural land benefited from improved water management practices throughout the project. Many of the participating farmers have reported significant water savings through skipped or reduced irrigations. They have reported reduced water logging in fields and been assisted in managing issues with salinity that are prevalent across Pakistan.

7.4 Communication and dissemination activities

- IWMI paper - Enhancing Water Resource Management through VIA Soil & Water Monitoring Tools in Pakistan's Agricultural System. (Appendix 6)
- Better Cotton Knowledge Network quarterly newsletter (Appendix 7) included a story of a farmer who received a Wetting Front Detector as part of this project. Better Cotton Pakistan has over 500,000 member farmers and 6 organisational partners.
- VIA established a page on its website to promote the SRA activities and provide information to interested participants.
- VIA social media has continued to highlight the SRA and the benefits to farmers throughout the project.
- IWMI promoted the VIA sensors at the 2022 and 2023 Pakistan Water Week. This is an international conference which includes organisations like GIZ, UNICEF and WWF among many others.
- Promotional events, training and capacity building sessions conducted by Haji Sons and RBDC

8 Conclusions and recommendations

8.1 Conclusions

This SRA has provided further demonstration of the immense potential contained in the VIA suite of tools to bring positive economic, environmental, and social impacts to farmers in Pakistan. It has built on the work of LWR 2014 074 and documented 148 new users of the VIA tools, covering over 930 Hectares. While not captured in detail within this project, some users provided indicated water savings, recorded in Appendix 5, and productivity increases from farmers will have ongoing economic, social and environmental benefits in years to come. The focus on understanding delivery models for the VIA has highlighted the need to ensure these types of products are not treated and sold the same way as other agricultural inputs. If these tools are to be adopted and used in an ongoing and meaningful way by farmers, the supply of the product must be accompanied by both upfront and ongoing support services. This has been demonstrated by Haji Sons and RBDC in a Where Chameleon Wi-Fi systems are deployed, there needs to be a very clear value proposition to justify the additional expense. On small farms, or where there is no defined plan to collect and use the data, card systems should be deployed. Education, capacity building and information sharing were also highlighted as key elements to driving increased adoption of the VIA.

VIA data, as colours from Chameleon or WFD products, was a key element of the information sharing and capacity building activities conducted under this project. However, it should be noted that most of this activity was conducted outside of VIA's website and reporting systems. There are several likely reasons for this. First is lack of data system for Chameleon card users. VIA's systems do not allow for the collection and display of data from Chameleon card users at this time. Second is the language barrier. VIA's website is all in English and farmers in Pakistan may find that a hinderance to use. Finally, it is the issue of accessibility. VIA's systems are all online and do not allow for data collection or visualisation without internet connectivity. Farmers without access to reliable and cost-efficient internet access may not engage with the tools in that manner. All participating organisations used their own methods for collecting and sharing data from VIA products. While the value of the data is evident, further understanding of user preferences for data capture, reporting and sharing is needed.

It is interesting to note that farmers showed more readiness to adopt the WFD in comparison to the Chameleon products. This was evidenced in Haji Sons initial deployment of tools where farmers used for a period but dropped off due to farmers not using or benefiting from the data. Most of these farmers were using Chameleon cards. The likely reason is the difference in 'data' output from each product. Where the Chameleon provides information as a coloured light, the WFD provides a physical sample of water. Similar sentiment has been witnessed in other locations where farmers ask how they know the light is accurate. There is no simple way to show a farmer that a blue light indicating wet soil is telling the truth. However a farmer with a WFD can collect a physical water sample if the device is triggered by the wetting front. Understanding the decision-making processes of a farmer and helping them to understand new methodologies for existing irrigation practice is essential to sustained adoption of VIA tools. Having existing, trusted relationships with those farmers makes this process much easier.

The project has gathered strong evidence from 2 local business who have demonstrated models in which these tools can be supplied to farmers in a way that is potentially

economically viable for both the business and the farmers. Both Haji Sons and RBDC Pvt Ltd will be given the opportunity to partner with VIA Ltd on an ongoing basis. As established agricultural businesses who purchase and supply various inputs and products, they have the resources and experience needed to purchase and import ongoing supplies of VIA products. Maintaining momentum with these businesses will be crucial to the ongoing expansion of the VIA tools within Pakistan. As farmers have been adopting the tools through this project and continue to do so word continues to spread about these products and their benefits. Establishing ongoing supply with these existing operators is crucial to see ongoing impacts from the investments made through this project and LWR 2014 074. The stop-start nature of project-based activities makes maintaining momentum and ongoing expansion challenging. The benefit of working with private sector organisations in this activity is that their operations are not tied to project timelines and budgets. They do however, need ongoing financial, technical and institutional support if they are going to continue expanding the distribution of VIA within Pakistan.

Ongoing testing and validation by IWMI has provided additional evidence of the benefits of the tools in Pakistan. Their continued advocacy for the use of these innovations to assist farmers in improving productivity and water use efficiency is greatly appreciated and will continue to stimulate demand. Their use of VIA products in large scale project settings, both within Pakistan and in surrounding countries, where they are already collaborating and providing other services, provides further opportunities for local product suppliers or manufacturers.

An updated user decision matrix has been developed based on the learning and experience gained in this project. It will be shared with both organisations and will continue to be modified and added to as required. It will be a useful tool for new businesses wishing to incorporate the VIA into their product suite. Customer service, training and support has been included in all aspects of the matrix but the elements and implementation of these will need to be customised to each businesses chosen operating model. This allows for it to be used by business with upfront payment models and subscription or pay-as-you-go models.
Digitalisation of the matrix presents an opportunity for both VIA and partner organisations to assist in the design and quotation of solutions for customers. The matrix has also been developed with the consideration of indicated solution viability (Table 9) and solution cost per hectare (Table 10). These findings were based on a number of assumptions, such as sample farms being accurate representations of benefits and costs, uniformity of yield across large farms, and no changes in crop or input prices. The number of variables involved make calculating viability for individual locations and seasons difficult. This activity has tried to use conservative assumptions to provide reasonable confidence in the assessment of what is or is not viable.

Assessing demand for the VIA in Pakistan is challenging. Feedback from project participants showed that farmers were initially reluctant to use these tools when they had not seen them being used. This makes generating farmer demand through simple advertising or promotional campaigns unlikely to be effective at large scales. Scaling of the VIA products must be conducted through credible organisations who can provide the training, support and ongoing advisory services needed for farmers to overcome this. Demand for VIA products would appear to be directly linked to the scale and availability of these awareness and capacity building resources. Where they do not exist, demand will remain low. Both Haji Sons and RBDC have shown that organisations who existing relationships with farmers can generate strong demand within their own networks through

a combination of training, practical demonstration, and knowledge sharing. Haji Sons and RBDC both have large existing customer bases and existing systems to scale the availability of the VIA tools. Support from the public sector, research institutions and the donor community will assist in providing additional credibility and advocacy for the products as well as potentially contributing financial resources, through grants, subsidies or purchases, to assist private distributors in having value propositions that work for them and farmers. With ongoing access to the tools and the ongoing support of organisations like PCRWR and IWMI, VIA should be able to move toward local production of products within the next 2-3 years. An outline for achieving this has been developed, shared with local stakeholders and attached to this report.

8.2 Recommendations

Based on the activities of this project and using information gathered during LWR 2014 074, the following recommendations are made.

1. Both Haji Sons and RBDC Pvt Ltd should be offered formal distribution agreements with VIA Ltd to continue making the VIA tools available to farmers in Pakistan. Both organisations have displayed enthusiasm for the products and have been active in promoting their use to farmers. They also have active links to networks of commercial farmers who, in the short term, are most likely to take up the use of the tools.
2. Haji Sons use of WhatsApp to share collect and share information with farmers should be encouraged and promoted. Further steps to automate and integrate this type of system should be investigated, including the development of a bespoke mobile Application.
3. Further development, documentation and dissemination of a comprehensive VIA user matrix should be undertaken and provided to these Haji Sons and RBDC. The ability to reference use cases, costs and benefits of different deployment options, both from within Pakistan and other countries, would further empower the businesses to create value propositions and service offerings for farmers, particularly if elements can be incorporated into a mobile application or VIA website to make them easily accessible. For example, this could form the basis of a quotation builder, or recommended deployment plan.
4. Further investigation of including VIA tools as part of an ‘irrigation as a service’, ‘pay as you go’, or ‘monthly subscription’ type business model should be conducted. Indications are that this type of model would be well received, if it includes regular customer interaction, but this has not been tested or validated.
5. Local production of Wetting Front Detectors (WFDs) should be investigated and costed. Local production of Chameleon products should be delayed until demand increases or financial investment is available to implement.
6. Haji Sons and RBDC should be upskilled to enable them to diagnose problems with the Chameleon tools and perform basic repairs and servicing. This would further enhance their service offering to farmers by helping to ensure the tools remain in good working condition for their full lifetimes. This upskilling could be extended to include testing of VIA sensors, through the provision of VIA’s testing equipment and training in its use.
7. There needs to be ongoing collaboration between public and private stakeholders to ensure advocacy for these types of innovations continues and becomes part of public policy and operational plans. Gaining the ongoing support of PCRWR and the broader Ministry of Water Resources will be crucial to the expanding the use of VIA tools beyond the markets currently served by Haji Sons and RBDC.

8. Further sources of financial investment should be sought to assist in implementation of these recommendations. Donor support and other financial investment continues to flow into Pakistan to support improving farmer productivity, water use efficiency and environmental sustainability. Subsidisation of technologies to assist farmers in this would increase uptake, especially by smallholders.
9. Haji Sons, RBDC and IWMI should actively seek opportunities to include VIA tools in any donor funded projects they are participating in. This would assist in subsidising the cost of products to farmers and help to continue building local capacity, awareness and demand for the tools.

9 References

9.1 References cited in report

Better Cotton Pakistan, 2023, Better Cotton Knowledge Network, Issue 2, Volume 8

Fatima, Bareerah and Hasan, Faizan ul and Stirzaker, Richard and Heaney Mustafa, Sandra and Ashraf, Muhammad, 2022, A Case Study of the Implementation of Improved Irrigation and Nutrient Management Tools in a Less Developed Region. Available at SSRN: https://ssrn.com/abstract=4117241 or http://dx.doi.org/10.2139/ssrn.4117241

9.2 List of publications produced by project

None

10 Appendixes

10.1 Appendix 1: Letter from PCRWR Chairman to ACIAR

PAKISTAN COUNCIL OF RESEARCH IN WATER RESOURCES
Ministry of Science & Technology
Government of Pakistan

PCRWR

Dr. Muhammad Ashraf
Chairman

Tel: +92-51-9101275
Fax: +92-51-9101280
Email: muhammad_ashraf63@yahoo.com

PCRWR 4(1)/IL/WM/18/
May 13, 2020

Dr Robyn Johnston
Research Program Manager
Water and Climate
Australian Centre for International Agricultural Research
Canberra, Australia

Subject: **Country Collaboration of Australian Centre for International Agricultural Research (ACIAR) and Ministry of Science & Technology for Smart Water Management in Irrigated Agriculture of Pakistan**

Dear Dr. Robyn,

We would like to thank the ACIAR's international and country offices for arranging the visit of ACIAR's Chief Executive Officer Professor Andrew Campbell to Pakistan. I am also thankful to Professor Campbell for taking the time to meet with us at Ministry of Science and Technology. The technical and financial support of Australian Government to Pakistan in water sector is historical and have developed many learning opportunities for researchers and scientists of both nations. In the same context, Pakistan Council of Research in Water Resources is leading two water sector research projects supported by ACIAR, namely; *Developing approaches to enhance farmer water management skills in Punjab, Sindh and Balochistan in Pakistan* and *Improving groundwater management to enhance agriculture and farming livelihoods in Pakistan*.

2. I would like to particularly draw your attention to Chameleon moisture sensors developed by CSIRO for irrigation management in one of these projects. Since 2016, these sensors have been introduced to farmer community, researchers, academia and field technicians. High performance of these sensors has also developed their demand in other farmers and researcher across the country. As this project is going to be completed this year, it is essential to make these sensors available in Pakistan in large numbers for sustainability of project impacts. Therefore, it is suggested to establish a manufacturing facility in Pakistan for Chameleon moisture sensors under Public Private Partnership. It is high time to take this step, otherwise the project interventions may not be upscaled for its wider adaptation.

3. As discussed during the meeting of CEO ACIAR with the Federal Minister for Science and Technology, it is requested to kindly take up the matter with CSIRO to develop such model facility in Pakistan similar to South Africa. Government of Pakistan assures full cooperation in this regard.

With best regards

Yours faithfully

(Dr. Muhammad Ashraf)

Khyaban-e-Johar, H-8/1, Islamabad, Pakistan Email: pcrwr@isb.comsats.net.pk

10.2 Appendix 2: Grand Challenge Applications

Applicant name	Name of business	How long has your business been operating	What region will you operate in?	What is the size of your available market?	Do you have experience working with farmers? If so, please describe this experience	Why are you interested in supplying VIA tools to farmers?	How will you promote the VIA tools to farmers?	How will you work with and make money from farmers? (Will you sell/rent/lease the tools? Will you provide other services or advice?)	What costs will you have to provide VIA tools and any services to farmers? (Please provide an estimate of annual costs)	What do you need to do to get your business ready to start this challenge?	What are some obstacles or hurdles you will face during this challenge?	How will you grow your business over the next 2-3 years?
Tahir Saleemi	Haji Sons	Since 1996	All over Pakistan	Around 5,000 Farmers	Yes, based on the mission of company which is to provide all agricultural services to the farmers under one roof, we are direct services providers to farmers, as currently we are serving farmers with basic agricultural inputs like hybrid seeds/seedlings/High efficiency irrigation systems/fertilizers/solution for the post-harvest losses and direct extension /advisory services through out the complete crop cycle. We had done projected with FAO, Winrock International, ADB and MDF, In High Efficiency Irrigation and lining of watercourses , we are implementing partner of on Farm Water management under World bank project.	Haji Sons had always introduced new technologies to the farmers. Off season vegetable production under plastic, Seedling production in peat and tray, many new hybrid seeds , hermetic technology are few examples. Beside these technologies in 2010, Haji Sons took initiative to introduce high efficiency irrigation system to Pakistan and installed free of cost on different places for different crops to check the efficiency of the system. On success of these trials being conducted by Haji Sons, the results were being shown to different govt institutions and International organizations such as world bank to get the subsidy and funding for small holding farmer, and today this technology is adopted by thousands of farmers in Pakistan, As still water scarcity is the major issue being faced by Pakistani farmers and in Our opinion still over irrigation is not only wastage of water but also one of the main cause of low productivity. This technology will be very fruitful if adapted by the farmers and Haji Sons team is more than happy to bring this innovative technology to the farmer of Pakistan.	Through effective demonstrations , Success stories and education of farmers. Target will be the farmers where Haji Sons already installed drip & sprinkler systems and who are now worried about high electricity cost. Model and data will be shared in farmer meetings and through Digital platform of Haji Sons.	As Haji Sons is already working with different international organizations to promote innovative technologies to the farmers and depending on the capital cost, the models are designed for the clients, we use to give options for Rental/lease and customer can directly buy as well. Without out effective follow ups and advisory services, no product can be promoted especially in farming community. Haji Sons has very devoted back up team which not only provides advisory service to farmers but also share data and success stories of field. Since Haji Sons is selling wide range items to farmers therefore this will strength it product portfolio and will help[to make better product mix to get reasonable income.	Depending on duties and taxes , besides product cost, around Rs. 10 million will be additional cost for: Establishment of demo site Installation of Chameleon Started Kits New Demo sites establishment Training and HR cost of staff Marketing and Promotions Farmers trainings at their door steps and on demo sites Data taking and propagation of data	Technical training of the Products Starter Kits to test Product/crop wise specification details Cost and benefits analysis Testimonials and Success stories	Currency conversion rates Cost of product Govt policy to allow import Data accuracy Poor Education level of farmers to read and understand the readings of kit Electricity if required Leveling of land which may give different readings of same acre Water availability on due date.	If h it helped to save electricity cost of irrigation and fertilizer, growth rate in next three years will be 20%, 35 % and 60% respectively.

Dr. Aftab Ahmad	Chattha Bio Care	3-5 years	Punjab	5000	We are from a farmers family and running different agriculture businesses in our district gujranwala as well as recent startups of Chattha Bio Care and AgriGrow. We are already actively working with farmers for seeds, fertilizers, biofertilizers and other related products and having great experience. We arrange farmers day on regular basis and engage with farmers.	Pakistan is wasting lot of fresh water in Agriculture, in addition, we don't have tools to access salts and nitrates in the soil so VIA tools will not only help us to manage freshwater but also precise use of fertilizers in the fields.	We arrange farmers gatherings (Farmer's day, Kissan Mela etc.) so will arrange at different locations to introduce VIA tools to farmers. Moreover, we are quite active on social media so will surely use social media tools and whatsapp groups.	We will sell the tolls to progressive farmers and also to farmers who own large cultivated areas while we can give on lease bases to small farmers. We also have a network in our area so we can also provide soil testing services in different locations.	Initially we will provide the tools with our purchase cost with minimum margin so we could provide tools to maximum farmers and later we can increase our profit margin gradually.	We need initial training and devices so we could test in our fields and with some progressive farmers and after this we can start the business at large scale.	Initially it may be little hard to convince the farmers about this new technology but with successful examples and impact, we can easily start it rapidly.	Initially we will have a focus in 3-4 districts so we could provide quality tools and services, later we will higher a team and expand to province level and finally at national level. We are quite hopeful to reach national level within 2 years.
Shahid Zia	RBDC Pvt Ltd	more than 5 years	Punjab	More than 100000	Have more than 10 years of experience of working with more than 100000 registered farmers with us.	We are interested in the moisture meter as we are working with farmers on water stewardship. and see a business model for us to work with VIA.	We will demonstrate VIA device on around 30 sites. Arrange farmers visits to the demo sites so that they can learn directly from the field.	We will sell device to farmers and advice to farmers will be made regular part of our farmers training and advice system.	For one device, RBDC staff and logistic costs for demo and trainings will come around Rs. 200000. For 30 devices, cost will come around Rs. 6000000.	We would like to get ensured supply of devices at affordable price, preferably to go in joint production of devices in Pakistan.	Farmers trainings and adaptations of device to local needs will be the major challenge.	RBDC will plan to introduce device/tool in at least two districts. More than 80000 farmers will have knowledge of the device and its benefits. From 30 devices, we expect we will reach 300 in first year, more than 600 in 2nd year and from the third year on we will expect large scale adoption of the device.
Abeera Noor	Seed to Harvest	New venture	Karachi	more then 5000	yes							

10.3 Appendix 3: Grand Challenge progress reports

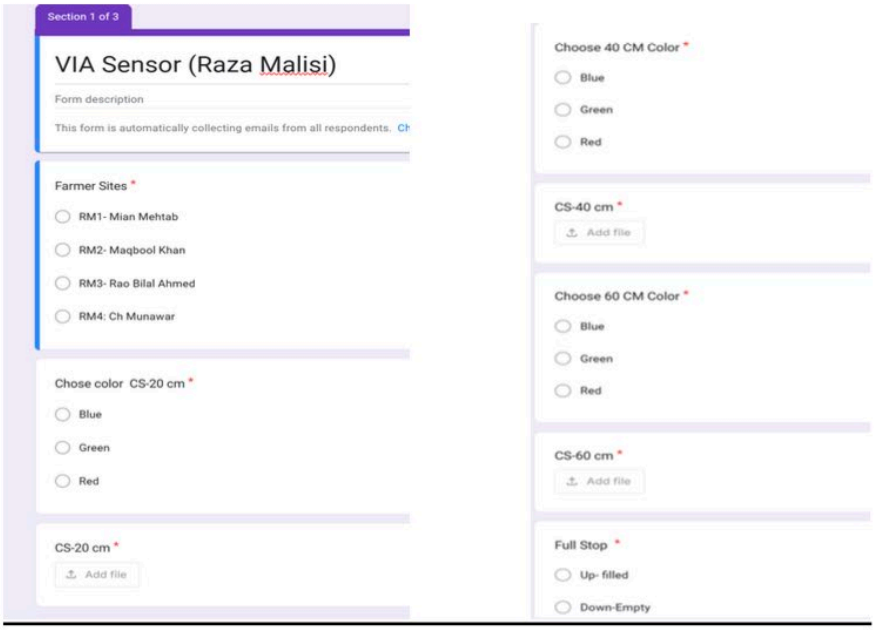
Refer attached reports

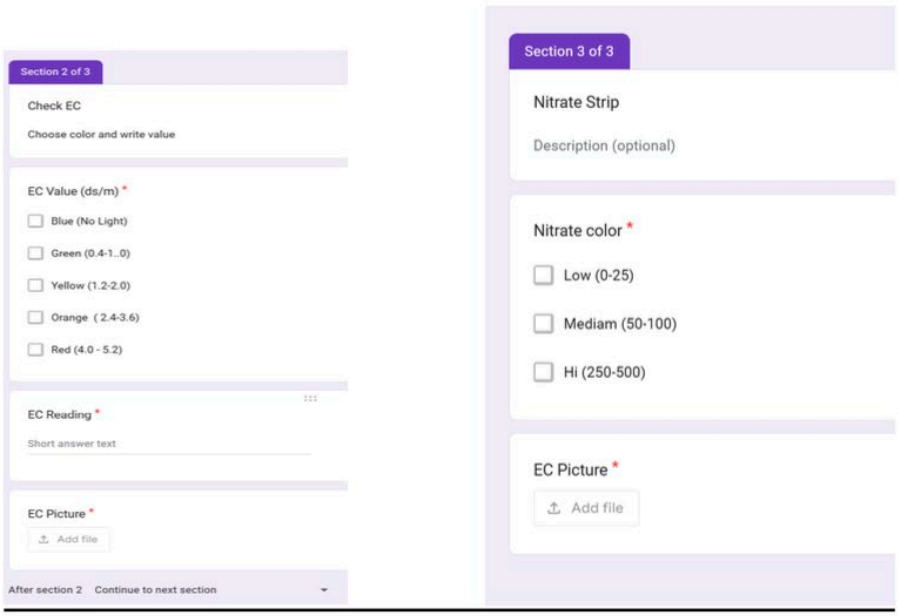
- VIA Tools Report Lok Sanjh Foundation

- Haji Sons Report- Sharqpur

10.4 Appendix 4: Haji Sons Online Form and message example

Development of online form for real time data collection





Daily Result communication with farmers through social media in local language

1st Message –Shared with Farmers

Dear Farmer

Water is the biggest blessing of God, So where there is water, there is life and agriculture.

While on one hand we are suffering from water shortage, on the other hand its excess in crops is the cause of less production/fungal diseases. It is necessary to use advanced VIA technology to decide the right amount of water at right time for the crop. In view of this need, Haji Sons Introducing VIA Sensors for technology lovers and who are already engaged with Haji Sons. We are glad that your name is also among the lucky ones who will be among the pioneers of introducing this advanced technology in the country. Hopefully, by now our field team must have installed 2 sensors on your farm, now our technical team will continue to provide information about the water and fertilizer requirements of your crop on daily basis. This technology will not save water, but will also prove useful in increasing your crop yield.

Best Regards,

Team Haji Sons

محترم کسان بھائی،

پانی جہاں نعمت ربِ زوالجلال ہے وہیں ہماری اور اگر یکچر کی زندگی۔

جہاں ایک طرف ہم پانی کی قلت کا شکار ہیں تو دوسری طرف فصلوں میں اس کی زیادتی پیداوار میں کمی کا سبب۔

یہ فیصلہ کرنے کے لیے کہ فصل کے لیے پانی کی صحیح مقدار اور مناسب وقت کیا ہونا چاہیے اسکے لیے جدید ٹیکنالوجی استعمال کرنے کی ضرورت ہے۔ اسی ضرورت کے پیش نظر حاجی سنز VIA

سنسرز متعارف کروا رہا ہے۔ جس کے لیے پہلے مرحلہ پر جدت پسند اور حاجی سنز کے ساتھ منسلک فارمر کا انتخاب کیا گیا ہے۔ ہمیں خوشی ہے کہ آپ کا نام بھی ان خوش نصیبوں میں شامل ہے جو ملک میں اس جدید ٹیکنالوجی متعارف کروانے والے ہراول دستہ میں شامل ہوں گے۔

امید ہے اب تک ہماری فیلڈ ٹیم آپ کے فارم پر ۲ عدد سنسرز لگا چکی ہو گی اب ہماری ٹیکنکل ٹیم روزانہ کی بنیاد پر آپکی فصل کو پانی اور کھاد کی ضرورت کے بارے میں معلومات مہیا کرتی رہے گی۔ امید ہے یہ ٹیکنالوجی نہ صرف پانی بچائے گی بلکہ آپکی فصل کی پیداوار بڑھانے میں بھی کارآمد ثابت ہو گی۔

آپکی ترقی کے لیے کوشاں،

ٹیم حاجی سنز

2nd Message

Dear farmer,
You are informed that your land doesn't need water at all today because the card sensor is flashing blue, which means your land has plenty of water. Too much water can cause fertilizer wastage and fungal issues.
Save water, save time and save money.

Best Regards,
Team Haji Sons

محترم کسان بھائی،

آپکو مطلع کیا جاتا ہے کہ آج آپکی زمین کو قطعاً پانی کی ضرورت نہیں ہے کیونکہ کارڈ سنسر نیلے رنگ کی روشنی دے رہا ہے جسکا مطلب آپکی زمین میں وافر پانی موجود ہے۔ زیادہ پانی کھاد کے ضیاع اور پھپوندی کا سبب ہو سکتا ہے۔

پانی بچائیں / وقت بچائیں اور پیسہ بچائیں۔

آپکی ترقی کے لیے کوشاں،

ٹیم حاجی سنز

مورخہ 20 جنوری، 2024

10.5 Appendix 5: VIA User Matrix

**Double click on each image to open in Microsoft Excel*

Sr. No.	Farm Name	User type	Farm size (Ha)	Irrigation method	Problem to be solved	VIA solution provided	Wholesale solution cost (AUD)	Potential benefits or improvements (AUD)	Potential saving in irrigation & fertiliser cost only (AUD)	Potential net financial benefit (AUD)	Crop	Is solution viable	User reported benefit
HS-01	Haji Sons Farms	Commercial	9.7	Drip [gravity]	Water use efficiency	6 x WFD, 7 x Card, 1 x Wifi	2300	3606		1306	Cotton, Wheat	Yes	
HS-02	Mahmood Ahmed	Commercial	11.7		Water use efficiency	3 x WFD, 3 x Card, Wifi	1230	4357		3127	Cotton, Wheat	Yes	
HS-03	Mudhsam Saleem	Commercial	42.5		Water use efficiency	3 x WFD, 3 x Card, Wifi	1230	15777		14547	Cotton, Wheat	Yes	
HS-04	Zulfiqar Ali	Commercial	35.2		Water use efficiency	3 x WFD, 3 x Card, Wifi	1230	13072		11842	Cotton, Wheat	Yes	
HS-05	Kaleem Akhter	Commercial	32.4	Flood	Water use efficiency	3 x WFD, 3 x Card	970	12020		11050	Cotton, Wheat	Yes	
HS-06	Rao Tasawwar	Commercial	6.9		Water use efficiency	1 x WFD, 1 x Card	325	2554		2229	Cotton, Wheat	Yes	
HS-07	Maqbool Khichi	Commercial	7.7		Water use efficiency	1 x WFD, 1 x Card	325	2855		2530	Cotton, Wheat	Yes	
HS-08	Mehar Jawed	Commercial	14.2		Water use efficiency	1 x WFD, 1 x Card	325	5259		4934	Cotton,Wheat	Yes	
HS-09	Mehar Sharif	Commercial	42.5		Water use efficiency	3 x WFD, 3 x Card, Wifi	1230	15777		14547	Cotton,Wheat	Yes	
HS-10	Umar Siddique	Commercial	30.4		Water use efficiency	3 x WFD, 3 x Card, Wifi	1230	11269		10039	Cotton,Wheat	Yes	
HS-11	Afzal Khan	Commercial	52.2		Water use efficiency	3 x WFD, 3 x Card, Wifi	1230	19383		18153	Cotton,Wheat	Yes	
HS-12	Sunny Khan	Commercial	10.1		Water use efficiency	1 x WFD, 1 x Card	325	3756		3431	Cotton,Wheat	Yes	
HS-13	Dilshad Ahmed	Commercial	16.2		Water use efficiency	1 x WFD, 1 x Card	325	6010		5685	Cotton,Wheat	Yes	
HS-14	Allah Rakha	Commercial	9.3		Water use efficiency	1 x WFD, 1 x Card	325	3456		3131	Cotton,Wheat	Yes	
HS-15	Syed Shah Jan	Commercial	23.9		Water use efficiency	3 x WFD, 3 x Card, Wifi	1230	8865		7635	Cotton,Wheat	Yes	
HS-16	Ch. Barkat	Commercial	16.6	Flood	Water use efficiency	1 x WFD, 1 x Card	325	6160		5835	Cotton,Wheat	Yes	
HS-17	Haji Hanif	Commercial	16.2		Water use efficiency	1 x WFD, 1 x Card	325	6010		5685	Cotton,Wheat	Yes	
HS-18	Rana Abdul Ghafoor	Smallholder	3.6		Water use efficiency	1 x WFD, 1 x Card	325	1352		1027	Cotton,Wheat	Yes	
HS-19	Rana Muhammad Balish	Commercial	5.7		Water use efficiency	1 x WFD, 1 x Card	325	2104		1779	Cotton,Wheat	Yes	
HS-20	Rana Ghafoor	Smallholder	2.0	Flood	Water use efficiency	2 x WFD, 2 x Card	520	751		231	Cotton,Wheat	Yes	
HS-201	Tariq Basheer	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				Cucumber		
HS-202	Mohr Zafar	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				Cucumber		
HS-203	Arslan	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				Bitter Gourd		
HS-204	Abbas	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				Cucumber		
HS-205	Ch Akhtar	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				Chilli		
HS-206	Rana Shahid	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				Squash		
HS-207	Zubair	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				wheat		
HS-208	Zafar Iqbal	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				Cucumber and chilli		
HS-209	Hafiz Muneer	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				Bitter Gourd		
HS-21	Taj Muhammad	Commercial	5.7		Water use efficiency	1 x WFD, 1 x Card	325	2104		1779	Cotton,Wheat	Yes	
HS-210	Mi Sadiqiue	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				Okra		
HS-211	M Abid	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				Cucumber		
HS-212	Aslam Choudhry	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				Onion		
HS-213	Mian Mohtab	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				Cucumber		
HS-214	Maqbool Khan	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				Bitter Gourd		
HS-215	Rao Bilal Ahmed	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				spongegourd		
HS-216	Ch. Munawar	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				Onion		
HS-217	Hafeez Ur Rahman	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				Chilli		
HS-218	Saif ur Rahman	Smallholder			Water use efficiency	WFD, nitrate strip, EC meter, Chameleon Card kit	320				Wheat and watermelon		
HS-22	Muhammad Akhtar	Smallholder	2.4		Water use efficiency	1 x WFD, 1 x Card	325	902		577	Cotton,Wheat	Yes	
HS-23	Ranjhey Khan	Commercial	9.7		Water use efficiency	1 x WFD, 1 x Card	325	3606		3281	Cotton,Wheat	Yes	
HS-24	M.Shabir	Smallholder	2.8		Water use efficiency	1 x WFD, 1 x Card	325	1052		727	Cotton,Wheat	Yes	
HS-25	M. Imran Yaqoob	Commercial	5.7		Water use efficiency	1 x WFD, 1 x Card	325	2104		1779	Cotton,Wheat	Yes	
HS-26	Sanaullah	Smallholder	3.2		Water use efficiency	1 x WFD, 1 x Card	325	1202		877	Cotton,Wheat	Yes	
HS-27	Imran	Commercial	17.4		Water use efficiency	1 x WFD, 1 x Card	325	6461		6136	Cotton,Wheat	Yes	

Sr. No.	Farm Name	User type	Farm size (Ha)	Irrigation method	Problem to be solved	VIA solution provided	Wholesale solution cost (AUD)	Potential benefits or improvements (AUD)	Potential saving in irrigation & fertiliser cost only (AUD)	Potential net financial benefit (AUD)	Crop	Is solution viable	User reported benefit
HS-28	Anwar Sajjad	Smallholder	2.8		Water use efficiency	1 x WFD, 1 x Card	325	1052		727	Cotton, Wheat	Yes	
HS-29	Ghulam Abbas	Commercial	5.3		Water use efficiency	1 x WFD, 1 x Card	325	1953		1628	Cotton, Wheat	Yes	
HS-30	Sajid	Smallholder	1.2	Flood	Water use efficiency	1 x WFD, 1 x Card	325	451		126	Cotton, Wheat	No	
HS-31	Fazal	Commercial	10.1		Water use efficiency	3 x WFD, 3 x Card, WiFi	1230		2075	795	Vegetables	Yes	
HS-32	M. Shoaib	Commercial	18.2		Water use efficiency	3 x WFD, 3 x Card, WiFi	1230		3645	2415	Vegetables	Yes	
HS-33	Naeem Raza	Commercial	13.4		Water use efficiency	3 x WFD, 3 x Card, WiFi	1230		2673	1443	Maize	Yes	
HS-34	Zubair Ahmed	Smallholder	2.4		Water use efficiency	1 x WFD, 1 x Card	325		486	161	Wheat, Maize, Potato	Yes	
HS-35	Saqlain Raza	Commercial	5.7		Water use efficiency	1 x WFD, 1 x Card	325		1134	809	Wheat, Maize, Potato	Yes	
HS-36	Muhammad Ahmed	Commercial	21.9		Water use efficiency	3 x WFD, 3 x Card, WiFi	1230		4374	3144	Wheat, Maize	Yes	
HS-37	Muhammad Saleem	Commercial	14.2		Water use efficiency	3 x WFD, 3 x Card, WiFi	1230		2835	1605	Vegetables	Yes	
HS-38	M. Ramzan	Commercial	16.6		Water use efficiency	3 x WFD, 3 x Card, WiFi	1230		3321	2091	Wheat, Maize	Yes	
HS-39	Murad Khan	Commercial	30.4		Water use efficiency	3 x WFD, 3 x Card, WiFi	1230	11269		10039	Cotton, Maize	Yes	
HS-40	Muhammad Yousaf	Commercial	19.2		Water use efficiency	3 x WFD, 3 x Card, WiFi	1230		3847.5	2617.5	Vegetables	Yes	
HS-41	Haji Yameen	Smallholder	2.8		Water use efficiency	1 x WFD, 2 x Card	425	1052		627	Cotton	Yes	
HS-42	Zafar Iqbal	Smallholder	4.1		Water use efficiency	1 x WFD, 1 x Card	325		810	485	Vegetables	Yes	
HS-43	Rana amir	Smallholder	1.6		Water use efficiency	1 x WFD, 2 x Card	425	601		176	Cotton	Yes	
HS-44	Malik Dilshad	Smallholder	4.1		Water use efficiency	1 x WFD, 1 x Card	325		810	485	Vegetables	Yes	
HS-45	Younas	Smallholder	1.6		Water use efficiency	1 x WFD, 1 x Card	325		324	-1	Vegetables	No	
HS-46	M. Shoukat	Smallholder	3.6		Water use efficiency	1 x WFD, 1 x Card	325		729	404	Vegetables	Yes	
HS-47	Saif ur Rahman	Commercial	6.1		Water use efficiency	1 x WFD, 1 x Card	325		1215	890	Vegetables	Yes	
HS-48	Hameed chohja	Commercial	5.7		Water use efficiency	1 x WFD, 1 x Card	325		1134	809	Vegetables	Yes	
HS-49	M. Usman	Smallholder	3.6		Water use efficiency	1 x WFD, 1 x Card	325		729	404	Vegetables	Yes	
HS-50	Safdar	Commercial	6.1		Water use efficiency	1 x WFD, 1 x Card	325		1215	890	Vegetables	Yes	
HS-51	Hazoor Ahmed	Commercial	49.4		Water use efficiency	3 x WFD, 3 x Card, WiFi	1230		9882	8652	Vegetables	Yes	
HS-52	Basheer Ahmed	Commercial	26.3		Water use efficiency	3 x WFD, 3 x Card, WiFi	1230		5265	4035	Vegetables	Yes	
HS-53	Tariq Hassan	Commercial	17.8		Water use efficiency	3 x WFD, 3 x Card, WiFi	1230		3564	2334	Vegetables	Yes	
HS-54	M. Yaqoob	Commercial	6.9		Water use efficiency	1 x WFD, 1 x Card	325		1377	1052	Vegetables	Yes	
HS-55	M. Farooq	Commercial	20.3		Water use efficiency	3 x WFD, 3 x Card, WiFi	1230		4050	2820	Vegetables	Yes	
HS-56	Malik Basheer Awan	Commercial	10.1		Water use efficiency	3 x WFD, 3 x Card, WiFi	1230		2075	795	Vegetables	Yes	
HS-57	Ghulam Mustafa	Smallholder	4.1		Water use efficiency	1 x WFD, 2 x Card	425	1503		1078	Wheat, Cotton	Yes	
HS-58	M. Amin	Commercial	7.3		Water use efficiency	1 x WFD, 1 x Card	325		1458	1133	Vegetables	Yes	
HS-59	M. Shahid	Smallholder	4.1		Water use efficiency	1 x WFD, 1 x Card	325		810	485	Vegetables	Yes	
IWMI-01	Azam Tahir	Smallholder	6.1	Canal and pump (canal is	Inequitable distributio	Chameleon WIFI	260	2763		2503	Wheat	Yes	- Two Irrigation Events Saved
IWMI-02	Bashir Ahmad	Smallholder	10.1	Canal	Inequitable distributio	Chameleon WIFI	260	4575		4315	Wheat	Yes	- Two Irrigation Events Saved
IWMI-03	Bilal Ahmad	Smallholder	4.9	Canal	Saline groundwater	Chameleon Card reader	105	2220		2115	Wheat	Yes	- Two Irrigation Events Saved
IWMI-04	Ch. Yawer Site 1	Smallholder	4.9	Canal	Salinity	Chameleon WIFI + WFD	480	2220		1740	Wheat	Yes	- Two Irrigation Events Saved
IWMI-05	Ch. Yawer Site 2	Smallholder	4.5	Canal	Salinity	Chameleon WIFI	260	2039		1779	Wheat	Yes	- Two Irrigation Events Saved
IWMI-06	Choudhary Naeem	Large Holding/WUG	80.9	Canal	Saline Groundwater	Chameleon WIFI + WFD	480		16180	15700	Maize	Yes	- Three Irrigation Events Saved
IWMI-07	Choudhary Tahir	Commercial	141.6	Canal + Pump	salinity	Chameleon WIFI	260	64145		63885	Wheat	Yes	- Two Irrigation Events Saved
IWMI-08	Dilshad Nabi	Smallholder	4.9	Drip Irrigation	Saline groundwater	Chameleon WIFI	260		980	720	Citrus	Yes	- Frequency of Irrigation Increased from 15 to 30 Days.
IWMI-09	Dr. Iqbal - REEDS	Smallholder	0.6	Pump	No canal water	Chameleon WIFI + WFD	480	777		-708	Wheat	No	- Two Irrigation Events Saved
IWMI-10	Dr. Umair	Large Holding/WUG	80.9	Canal	Salinity	Chameleon WIFI + WFD	480	36648		36168	Wheat	Yes	- Two Irrigation Events Saved
IWMI-11	FACE Site 1	Commercial	1.2	Pump	Salinity	Chameleon WIFI	260	544		284	Wheat	Yes	- Two Irrigation Events Saved
IWMI-12	FACE Site 2	Commercial	0.2	Pump	salinity	Chameleon WIFI	260		40	-220	Mustard/Raya	No	- Two Irrigation Events Saved
IWMI-13	Fayyaz Mehmood Site-1	Smallholder	0.8	Canal	Salinity	Chameleon Card reader	105	362		257	Wheat	Yes	- Two Irrigation Events Saved
IWMI-14	Fayyaz Mehmood Site-2	Smallholder	0.4	Canal	Salinity	Chameleon Card reader	105	181		76	Wheat	No	- Two Irrigation Events Saved
IWMI-15	Fazeel Gujjar	Large Holding/WUG	60.7	Canal	Water Scarcity	Chameleon WIFI + WFD	480		12140	11660	Mustard/Raya	Yes	- Two Irrigation Events Saved
IWMI-16	Hafiz Umar	Smallholder	3.6	Canal	Saline groundwater	Chameleon Card reader	105	1631		1526	Wheat	Yes	- Two Irrigation Events Saved
IWMI-17	Hafiz Umer	Smallholder	3.6	canal	Saline groundwater	Chameleon WIFI	260	1631		1371	Wheat	Yes	- Two Irrigation Events Saved
IWMI-18	Hasham Mukhtar	Smallholder	2.2	Canal + pump	Salinity	Chameleon WIFI + WFD	480	997		517	Wheat	Yes	- One Irrigation Event Saved
IWMI-19	Ittehad Agriculture Farm	Commercial	40.5	Drip Irrigation	Water scarcity	Chameleon WIFI + WFD	480	18347		17867	Wheat	Yes	- Two Irrigation Events Saved

Sr. No.	Farm Name	User type	Farm size (Ha)	Irrigation method	Problem to be solved	VIA solution provided	Wholesale solution cost (AUD)	Potential benefits or improvements (AUD)	Potential saving in irrigation & fertiliser cost only (AUD)	Potential net financial benefit (AUD)	Crop	Is solution viable	User reported benefit
NMI-20	IPL Site 1	Commercial	60.7	Pump	Inequitable distributio	Chameleon WIFI	260	27497		27237	Wheat	Yes	- Two Irrigation Events Saved
NMI-21	IPL Site 2	Commercial	0.4	Canal	Saline groundwater	Chameleon WIFI	260		80	-180	Herbs	No	- Two Irrigation Events Saved
NMI-22	IPL Site 3	Commercial	8.1	Canal	Saline groundwater	Chameleon WIFI	260	3669		3409	Wheat	Yes	- Two Irrigation Events Saved
NMI-23	IDFUEIT Site 1	Government	0.6	Canal	Salinity	Chameleon WIFI + WFD	480	272		-208	Wheat	No	- Two Irrigation Events Saved
NMI-24	IDFUEIT Site 2	Government	0.7	Canal	Salinity	Chameleon WIFI	260	317		57	Wheat (raised bed technology)	No	- Three Irrigation Events Saved
NMI-25	Khalid Pervaiz	Smallholder	1.2	Canal	Saline groundwater	Chameleon Card reader	105	544		439	Wheat	Yes	- Two Irrigation Events Saved
NMI-26	Khurram Saeed	Smallholder	0.4	Canal	Saline Groundwater	Chameleon WIFI + WFD	480		80	-400	Maize	No	- Three Irrigation Events Saved
NMI-27	Mujtuba Kamran	Smallholder	2.1	Canal and Pump	Water Scarcity	Chameleon WIFI	260	951		691	Wheat	Yes	- Two Irrigation Events Saved
NMI-28	Naeem Rustam	Smallholder	2.1	Canal + Pump	Salinity and inequitabl	Chameleon WIFI	260		420	160	Mango Orchard	Yes	- Frequency of Irrigation Increased from 15 to 30 Days.
NMI-29	Naveed Ur Rehman	Smallholder	1.6	canal	Saline groundwater	Chameleon Card reader	105	725		620	Wheat	Yes	- Two Irrigation Events Saved
NMI-30	Rashid Mehmood	Smallholder	2.6	Canal and Pump	Inequitable distributio	Chameleon WIFI	260	1178		918	Wheat	Yes	- Two Irrigation Events Saved
NMI-31	Shehrez Ali	Smallholder	1.2	Canal and Pump	Water Scarcity	Chameleon WIFI	260	544		284	Wheat	Yes	- Two Irrigation Events Saved
NMI-32	Uzair Shah	Commercial	80.9	Canal + pump	Salinity	Chameleon WIFI	260	36648		36388	Wheat	Yes	- Two Irrigation Events Saved
NMI-33	Waleed Tahir	Smallholder	8.5	Canal + Pump	Saline Groundwater	Chameleon WIFI	260	3851		3591	Wheat	Yes	- Two Irrigation Events Saved
NMI-34	Zaka Ashraf	Large Holding/WUG	80.9	Drip Irrigation	Saline groundwater	Chameleon WIFI	260		16180	15920	Citrus	Yes	- Frequency of Irrigation Increased from 15 to 30 Days.
NMI-35	Syeda Farms	Commercial	0.6	Canal	Water Scarcity, Salinit	Chameleon Card	105		120	15	Rice/Wheat/Maize	No	- Two Irrigation Events Saved
NMI-36	OFWM, Okara	Government	0.4	Drip Irrigation	Inequitable Distributio	Chameleon Card, Chameleon WIFI, and WFD	585		80	-505	Guava (High Dense)	No	- Frequency of Irrigation Increased from 15 to 30 Days.
NMI-37	OFWM, Okara	Government	0.2	Drip Irrigation	Inequitable Distributio	Chameleon WIFI	260		40	-220	Guava (Dense)	No	- Frequency of Irrigation Increased from 15 to 30 Days.
NMI-38	OFWM, Okara	Government	0.4	Drip Irrigation	Inequitable Distributio	Chameleon WIFI	260		80	-180	Guava (Farmer's Practice)	No	- Frequency of Irrigation Increased from 15 to 30 Days.
NMI-39	OFWM, Okara	Government	0.5	Drip Irrigation	Inequitable Distributio	Chameleon WIFI	260		100	-160	Citrus	No	- Frequency of Irrigation Increased from 15 to 30 Days.
NMI-40	OFWM, Okara	Government	3.8	Center-Pivot Irrigation	Inequitable Distributio	Chameleon WIFI	260	1721		1461	Cotton/Maize/Wheat	Yes	- 70-80% Water Saving During Cropping Season
LS-01	Muhammad Tariq Mehmood	Commercial	6.5	Canal, and Pump	Water scarcity	Wetting Front Detectors & EC Meters	150		1296	1146	Vegetables	Yes	
LS-02	Muhammad Ahmed	Smallholder	3.2	Canal, and Pump	Water scarcity	Wetting Front Detectors & EC Meters	150		648	498	Vegetables	Yes	
LS-03	Zia Ul Haq	Smallholder	2.8	Canal, and Pump	Water scarcity	WFD	240	652		412	Wheat	Yes	
LS-04	Muhammad Sarwar	Smallholder	1.2	Canal, and Pump	Water scarcity	WFD	240	279		39	Wheat	No	
LS-05	Shahid Imran	Smallholder	3.2	Canal, and Pump	Water scarcity	WFD	240	745		505	Wheat	Yes	
LS-06	Peer Ijaz Muhammad Chishti	Commercial	8.1	Canal, and Pump	Water scarcity	WFD	240	1700	599	1460	Wheat, Cotton	Yes	30% water reduction, 20% yield increase
LS-07	Arshad Ahmed	Smallholder	4.1	Canal, and Pump	Water scarcity	Wetting Front Detectors & EC Meters	150	1503		1353	Cotton, Maize	Yes	
LS-08	Ahsan Ullah	Smallholder	4.9	Turbine Pumps	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260		972	712	Vegetables	Yes	
LS-09	Muhammad Tanveer	Commercial	16.2	Turbine Pumps	Water scarcity	1 x WFD, 1 x Card	325	6010		5685	Wheat, Cotton	Yes	
LS-10	Muhammad Arif	Commercial	40.5	Turbine Pumps	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260	15026		14766	Cotton, Maize	Yes	
LS-11	Mazhar Abbas	Commercial	10.1	Turbine Pumps	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260	3756		3496	Cotton, Maize	Yes	
LS-12	Muhammad Imtiaz	Smallholder	4.9	Turbine Pumps	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260		972	712	Vegetables	Yes	
LS-13	Muhammad Amjad	Commercial	6.1	Turbine Pumps	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260		1215	955	Vegetables	Yes	
LS-14	Muhammad Rehan Anjum	Smallholder	2.4	Turbine Pumps	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260		486	226	Vegetables	Yes	
LS-15	Muhammad Saeed	Commercial	10.5	Turbine Pumps	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260		2106	1846	Vegetables	Yes	
LS-16	Wajid Ali	Commercial	14.2	Turbine Pumps	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260		2835	2575	Vegetables	Yes	
LS-17	Fayaz Ahmed	Smallholder	1.2	Turbine Pumps	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260		243	-17	Vegetables	No	
LS-18	M. Hafeez	Commercial	8.1	Turbine Pumps	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260		1620	1360	Vegetables	Yes	
LS-19	Mazhar Hussain	Commercial	14.2	Turbine Pumps	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260		2835	2575	Vegetables	Yes	
LS-20	M.Shafeel	Commercial	16.2	Turbine Pumps	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260		3240	2980	Vegetables	Yes	
LS-21	M. Akthar	Commercial	7.7	Turbine Pumps	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260		1539	1279	Vegetables	Yes	
LS-22	M. Shafiq	Smallholder	2.4	Turbine Pumps	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260		486	226	Vegetables	Yes	
LS-23	M.Shahid	Commercial	14.2	Turbine Pumps	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260		2835	2575	Maize	Yes	
LS-24	M.Ajmal	Smallholder	2.0	Turbine Pumps	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260		405	145	Maize	No	
LS-25	Abdul Latif	Smallholder	1.6	Turbine Pumps	Water scarcity	1 x WFD, 1 x Card	325	601		276	Wheat, Cotton	Yes	
LS-26	Qazi Javid Akthar	Smallholder	2.4	Turbine Pumps	Water scarcity	1 x WFD, 1 x Card	325	902		577	Wheat, Cotton	Yes	
LS-27	Haji Khan	Smallholder	3.2	Turbine Pumps	Water scarcity	1 x WFD, 1 x Card	325	1202		877	Wheat, Cotton	Yes	
LS-28	Muhammad Rizwan	Smallholder	3.2	Canal, and Pump	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260		648	388	Vegetables	Yes	
LS-29	Muammad Saleem	Smallholder	2.0	Canal, and Pump	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260		405	145	Vegetables	No	
LS-30	Irshad Ali	Smallholder	3.6	Canal, and Pump	Water scarcity	WFDs, EC Meters & Chameleon Card kit	260		729	469	Vegetables	Yes	

10.6 Appendix 6: Additional partner reports

Refer attached reports

- IWMI Concept Note for Webinar on VIA Irrigation Equipment
- IWMI Report - Enhancing Water Resource Management through VIA Sensor Technology in Pakistan
- VIA Tools Training Report by Haji Sons – January 2024
- VIA Tools Report RBDC – December 2023
- VIA Report to PCRWR/PID
- VIA Presentation on Distribution and Production of VIA products Pakistan

10.7 Appendix 7: Better Cotton Pakistan Quarterly Newsletter

Issue 2
Volume 8
Year 2023

Better Cotton Knowledge Network

In this Issue

- *Field Insights from PPs*
- *Research paper on climate change*
- *Crop Advisory for partners*
- *Success Stories – RBDC*

Photo Credit: Better Cotton / [RBDC]

Our Top Picks

Better Cotton farmer, Mr. Ijaz Chishti have managed a reduction in water usage and are expecting significant increase in their cotton yield based on this change. For more details visit page no.7.

Women's Empowerment

Research

Farmer Smiles

Success Story

Use of Wetting Front Detectors (WFD)

One of the most notable success stories came from a cotton farmer Mr. Ijaz Chishti from District Bahawalnagar. Before the installation of the WFD, Mr. Ijaz Chishti used traditional irrigation methods, which often led to over-irrigation, water wastage, and sometimes even crop damage due to waterlogging.

After installation, Mr. Ijaz Chishti was able to monitor the soil moisture accurately. He adjusted his irrigation practices based on the data provided by the WFD, which resulted in a significant reduction of water usage. Not only did this save him money on his tubewell expenses, but it also led to a healthier crop yield as the cotton plants were no longer subjected to water stress.

Photo Credit: Better Cotton / [LSF]

Within the first year of using the WFD, it helped in a 20% increase in cotton yield and a 30% reduction in water usage for Ijaz. This success story serves as powerful evidence of the benefits of the WFD instruments, encouraging other farmers in the district to embrace the technology.

I was sceptical about the technology fearing that it might not result in significant benefits and agreed to use it after several trainings and demonstrations.

Mr. Ijaz Chishti (Better Cotton Farmer)

"The initiative by the Lok Sanjh Foundation in Bahawalnagar district demonstrates the potential of technology like the Wetting Front Detector in promoting sustainable and efficient farming practices. The success story of Mr. Ijaz Chishti's farm serves as an inspiration for other farmers to adopt such technologies, paving the way for a more sustainable future for agriculture in the region."

Mr. Nouman Noor (PUM-PKBN14)LSF

We would like to hear from you! Drop your feedback on the given link.

Link:
https://docs.google.com/forms/d/1M7ovFYF70sUhZW7xztRznY0DX5NcZS6qyZjmCD0AKYk/edit

For any queries write to us at muhammad.umar@bettercotton.org

10.8 Appendix 8: FIDA Business Model

+92 (0) 3017931535
info@fida.org.pk
https://fida.org.pk

Business Model

Providing Agricultural Services through "Chameleon" Scientific Tool

Submitted by:

Farmers' Integrated Development Association (FIDA)

1. Executive Summary:

Our business aims to revolutionize the agricultural industry by offering farmers a comprehensive suite of services through a scientific tool called "Chameleon." This tool combines cutting-edge technologies such as data analytics, and machine learning to provide farmers with real-time insights, recommendations, and solutions for optimizing their farming practices. By empowering farmers with data-driven decisions, we strive to enhance productivity, reduce costs, and promote sustainable agricultural practices. The subject model will develop skills and capacity among women and men farmers to manage and maintain irrigation which is the need of the hour for Pakistan's continued economic growth, food security, and poverty reduction.

2. Problem Statement:

Traditional farming methods often lack precision and are susceptible to environmental variations, leading to suboptimal yield, excessive resource usage, and increased costs. Farmers require timely and accurate information to make informed decisions and adapt to changing conditions. "Chameleon" addresses these challenges by providing data-driven insights for better decision-making.

3. Solution Offerings:

"Chameleon" is a comprehensive agricultural tool that offers the following services:

- Data Collection and Analysis
- Personalized Recommendations
- Knowledge Sharing

4. Objectives:

- Introduce farmers to modern irrigation technologies like soil moisture sensors.
- Provide guidance on the selection, installation, and maintenance of these technologies to improve water-use efficiency.
- Equip farmers with skills to collect and interpret data related to soil moisture, weather patterns, and crop water requirements.

5. Services to offer:

5.1. Training and Support:

- Onboarding and Training: Offer training sessions to help farmers effectively use the Chameleon platform and interpret data.
- Customer Support: Provide ongoing support to address technical issues and answer questions.

5.2. Irrigation Management:

- Real-time Monitoring: Monitor irrigation systems and water usage in real-time through Chameleon's sensors.
- Water Scheduling: Create optimized irrigation schedules based on weather data, soil moisture levels, and crop needs.

5.3. Water Conservation Strategies:

- Water Usage Analysis: Provide insights into water consumption patterns to help farmers optimize water usage and reduce waste.
- Drought Preparedness: Offer guidance on how to conserve water during

drought conditions.

5.4. Customized Solutions:

- Tailored Recommendations: Provide personalized irrigation strategies based on a farm's specific conditions and goals.
- Consultation Services: Offer consulting sessions where experts review data and provide strategic advice.

6. Methodology:

1. Selection of the Service Providers: The FIDA will select potential service providers (men and women) from among the existing team of farmer facilitators,
2. Training of service providers: A training of Trainers (ToT) will be organized for the selected farmer facilitators to train them as "Service Providers",
3. Orientation sessions at the villages level: The FIDA will organize sessions at the village level for farmers (men and women) orientation to the Chameleon,
4. Selection of demonstration sites: The FIDA will select the sites to demonstrate the results of the "Chameleon",
5. Part of the ongoing activities: Raising awareness and capacity building of farmers regarding the use of Chameleon will be made part of the FIDA ongoing farmers capacity building programs especially Farmer Field Schools, Women Open Schools,

7. Geographic area:

District Vehari of South Punjab, Pakistan

8. Cropping Pattern:

8.1. Rabi Crops (Winter Crops):

- Wheat

8.2. Kharif Crops (Summer Crops):

- Rice
- Cotton
- Maize (Corn)
- Sugarcane

9. Source of Irrigation:

9.1. Canal Irrigation

9.2. Tube Wells and Groundwater Irrigation

10. Subscription Models:

Different subscription tiers will be introduced that can provide varying levels of service and support based on farmers' needs and budgets