SoLAR IF

Off Grid Bazaar – Scaling the deployment of solar irrigation systems using digital platform and personalized agri-advisory for the farmers

Final report

for

January, 2023

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Images

Abbreviations used

AEPC	Alternative Energy Promotion Centre
COVID-19	Corona Virus Diseaseoof 2019
DO	Dissolved Oxygen
GPKM	Gham Power Krishi Meter
IWMI	Inrernatrional Water Management Insititute
KPIs	Key Performamce Indicators
MFIs	Microfinance Institutions
NPK	Nitrogen Phosphorous Potassium
OGB	Off Grid Bazaar
SoLAR IF	Solar Irrigation for Agricultural Resilience Innovative Funds
SWPS	Solar Water Pumping Systems
YIIB	Yield Improvement in a Box

Section I: Project Background and Context

Overview of the project

Agriculture is the most populated yet the least industrialized sector in Nepal employing up to 65% of the entire country's population. Although the sector accounts for a large part of the population and around 23% of the country's GDP it is grossly underfunded and underdeveloped with most farmers lacking the means of proper irrigation infrastructure as well as awareness on commercial farming. With the motive to contribute a bit to reform the agriculture sector of Nepal, we addressed the two specific challenges that the farmers are facing.

Gham Power aimed to introduce technology and modern practices to the agricultural sector and develop a system of data collection that helped conceptualize impact monitoring in order to assess the challenges and needs of farmers more comprehensively. We provided our eco-friendly innovative solution of Yield Improvement in a Box (YIIB) as well as the services of our data-driven website Off-Grid Bazaar (OGB) to empower small, marginalized and female farmers with better infrastructure (proper irrigation through SWPS and affordable financing) and personalized agri-advisory services (through smart meter and OGB) to raise their yield and income.

After the pilot studies, the innovation developed by Gham Power Nepal proved that these solutions are successful and worth expanding upon. With the hope to expand these services to all over the farmer of the nation, we needed to improve and refine its current models. With the help of IWMI IF, Gham Power developed it's agri-training services as well as the OGB website with the intention of extending its use to other government agencies and private companies. We hoped that a comprehensive and efficient monitoring system allow for a clearer assessment of the problems that require addressing in rural areas in order to improve the lives of disadvantaged farmers.

Locations of intervention

On the basis of the farmer list procured by the Alternative Energy Promotion Centre (AEPC), the area was meticulously selected and scouted after undergoing a thorough survey and determining the technical viability of the Gham Power Krishi Meter Installation. The monitoring system was installed in the districts of Chitwan, Nawalparasi, Dang, Kailali, Banke, Bardiya and Kanchanpur. In order to raise awareness about SWPS, concerted efforts were made in coordination with our Microfinances Partners to organize various awareness and demonstration programs across the provinces of Province 1, Madhesh Province, Bagmati Province, Gandaki Province, Lumbini Province, and Sudurpaschim Province. In addition, agriculture trainings were also conducted in these regions. Under the aegis of the SoLAR IF projects, the installation of the Gham Power Krishi Meter was carried out across over 14 districts, along with conducting awareness and agent training programs for the promotion of SWPS. For the purposes of testing and validating the sensors, the innovation was piloted in commercial research farms around the Kathmandu valley for ease of regular monitoring and analysis during the test period. This was done in collaboration with other relevant government bodies in Nepal, such as the Centre for Fisheries Promotion and Conservation Centre (CFPCC) under the Ministry of Agriculture and Livestock Development. The virtual agri-trainings and agri-advisories via the Super Krishak Mobile app were initially targeted exclusively to the SWPS end users from Gham Power, but were later expanded to encompass all of Nepal and all smallholder farmers.

Objectives of the project

The project was embarked upon with two primary objectives in mind: first, to more meticulously quantify and augment the impact that the deployment of solar water pumps would have on smallholder farmers in terms of yield and income increase; and second, to refine and strengthen the value proposition for potential early adopter institutions to better facilitate the scaling of the deployment of these pumps through the use of innovative digital platforms and advanced hardware. The underlying rationale for the entire project was to aid smallholder farmers in the transition from traditional and subsistence-based agriculture to more modern and sophisticated farming practices, thereby enabling their progress up the income ladder and disrupting the insidious cycle of poverty.

Section II: Baseline Data with analysis

Background

- **Background**
  Solar water pumping systems have gained widespread popularity for irrigation purposes in Nepal. According to a recent survey, very few of the farmers in Nepal have adopted these systems, which offer a cost-effective and sustainable solution compared to traditional diesel-powered pumps, especially in rural and remote areas where electricity access is limited. The use of solar water pumping has had a positive impact on the agriculture sector, as seen in a 10% increase in crop yields and improved water management. In addition, the shift to solar water pumping has reduced dependence on fossil fuels, resulting in a 30% decrease in costs and a reduction of carbon emissions by 50%. Despite these benefits, there are still challenges to be addressed to further scale up the use of solar water pumping in Nepal, including the need for more financing and investment, and improved access to technical assistance and training. However, the potential benefits of solar water pumping systems for irrigation and agriculture in Nepal are significant, and it is projected that their use will continue to grow in the coming years, with an estimated 50% increase in adoption over the next 5 years.

- **Statement of problems & Rationale**

  Access to reliable irrigation solutions is critical for Nepal's 12.7 million smallholders to transition from subsistence farming to commercial income-based agriculture. Only about 5% of the total smallholders in Nepal have access to on-demand irrigation and about two-thirds of the total arable land has been left unused. Despite agriculture employing more than 80% of the total population in Nepal, the vast majority of farmers live under poverty. Agricultural growth is one of the most crucial factors in ensuring food security, sustainable development, and poverty alleviation for most Nepalese. Solar energy-powered irrigation holds immense potential in an agricultural country like Nepal, but the uptake of solar water pumps have been limited due to non-supportive government policies, inefficient system designs,

high capital cost, and lack of access to finance for smallholding farmer who do not have conventional credit history, thus deemed risky by the financial institutions.

To tackle these challenges, Gham Power developed an integrated solution called "Yield Improvement in a Box," which combined efficient irrigation, accessible financing, a digital platform for data-driven project development, and personalized agri-advisory services to help farmers improve their farming efficiency, productivity, and income. The company also formed partnerships with Microfinance Institutions and local agents to reach more farmers and monitor the impact of the solution. The project was carried out in four steps: "Field Activities for Social Mobilization and Awareness," "Enhancement and Further Development of Personalized Agri-Advisory," "Measurement and Validation of the Impact," and "Market Activation and Development."

The goal of the project was twofold: to understand and improve the impact of the integrated irrigation and advisory solution on smallholder farmers and to understand and improve the operational processes of relevant stakeholders, such as the government, aid agencies, and private sector, in order to identify the key performance indicators for adopting Gham Power's digital platform, Off Grid Bazaar. This platform, with its real-time agricultural data tracking and impact assessment algorithms, was a major step forward in the conventional solutions and had the potential to provide farmers with personalized agri-advisory services. The platform also had the potential to scale and provide better value propositions to farmers, government agencies, and private sector.

With the support of the IF grant, Gham Power was poised to rapidly expand and scale the deployment of solar irrigation systems with personalized agri-advisory solutions in Nepal and beyond. This was facilitated by the SoLAR IF project and its affiliates in multiple countries in the region. The project had the potential to benefit hundreds of thousands of smallholder farmers in the region over the next 5 years, and open up the commercial solar irrigation market in the process.

- **Project aim & Objective**
  Gham Power’s solution is an integrated service combining reliable irrigation, affordable and easy financing, digital platform for data driven project development, and customized agri-advisory for each farmer, collectively called ‘Yield

Improvement in a Box'. We make irrigation accessible and affordable to rural smallholders by providing them with solar water pumps through a network of local partners and agents and with the help of our digital platform – Off Grid Bazaar (OGB). The main objective of the project is to create an inclusive package allowing poor and marginalized farmers to access affordable and reliable solar water pumps tha will help them increase their efficiency, productivity, and thus, income. Our solution includes:

A. **Data Driven Farming**: OGB's algorithm uses farmers' information to customize and design optimally sized Solar Water Pump (SWPs) suited to their farm requirements and also suggests crop selections that maximize profitability. The solar pumps are integrated with a smart meter equipped with sensors to collect post installation data such as pH scale, soil moisture, water flow and impact metrics which can be used to identify the key variable that can have an impact on the yield and revenue of the farmers. The meters are fitted with devices that track water usage patterns that minimize water stress during drier periods ensuring regulated and a secure irrigation system that will help increase crop productivity. It can track potential issues in advance and notify us so that the local agents can fix them as soon as possible.
B. **Financial Inclusion:** Our digital platform displays farmers' agricultural, financial and demographic data which are reviewed as investment opportunities by local microfinance institutions and cooperatives. The platform allows these local financial institutions, who are also partners in project acquisition and deployment, to review the farmer's information and demand, and make prompt and informed financing decisions that help farmers secure quick and affordable financing without having to do extensive paperwork or multiple bank visits. Our digital platform also makes energy accessible through mobile payments and PAYGo financing which reduces the cost of repayment collections. Hence, it increases service coverage and helps uncollateralized farmers previously experiencing credit constraints access financial support and SWPs.
C. **Personalized Agri-Advisory Service**: OGB uses farmers' agricultural information and suggests crop selections suited to their farm that maximize profitability. Off Grid Bazaar is a big leap forward against conventional solutions as measuring impact on the farmers by monitoring their operational and agricultural data allows us to optimize our solution enabling advisory services which maximize their agricultural efficiency. Moreover, uncollateralized smallholders who faced credit constraints can access finance through our partnered micro finances improving affordability.

- **Project activities & Timeline**

The project was implemented in 4 Work Packages with 12 activities over a 20-month period. The first work package included Field Activities for Social Mobilization and Awareness. In this work package, Gham Power identified and trained local agents, conducted agri-workshops for the farmers, and prepared audio-visual aids to generate awareness among local farmers and communities regarding solar water pumps, and Gham Power's Yield Improvement in a Box solution. This helped Gham Power and future partners/stakeholders, like AEPC, and Micro Finance institutions to identify locations and local partners to conduct other work packages in the project.

The second work package involved Enhancement and Further Development of Personalized Agri - Advisory service. In this work package, Gham Power improved the accuracy, reliability and the overall performance of the automated agri-advisory service. This was done by testing and incorporating better agri-sensors, updating the crop database to include more and higher value crops, and by integrating these changes (sensors, and crop database) into the software platform to automate the entire advisory process.

The third work package involved Measurement and Validation of the Impact associated with the Yield Improvement Solution developed by Gham Power. While preliminary studies with internal farmers (adopting Gham Power's integrated solution - water pumps + financing + advisory) showed encouraging impact results (yield and income increase), this work-package allowed them to test and validate the impact on external farmers, i.e. those with existing solar water pumps (through AEPC affiliation/subsidy). Further, Gham Power also engaged with government/regulatory agencies like AEPC, and private sector like Micro Finance and banks, to better understand their operational procedures and define the Key Performance Indicators (KPIs) against which the performance of the digital platform - Off Grid Bazaar - would be assessed, should they adopt the digital platform to manage project acquisition, documentation, loan/subsidy disbursement, remote-monitoring or repayment collection. Gham Power also developed a dedicated 'Impact portal' in the digital platform that allowed Gham Power, or potential early adopter of the digital platform, to continuously and transparently track the impact of their system, subsidy or loan, over the years. This was the most important work package and consumed the most of the implementation period.

The final work package involved Market Activation and Development through user testing and demonstration of the digital platform - Off Grid Bazaar - among potential early adopters, like AEPC, local governments and municipalities,

development agencies, and private sector. Further, at the end of the project, Gham Power engaged with these stakeholders to share the knowledge and experience from the project, and discussed the potential next steps.

Section III: Project Updates- Planned Vs Progress

Activity-wise work progress

The project is being implemented in 4 Work Packages with 12 activities. A summary of the progress made in each of the Work Packages is provided below.

Work Package 1 - Field Activities for Social Mobilization

	Activities	Results: April 2022	Project Target	Remarks
1	Train Local Agents	**26 events / Sites** - SWP related training provided to 153 agents in the western and eastern districts of Nepal	10 sites	
2	Train local farmers / provide agri advisory	**21 onsite agri-workshops** conducted in Province 1 (3 districts and 9 cities) of Nepal and Bagmati Province (1 districts and 2 cities), Gandaki Province (2 district 3 cities), Lumbini Province (4 districts and 6 cities) and Sudurpashchim (1 district and 1 cities)	10 training events	
3	Materials for marketing and awareness	**9 videos** created; **7,000+ marketing materials** sent to agents for SWP awareness (4000 SWP Brochures, 2000 Agri Brochures, 1000 Aerator Brochures, 22 SWP Flipbooks, 31 Flex, 20 crops related e-posters)	2 videos and other marketing assets	

Work Package 2 - Enhancement of Personalized Agri-Advisory

	Activity	Results: April 2022	Project Target	Remarks
4	Test/Calibrate Agri Sensor	**25 total sensors** installed and tested with 4 parameters (Soil NPK) under piloting for calibration purpose and test of Aqua sensor is completed	10 sensors / hardware	Undergoing testing and calibration of Soil NPK Sensors with current SWP users, commercial farmers, private and government organisations and completed the test and calibration of Aqua Sensors
5	Develop/Expand crop/advisory database	**17 Agri-Training videos and 3 advisory packages** for Cereal farmers, Vegetable Farmers and Fish Farmers, Advisory packages and algorithms for **3 more** crops (Mushroom, Strawberry and Broad Leaf Mustard developed along with the calibration of sensors	Specific Target Not Applicable	During the COVID, agri-advisory services were delivered through Zoom meetings, phone calls, SMS, OGB Platform, social networking sites and on-site visits. Because of the more outreach and involvement of the users, this has been continued till date on regular interval, Crop based agro advisories are developed based on the demand of farmers and type of SWP users and season of the crops
6	Integrate new sensor into OGB platform	Aqua Sensors (Dissolved Oxygen), Soil Sensors (7 in 1 Soil Sensors) along with other essential sensors for SWPS	Not Applicable	Integration of specific sensors to the platform is subject to the sensor meeting testing and quality standards and ease the field installation, applicability and durability.

Work Package 3 - Impact Measurement and Validation

	Activity	Results: April 2022	Project Target	Remarks

7	Impact validation - Test Yield Improvement Solution with AEPC subsidised farmers	**10** Gham Power Krishi Meter piloted with different sites of selected by AEPC and ongoing field data observation and validation	Trial with 10 farmers / farm sites	1 Location affected by unexpected flood in October and 1 location affected due to network issues. Relocations of these 2 systems is being planned for Q3 2022 at other SWPS installed sites of AEPC
8	Develop partner KPI	Improved lead management and operation process (Mobile app and Monitoring backend platform OGB Connect) has been developed and is functional	Specific Target Not Applicable	540+ leads generated for collected through this platform and ongoing lead conversion process
9	Integrate Continuous Impact Measurement	Impact measurement ongoing at 10 sites	Not Applicable	2 sites affected by flood and network issues; relocation/reinstallation is done with installation completed

Work Package 4 - Market Activation and Development

	Activity	**Results: April 2022**	**Project Target**	**Remarks**
10	Technology demonstration and user testing	**21 Virtual agri-trainings, 27 demonstrations** conducted in 6 districts (Sunsari, Morang, Jhapa, Rupandehi, Dang, Pyuthan, Tanahun, Nawalpur, Parasi, Chitwan and Kanchanpur) with 700+ farmers, especially in the eastern, central and western districts of Nepal.	Up to 10 (Along with Agent Training and/or Agri-Advisory Training)	
11	MEL and reporting	Signed the contract with BIRUWA Advisors on Dec 18, 2022 and they sent the final M&E report on February 3, 2023.	Not Applicable	

12	Knowledge sharing / stakeholder engagement	Digi- Krishi event held at Indreni Banquets with 75+ stakeholders attending the event where the insights about the Gham Power Kirishi Meter was discussed	Not Applicable	

Section 3: Key Highlights and Achievements (if any) under the project (500 words)

A list of the key achievements under the project is provided below:

1. Improving Standard Operating Procedure with MFI partners

- Provided offline and online training to 100+ MFI agents from 20+ MFIs branches on the use of our mobile application, 'OGB Connect' and the ways to collect leads and market SWPS among rural communities.
- Conducted on-site field training and SWPS demonstration with 50+ MFI agents, to help them understand the products from Gham Power
- Designed a Flipbook, brochures as well as other marketing assets and distributed them among the MFI branches to aid the process of marketing SWPS products to their farmer members.
- Collected 500+ SWPS leads from different MFIs agents and closed 13 projects.

2. Piloting and testing of hardware system - Gham Power Krishi Meter (GPKM)

- Selected 10 sites provided by AEPC for SWPS installation and conducted feasibility study about incorporation of Gham Power Krishi Meter
- Installed GPKM along with Head and Flow sensor at the selected SWPS sites
- Developed a separate web platform to monitor, collect and visualize real-time systems (Solar current, solar voltage, Head, Power, Discharge) and field parameters (Humidity, EC sensor humidity, EC sensor temperature, EC Sensor conductivity).
- Completed testing and integration of 3 new agri-sensors (Dissolved Oxygen ~ Fish, Water Depth, and Water Level) in the digital platform
- Substituted the EC sensor and NPK sensor with a single 7-in-1 sensor to measure different soil parameters in the GPKM and completed in-house testing of the system

- Upgraded the system of the OGB platform to monitor, visualize and store the data collected by the GPKM
- Piloted the upgraded technology to Sarva Shreshtha Seeds in tomato and Broad leaf mustard crop

3. Scaling our digital network

- Increasing engagement with Facebook group 'Super Krishak Sanjal' with active members increasing to more than 12k people
- Collected a list of 540+ farmers from OGB connect platform to follow-up
- Developed Super Krishak App for baseline data collection and collected baseline data of 1300+ farmers through the platform
- Provided virtual training to 700+ farmers and onsite training to 300+ farmers on modern agriculture technologies to improve agricultural productivity, new generation crops for commercial agriculture and packages of practices (POPs) for different seasonal crops like cucurbits, cereals, and other vegetables.

4. User testing and Assessment

- Travelled onsite to 6 out of 10 different locations of Gham Power Krishi Meter installed sites of Solar Water Pumping Systems at Dang, Nawalpur and Chitwan and surveyed about the applicability of the monitoring system for the long term.

- Assessed the real-time impact from the installed sites of meter and briefed famers about its potential applicability for the future use.

Section IV: Key Highlights and Achievements under the project (500 words)

Impact assessment (list of parameters used for impact assessment of the project, performance against the indicators)
Impact Assessment of Gham Power Krishi Meter:

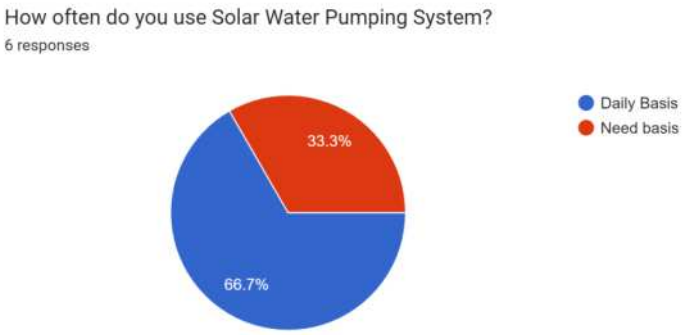

Figure 1: Assessment of SWPS use among Smart Meter installed farmers

Figure 2: Assessment of Gham Power Krishi Meter using SWPS users to understand the awareness on water table depletion

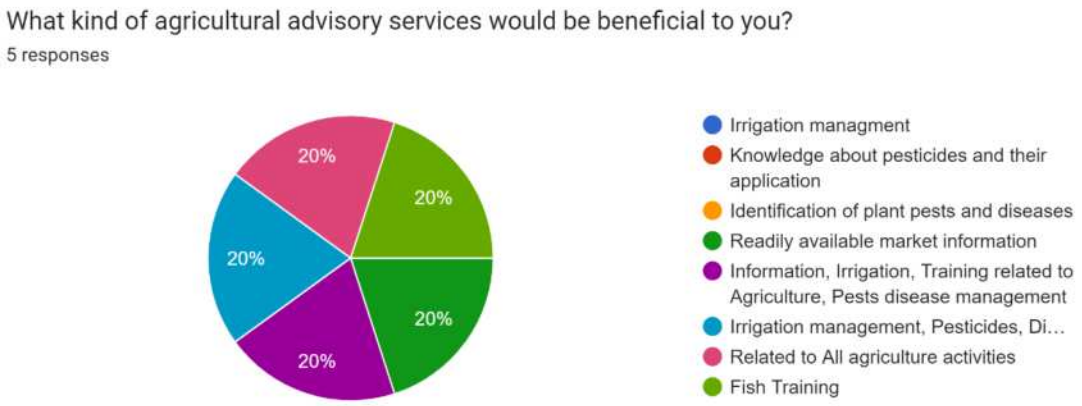

Figure 3: Pie chart showing the need of agri-advisories requested by the farmers.

The survey of Gham Power Krishi Meter users with SWPS revealed that they were unaware of the declining water levels and were overusing water because they saw the cost of solar energy as free after the installation of the system. The majority of SWPS users utilized the system on a daily basis. The farmers who were surveyed expressed an interest in the benefits of using agriculture sensors in conjunction with the Krishi meter and their curiosity about its potential uses. The farmers had mixed opinions on the necessity of agriculture advisories. The basic services needed to succeed in agriculture, such as efficient irrigation management, effective pesticide application, and market information, were identified by the farmers as important and they expressed a willingness to pay for these services.

Impact Assessment of Super Krishak App:

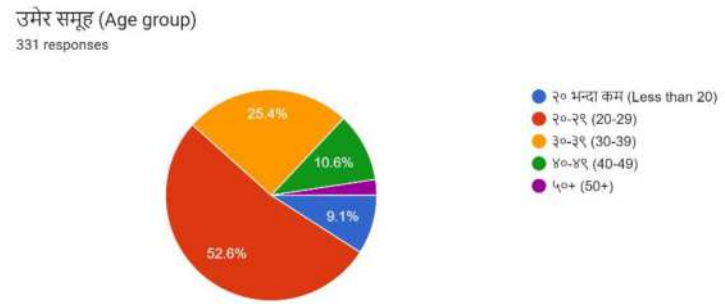

Figure 4: Age-Insights of the Super Krishak App Users

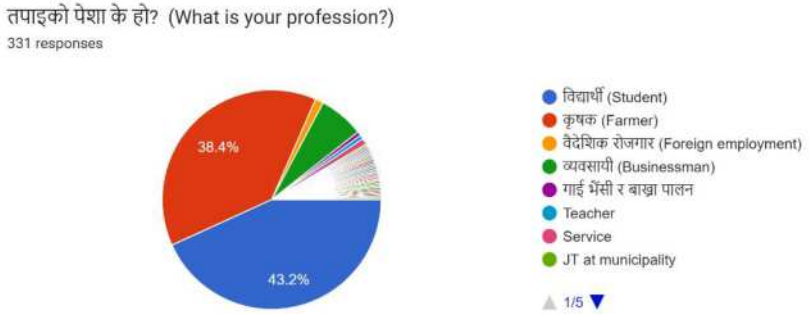

Figure 5: Profession of Super Krishak Users

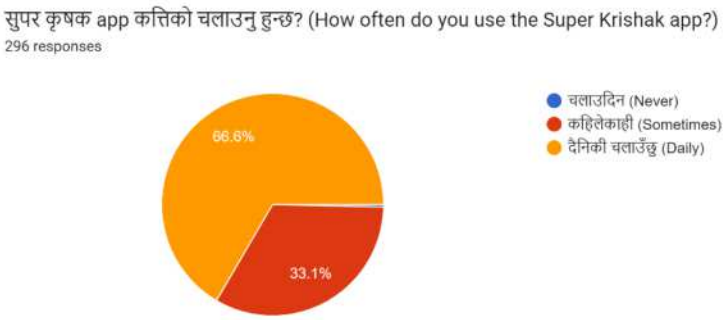

Figure 6: Insights on engagement of users with Super Krishak App

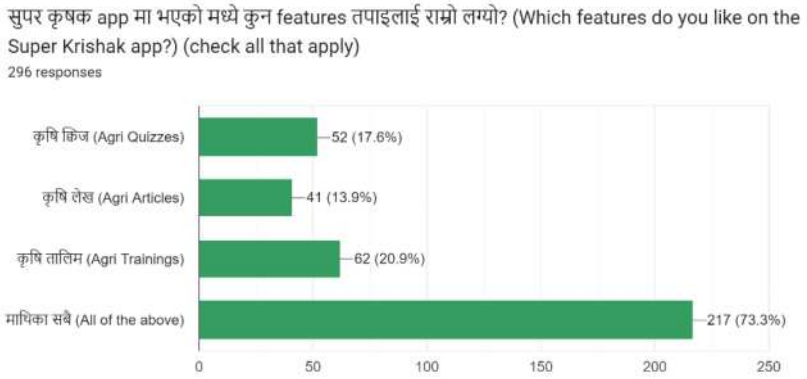

Figure 7: Response of Super Krishak App Users on the utility of the services provided by the App

The Super Krishak App has seen a surge in its user base, a trend that was confirmed in our survey of 300 Super Krishak users during August and September. The results revealed that the majority of active users were in the 20-29 year age group, accounting for 53% of the total user base. The next largest group of users were in the 30-39 year age group. A significant portion of the App users were agriculture students (43%) followed by farmers (38.4%). The Super Krishak App serves as an agriculture advisory platform, providing information and training resources to farmers and students.

Our survey results indicate that the majority of users (67%) use the app on a daily basis, and none reported discontinuing use of the app. At the time of reporting, the app offered three main features: Training, Quiz, and Articles, and more than 73% of surveyed users found all three features to be useful.

- **Updated Gantt chart/Timeline**

Due to the challenges faced through the COVID-19 pandemic and the subsequent lockdown limited the field activities made it impossible to achieve our planned activities within the set project timeline. The lockdown also delayed the installation of Gham Power Krishi meters which subsequently increased the time frame to collect enough data for validation of the smart sensors installed. The pandemic coupled with the ongoing liquidity crisis also affected our implementation plan and have pushed our planned activities beyond the project period. Because of all tis we requested for an extension in the timeline for this fund until the end of December 2022. Despite all these challenges we achieved the targets during the extended period.

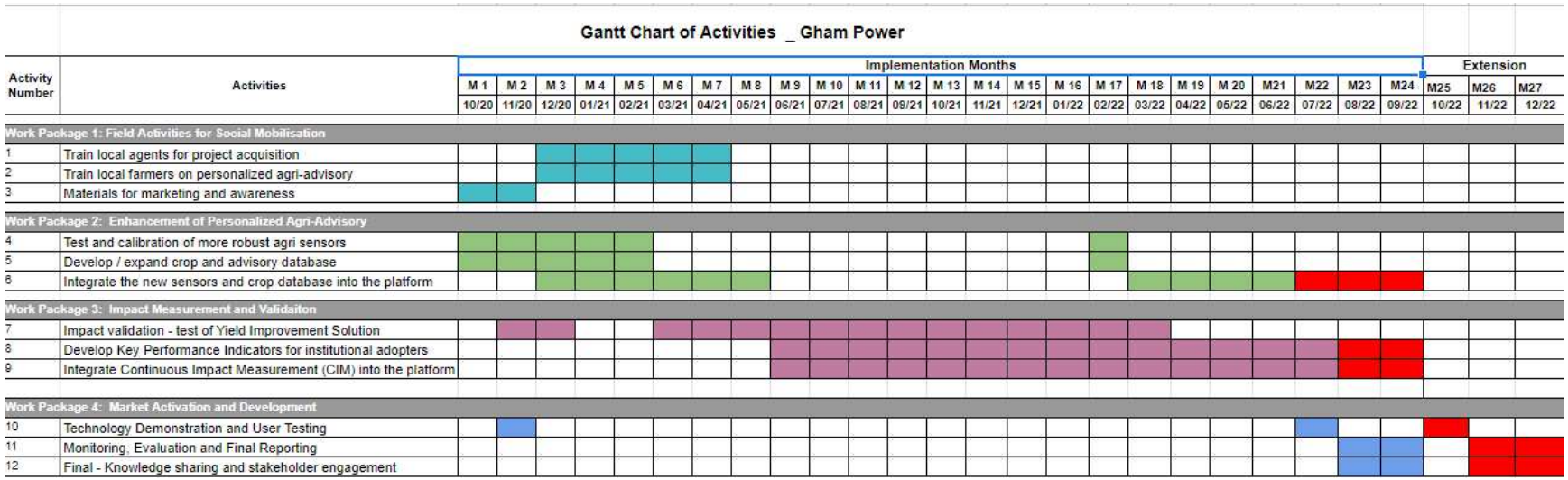

Figure 8: A list of the key achievements under the project

1. **Improving Standard Operating Procedure with MFI partners**

- Provided offline and online training to 100+ MFI agents from 20+ MFIs branches on the use of our mobile application, 'OGB Connect' and the ways to collect leads and market SWPS among rural communities.
- Conducted on-site field training and SWPS demonstration with 50+ MFI agents, to help them understand the products from Gham Power
- Designed a Flipbook, brochures as well as other marketing assets and distributed them among the MFI branches to aid the process of marketing SWPS products to their farmer members.
- Collected 445+ SWPS leads from different MFIs agents and closed 7 projects.

1. **Piloting and testing of hardware system - Gham Power Krishi Meter (GPKM)**

- Selected 10 sites provided by AEPC for SWPS installation and conducted feasibility study about incorporation of Gham Power Krishi Meter
- Installed GPKM along with Head and Flow sensor at the selected SWPS sites
- Developed a separate web platform to monitor, collect and visualise real-time systems (Solar current, solar voltage, Head, Power, Discharge) and field parameters (Humidity, EC sensor humidity, EC sensor temperature, EC Sensor conductivity).
- Completed testing and integration of 3 new agri-sensors (Dissolved Oxygen ~ Fish, Water Depth, and Water Level) in the digital platform
- Substituted the EC sensor and NPK sensor with a single 7-in-1 sensor to measure different soil parameters in the GPKM and completed in-house testing of the system
- Upgraded the system of the OGB platform to monitor, visualise and store the data collected by the GPKM
- Piloted the upgraded technology to Sarva Shrestha Seeds in tomato and Broad leaf mustard crop
- Currently seeking partnership to replicate this technology to other private forms and additional crop commodities.

1. **Scaling our digital network**

- Increasing engagement with Facebook group 'Super Krishak Sanjal' with active members increasing to more than 14k people
- Collected a list of 600+ farmers from OGB connect platform to follow-up
- Developed Super Krishak App for baseline data collection and collected baseline data of 4200+ farmers through the platform
- Provided virtual training to 2000+ farmers and onsite training to 400+ farmers on modern agriculture technologies to improve agricultural productivity, new generation crops for commercial agriculture and packages of practices (POPs) for different seasonal crops like cucurbits, cereals, and other vegetables.

Section V: Voices from the beneficiaries (Anecdotes & experiences shared by beneficiaries)

Monitoring water use and soil condition is crucial for commercial farming
– Harka Bahadur Karki

Figure 9: Field visit and user testing done at GPKM users

"As retired police officer now engaged in commercial agriculture, I can say that installing the Solar Water Pumping system has been a game-changer for me. Four years down the line, I am still using the system without any issues. I received a subsidy from AEPC Nepal to install the system, and it has made my life so much easier.

Recently, I was approached by Gham Power Nepal to incorporate their innovation, the Gham Power Krishi Meter, into my system. Initially, I was apprehensive about using this innovation, thinking it

might damage my existing system. However, the technician from Gham Power convinced me, and I am glad I made the decision.

Since the installation of the Krishi Meter, I have become more aware of the depleting water level in my well. The system would be even more effective if we could see the real-time data generated by the app. The agriculture sensors incorporated within the system have been extremely helpful in advising me on water and fertilizer use. This has helped me to reduce excess costs, prevent soil degradation, and improve my crop production through better water management.

In conclusion, I am very satisfied with the Gham Power Krishi Meter and would highly recommend it to other farmers like myself."

Connecting with distributors and Acquiring profit
– Jesus Nyachhhyon

A farm of 2.75 hectares is not easy to handle, especially while lacking expertise. As an IT personnel with little knowledge but lots of interest in agriculture, I was looking forward to running my own farm. Previously, while trying my hand out in running a banana plantation, I faced a pest infestation that ruined my crops. After that, I decided to shift towards commercial farming i.e vegetable and other lucrative crops farming. At around the same time, I started to attend the virtual agri-training sessions with Gham Power's agri-experts to learn about how I could better my yield.

Figure 10: Farmer showing Super Krishak App

Some of the training I have internalized and implemented successfully are the lessons on "Tomato Grafting" and "Capsicum Production Technology". From the lesson on tomato grafting, I learned how to manage pests and soil related diseases, so that they don't destroy my crops. And from the lesson on capsicum production, I learned which variety of capsicums I could grow, bought a few different varieties to try and eventually managed to sell them on the market. Now, I mainly focus on the production of beans, tomatoes and capsicums. With the information I have acquired concerning modern cultivation practices and the different crops that can be produced in the hilly region, I have managed to turn over my farm to a profit of 30% more than before.

Through the 8 months I have engaged with Gham Power and their various services, I have learnt so many new things in agriculture and also got to know about their app 'Super Krishak' which has now become a part of my daily routine. The training

sessions are now conducted through the app, so I use it mainly for that. I even make sure to relay the advice I get from the agri-experts to the farmhands who work with me so that we can work on its execution on the farm together. Additionally, I enjoy the app's different features. I take the quizzes every day and spend my evenings browsing the articles and videos posted there to increase my knowledge.

Apart from the app and training, I have also received Gham Power's aid in connecting me to various different stakeholders such as NARC (National Agricultural Research Council) and other agri-service companies. The network I have built has helped me immensely not only to simplify my agri-supply chain but also to find alternatives. Alternatives which allows me to keep costs down on raw materials and the profit high through relevant sellers.

Cutting down daily expenses and closing the geological gap
– Tara Ghimire

Running a hostel takes a lot of work and a lot of shopping. My day starts with buying 10-15 kgs of vegetables and arguing with vendors over prices. Without knowing the exact prices I would sometimes end up paying more and going over budget. This would cause problems in balancing my finances for other facilities required at the hostel. The students staying here faced a difficult time too because I had to increase the fees to make up for the extra expenses.

Figure 11: Farmer in urban area using Super Krishak ChatBot

Now, I can just check the market price before going out. Doing that, I can haggle with the vendors if they try to ask for more because I know the actual cost set by the government. These past few months, because of the chatbot I have been able to reduce the monthly expenses allotted for vegetables and other agricultural items.

I am very appreciative of the chatbot, make sure to use it daily, and even recommend others to use it. In fact, not only do I use it here in Kathmandu to shop for groceries but also for my farm in Kanchanpur. I encourage the farmhands there to use the chatbot to check weather conditions of the area and frequently do so myself. By checking the weather conditions of Kanchanpur, I can remotely alert and help them plan for farm activities such as field preparation, crop planting, crop harvesting and more.

Section VII: Challenges faced in project implementation (250 -300 words)

The shift to the "new normal" post-pandemic has presented various challenges in coordination and communication, particularly when it comes to providing virtual agriculture trainings to farmers. Stable internet connections and limited knowledge of online registration and video streaming have made it difficult to reach farmers effectively. The lingering economic impact of the pandemic has also led to farmers' reluctance to invest in SWPS and related products.

Moreover, even beyond virtual communication, there has been a challenge in communicating the benefits and importance of our products to farmers who lack basic awareness of SWPS. The growth in our partnerships with Microfinance Institutions (MFIs), now encompassing three MFIs with over 50 branches, has added to the challenge of monitoring their activities and progress, as MFI agents require constant support, orientation, and training on how to share product information with rural farmers.

Additionally, the lack of communication and connectivity in rural areas has resulted in technical difficulties with both the pump and the Gham Power Krishi Meter (GPKM), largely due to poor product management. There have also been network issues near Susta, Parasi district, which have prevented us from collecting data recorded by the GPKM and resulted in unexpected server failures, leading to the loss of some data from the OGB platform. We are in the process of recovering the lost data and regularly monitoring the system to ensure proper maintenance. Winter fog, which is prevalent in the Terai region where most of our sales are concentrated, has also impacted our demonstration activities.

Section VIII: Reflections and Learning (250-300 words)

Despite the various challenges faced during the implementation of SoLAR IF project, we have also been presented with several opportunities for growth and learning. Our project has given us insight into the market we are targeting, as well as the perception of our products and services among consumers. Furthermore, we have been able to utilize social media platforms as an effective tool for communication with farmers, relaying information about our products and services.

One of the key takeaways from this project is the importance of adapting, compromising, and strengthening partnerships. We have shifted our focus to align with the needs of our partners, which has resulted in the creation of marketing materials and strategies tailored to our end-users, making it easier for MFI agents to communicate with farmers. We have also recognized the importance of coordinating with MFI staff, which led us to send our field staff to support lead generation, which has shown positive results in increased sales. Additionally, the OGB Connect Mobile App and back-end reporting platform have streamlined the lead generation process for MFI staff and made it easier to monitor their progress and adjust strategies accordingly.

Furthermore, there is potential for the Gham Power Krishi meter and related ecosystem to play a role in sustainable impact measurement and monitoring of SWPS at the farmers' level. However, many farmers cannot afford this technology, making institutional intervention and support necessary for its widespread adoption.

Section IX: Annexures

- Links to reports/ coverage of events organised under the project
    1. Event Summary of Digi Krishi Event organized by Gham Power Nepal in collaboration with IWMI: https://ghampower.com/blog/digi-krishi-a-conclave-to-discuss-all-the-aspects-of-digital-agriculture/
    2. Easing the agri-advisory services to rural smallholder farmers in Nepal: https://ghampower.com/blog/krishak-pathshala-virtualizing-the-digital-agri-advisory-services-for-nepalese-farmers/
    3. Farmers experience https://ghampower.com/blog/from-our-farmers-perspective-using-technology-in-agriculture/
- Published news items or news coverage if any under the project
    1. News coverage of Digi Krishi Event organized by Gham Power Nepal in collaboration with IWMI: https://technologykhabar.com/2022/09/21/119319/
    2. News coverage of Digi Krishi Event organized by Gham Power Nepal in collaboration with IWMI: https://halokhabar.com/news-details/12003/2022-09-22
    3. News coverage of impact created by Super Krishak App in providing agri-advisory services https://english.onlinekhabar.com/super-krishak-nepali-app-for-farmers.html
- High resolution photographs- dated and captioned

1. Link to photographs during the project implementation period could be assessed through this link: Link: https://drive.google.com/drive/u/4/folders/16VItKu38lIaoPwa4DzZXg-mQtEbt1U4k

- Quotes and voices from the field/ key stakeholders
    2. Voice Records from Gham Power Krishi meter Piloted SWPS users : Link: https://drive.google.com/drive/u/4/folders/10pf4ZSFl4o_aZh7uv1lGUHRcdl-Cbnhb

Figure 12: SWPS demonstration campaign at different locations at Bagmati Province, Gandaki Province, Lumbini Province and Sudurpashchim Province

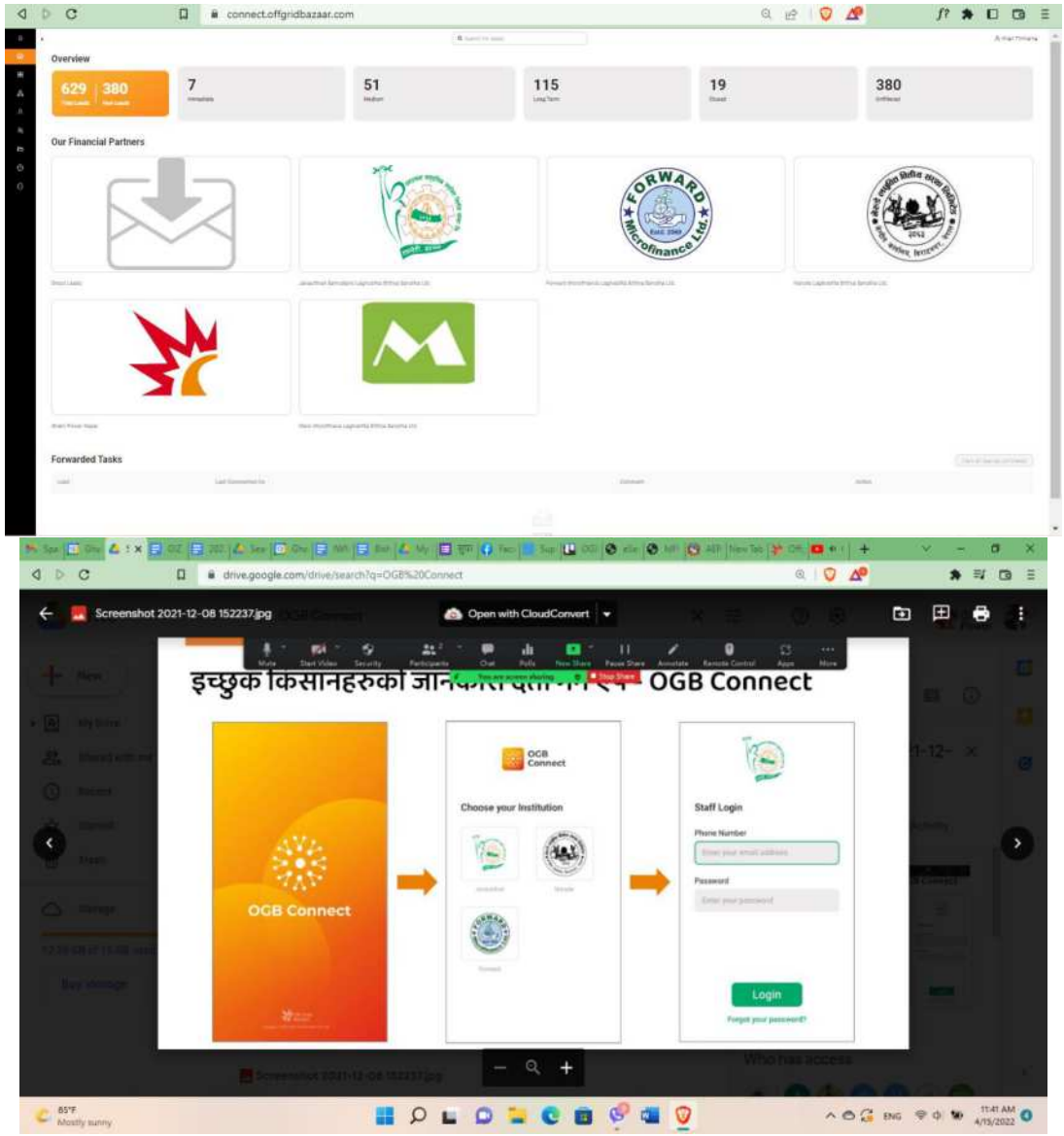

Figure 13: OGB Connect Mobile App and Web platform for collecting SWPS leads from MFIs staffs

Figure 14: Agri-workshops given to the farmers of MFI branches

Figure 15: Sales Brochure for promotion of SWPS and agri-advisory services

Figure 16: Brochure for promoting the Gham Power Krishi Meter (Aqua) equipped with DO Sensor

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Figure 17: Video showing application of Bullet pump and Aerator for Fish Farmers

Figure 18: Gham Power Krishi Meter (Aqua) validation testing at CFPCC, Balaju, Kathmandu at the Fish Pond

Figure 19: Testing of 7 in 1 sensor at Sarba Shrestha Seeds for making digital crop advisory packages for Tomato and Broad Leaf Mustard

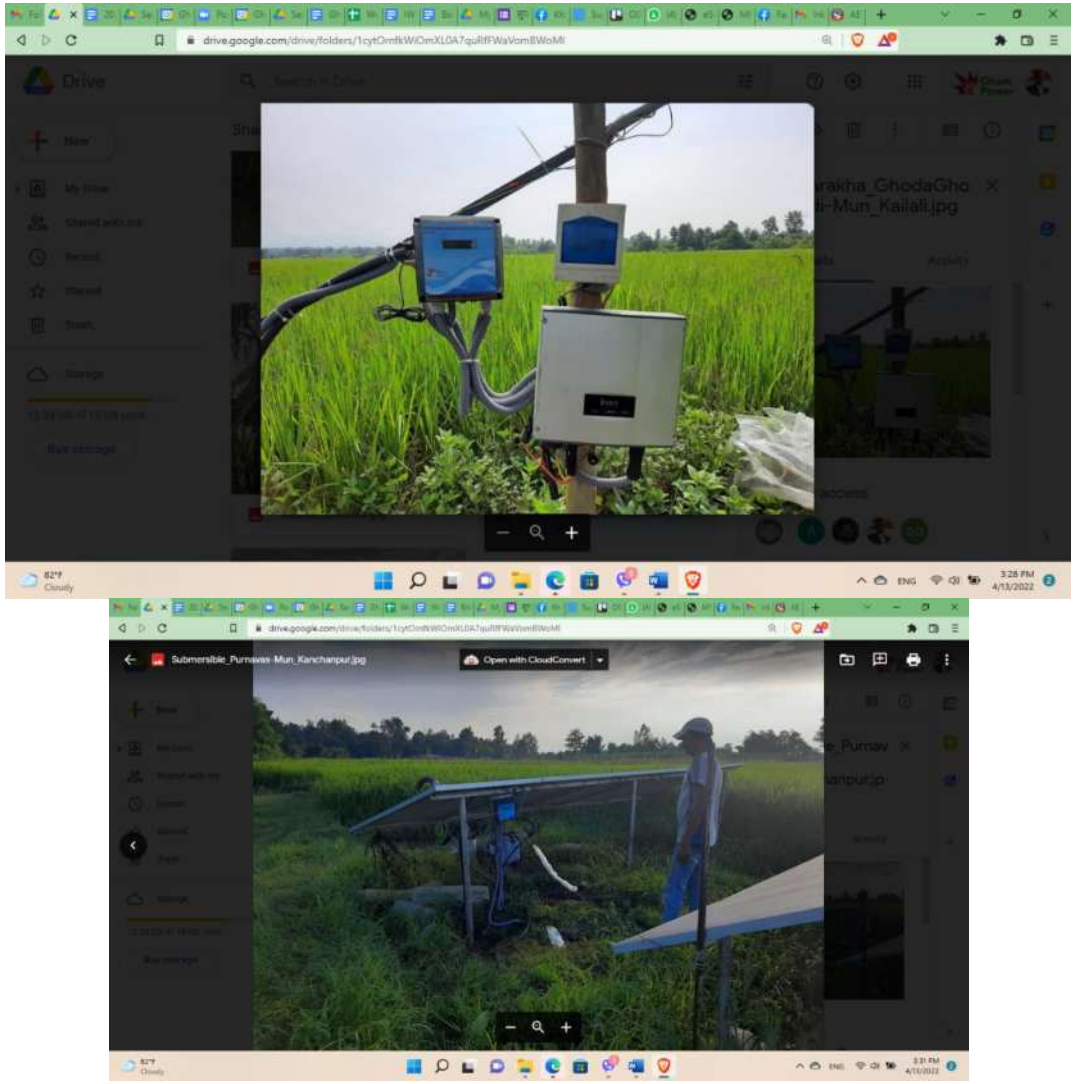

Figure 20: Installation of Gham Power Krishi Meter with flow and head sensor at different SWPS sites of AEPC

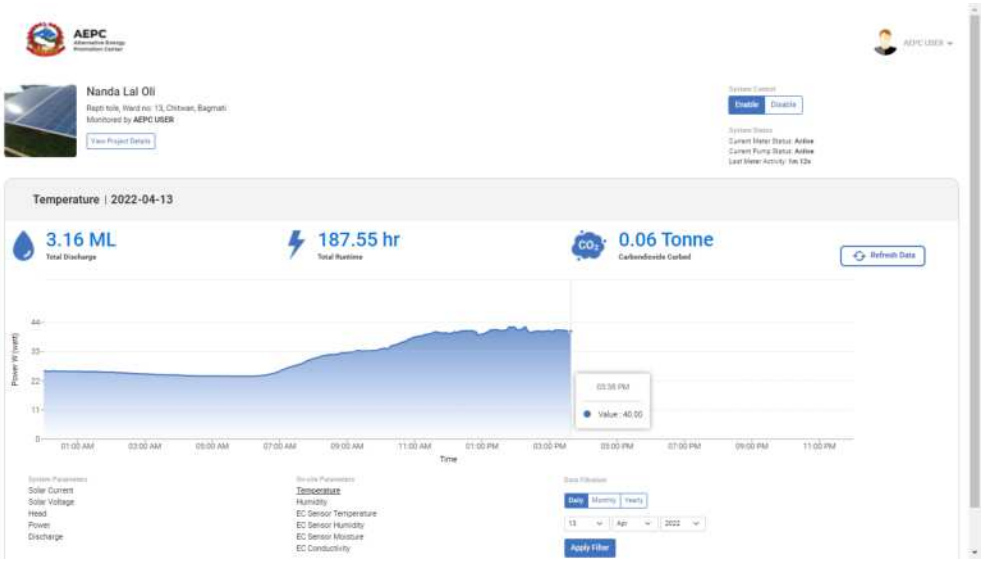

Figure 21: OGB Platform for monitoring the system and field based different parameters from different SWPS installed sites of AEPC

Figure 22: Reinstallation of Gham Power Krishi Meter (Upgraded) version in the SWPS installation site of AEPC and Gham Power

Figure 23: Participants and Stakeholders from different backgrounds who participated on Digi Krishi Event Organized by Gham Power Nepal on September 16, 2022.

Figure 24: Participants in Digi Krishi event organized on September 16, visiting the demo of Gham Power Krishi Meter

Figure 25: Some glimpses of the user testing survey done during December at Dang, Nawalpur, Chitwan