

PROJECT TRANSITION REPORT

**Integrated Shallow Groundwater Irrigation
Development (ISGWID) Project
Project Period: 2018/2019 to 2024/2025**



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Acronyms

AAU	Addis Ababa University
ACC	Agricultural Commercialization Cluster
AOSS	Agricultural One Stop Shop
ATI	Agricultural Transformation Institute (ATI)
B2B	Business to Business
CFSC	Commercial Farm Service Centre
EFY	Ethiopian Fiscal Year
EMA	Ethiopian Mapping Agency
ETB	Ethiopian Birr
DANIDA	Danish International Development Agency
DREAM	Distributed Renewable Energy Agricultural Modality
HO	Head Office
HVC	High value crops
ISGWID	Integrated Shallow Ground Water Irrigation Project
IWMI	(International Water Management Institute
JICA	Japan International Cooperative Agency
KPI	key performance indicators
MoA	Ministry of Agriculture
MoU	Memorandum of Understanding
MoWE	Ministry of Water and Energy
MoWIE	Ministry of Water, Irrigation and Electricity
MSMEs	Medium, Small and Micro Enterprises

NMA	National Meteorological Agency
PPMO	Project Portfolio Management Office
RBoA	Regional Bureau of Agriculture
RNE	Royal Netherlands Embassy
SDG	Sustainable Development Goal
SGWM	Shallow Groundwater Mapping
SHF	Smallholder Farmers
SMT	Senior Management Team
SNNPR	Southern Nation Nationalities and Peoples Region
SSI	Small Scale Irrigation
WBoA	Woreda Bureau of Agriculture
ZBoA	Zonal Bureau of Agriculture

Executive Summary

The Integrated Shallow Groundwater Irrigation Development (ISGWID) Project, implemented by the Agricultural Transformation Institute (ATI) from 2018 to 2024, aimed to improve smallholder farmers' livelihoods through sustainable irrigation development by unlocking Ethiopia's shallow groundwater potential. Implemented across Oromia, Amhara, Tigray, Sidama, Central Ethiopia, South Ethiopia, Southwest Ethiopia, and Harari regions, the project promoted groundwater-based irrigation, climate-smart technologies, youth employment, and market-oriented agricultural production.

The project delivered significant technical, economic, and institutional results. It mapped and quantified shallow groundwater resources over 234,772 km², exceeding its original target of 200,000 km², and identified 27.01 billion m³ of renewable groundwater with the potential to irrigate more than 3 million hectares and benefit over 6 million households. To support sustainable groundwater management, the project produced 267 groundwater atlases covering 193 woredas, trained 386 technical experts, equipped regional institutions with groundwater assessment and monitoring tools, and installed two groundwater monitoring wells in Oromia and Sidama regions.

A major achievement of the project was the establishment of a sustainable irrigation service ecosystem. The project created 226 irrigation-related micro, small, and medium enterprises (MSMEs) engaged in well drilling, pump maintenance, and manual pump manufacturing, enabling thousands of irrigation support services to smallholder farmers. In addition, 595 rural youth received technical and business skills training, creating employment opportunities while strengthening local service delivery systems and private-sector participation in irrigation development.

The project also strengthened irrigated agriculture through the promotion of market-oriented high-value crop production and improved irrigation agronomy. Intensive capacity-building activities, including training on localized cropping calendars, irrigation water management, and improved production practices, enhanced the technical capacity of extension personnel and farmers to adopt improved irrigation and crop management practices. To promote climate-resilient agriculture and efficient resource use, the project established 247 Solar Powered Irrigation System (SPIS) demonstration sites and trained over 6,555 farmers on solar irrigation technologies, efficient water management, and sustainable production practices.

Beyond agricultural productivity, the project generated broader socioeconomic and environmental benefits. Solar-powered irrigation systems expanded household access to renewable energy for lighting and mobile charging, while groundwater development interventions improved access to water for domestic and livestock use. Increased access to irrigation also created opportunities for crop diversification, improved household nutrition, and enhanced women's participation in economic activities.

To ensure long-term sustainability, the project promoted landscape restoration and the 3R approach (Recharge, Retention, and Reuse) to groundwater management, including recommendations on optimal well spacing and groundwater abstraction limits to prevent resource depletion. The project also strengthened groundwater governance by supporting monitoring systems, enhancing institutional coordination, and contributing technical inputs to national policy and planning processes.

As the project concludes, future priorities include expanding and refining groundwater mapping, strengthening irrigation water user institutions, scaling irrigation service enterprises, improving access to irrigation technologies and finance, and enhancing market systems for high-value crops. The project has established a scalable and sustainable model for groundwater-based irrigation development that supports rural employment, climate resilience, food and nutrition security, and Ethiopia's long-term agricultural transformation agenda.

1. Background

Ensuring food security for Ethiopia's rapidly growing population, which now exceeds 110 million, is a critical challenge that requires innovative interventions. The distribution of natural resources alone cannot meet the increasing demand; instead, a strategic approach that integrates key factors is necessary to overcome existing bottlenecks. Given the current era of global climate change, it is essential to assess the feasibility of projects from both local and global sustainability perspectives. This approach ensures ecological balance and the continuous supply of resources to meet our needs.

Investing in the use of shallow groundwater (SGW) has the potential to significantly benefit farmers by increasing agricultural yields. Unlike rainwater and surface water, which are highly variable and limited to certain regions, SGW is more consistently available across different areas. However, the major challenges to maximizing SGW irrigation include a lack of attention and focus on its utilization, limited capacity to identify and effectively use SGW, and the absence of a clear national policy and strategy. By prioritizing SGW irrigation, it is possible to mitigate weather and climate-related risks and extend the growing seasons for farmers.

The ISGWID project was initiated as a direct request by the Agricultural Transformation Council and the Ministry of Agriculture (MoA) to scale up ATI's SGW mapping pilot across the country and to integrate the mapping with irrigation development projects and best practices across the country. Shallow Groundwater (SGW) mapping pilot project, completed in 2017, had the main objective of understanding the SGW resources base and identifying the right technology for SGW mapping. The project was piloted twice, in 89 and 47 high SGW potential Woredas, in Oromia and SNNP regions using WATEX and AQUATEST owned technologies and identified AQUATEST owned technologies as the suitable technology for SGW mapping.

The ISGWID project implemented to enhance access of SHFs to SGW irrigation practices, increase in income through increasing production and productivity of HVCs. Furthermore, the project seeks to enable SHFs to adapt to climate change by reducing dependence on increasingly erratic rainfall. The geographic scope of the project includes Oromia, Amhara, SNNPR Harari and Tigray regions. The ISGWID project conduct SGW mapping on the area of 200,000 km² and contributes for the creation of 1800 new MSMEs and create 15400 new jobs in the project intervention regions. Moreover, the project intervention will increase irrigated area to 500,000ha to produce market-driven HVCs and benefit 1 million smallholder farmers of which at least 30% are female.

The ISGWID project intends to contribute to increased income for all male and female SHFs through increased sustainable production, productivity, irrigation practices and irrigable area. The project designed to achieve four main outcomes, namely enhancing access to applied knowledge and information to enable sustainable utilization of SGW resources, improving access to job among youth and enhance access to irrigation technologies to SHFs through PBGs, increase irrigation area, market-driven HVCs production and productivity, and enhance adoption of EE and WST among SHFs, which labelled as component I, II, III and IV, respectively.

Component I outcome has four outputs which include conducting SGW mapping over 200,000 km² and identify potential irrigation command area, provide training and advisory services on productive drilling sites for 1,000,000 SHFs, develop and implement policy/framework for water use and promoting the implementation of the policy framework for water use. Component II has one major output namely capacitating woredas and well drilling groups and increasing farmers' access to SGW. Component III has three main outputs, namely enhancing capacity of farmers,

woredas and zones by providing business orientation training and Training of Trainers (ToT) trainings, enabling market linkage environment creation by facilitating the linkage of coops/unions with institutional buyers and improvement on packaging and storage by incentivizing production of crates/boxes and implementing low-cost cold storage options. The last component IV has one output, which is enhancing the capacity of piloted SHFs to adopted solar pumps and drip systems technologies

The ISGWID project will leverage capacities available from partners, namely public bureaus development partners, knowledge institutes and private sector. The project target will be executed as a multi-stakeholder engagement involving public sector (i.e. Federal institutions/ Regional bureaus), development partners (i.e. both donor and implementing NGOs such as Horti-life), knowledge institutes (i.e. local and international universities, namely Hawasa University, Mekele University, Wageningen University and think tanks such as IFPRI and IWMI). Furthermore, the project intervention involves private sector institutions including small and medium-sized enterprises (i.e. well driller and equipment manufacturers and international seed companies). ISGWID leverage ATI's strategic role as a "system integrator" and "policy and regulation facilitator" and leverage other partners, especially the private sector and NGOs to implement as many of the interventions as possible. ATI should be a project leader/owner because no natural owner of the activity within the sector and the activities of the ISGWID project are complex, owned by multiple partners and requires alignment among different partners for effective execution.

2. Project Profile

2 Project Profile

Dates	Planned start date:	18 Sep 2017	Actual start date:	01 January 2018
	Planned end date:	30 June 2023	Actual end date:	31 Dec 2025
Project name	Integrated Shallow Groundwater Irrigation Development Project			
Project number	1505			
Project goal	Contribute to sustainable production, productivity and income for all male and female smallholder farmers through increased irrigation practices and irrigable area.			
Project outcomes				
#1	Enhanced access to applied knowledge and information that enables sustainable utilization of SGW resources			
#2	Improved access to job among youth (male and female) and enhanced access to irrigation technologies to smallholder farmers, through the promotion of business groups around shallow groundwater development			
#3	Increased market-driven high-value crops (HVC) production and productivity while maintaining quality and reducing post-harvest loss			
#4	Enhanced adoption of Energy Efficient and Water Saving Technologies among SHFs (female and male) in the four Regions			
Project location(s)	<i>The focus of the ISGWID scale-up was on 30 woredas (i.e. 19 HHI woredas and 11 new ISGWID woredas) in Oromia, Amhara, Tigray and SNNP regions. In the meantime, Harari region was included in the scale-up of SGWM.</i>			
Project direct beneficiaries	Men	Women	Youth	Total
				306,296 SHFs
Donor/s	DANIDA, RNE			
Project Period budget	Planned budget	201,410,391.51 birr	Actual expenditure:	95,753,240.52 birr
Project contact person, phone and email	ACC's Senior Director: Dagnachew Lule (PhD), Senior Director; Dagnachew.lule@ata.gov.et			

3. Project Progress

3.1 Contribution to ATI Mandate Areas

Contribution to Studies:

One of ATI's key initiatives is Shallow Groundwater Mapping (SGWM) aimed at developing small-scale irrigation (SSI) at the household level, with the goal of lifting millions of farmers out of deep-rooted poverty. To date, over 234,772 km² of SGWM, at a 1:50,000 scale, has been completed for the regions of Amhara, Harari, Oromia, SNNPR, and Tigray. Along with smallholder farmers, SGWM is crucial in providing water resource information for private investment purposes. This mapping effort contributes valuable large-scale maps and data to the national hydrogeological mapping project led by the Geological Survey of Ethiopia. Additionally, SGWM supports rural water supply by providing sustainable and quality water access, aligning with the Ministry of Water and Energy (MOWE) programs and Sustainable Development Goal 6 (SDG6). It also serves as a baseline survey for the Ministry of Agriculture (MoA) to design and formulate a national strategy for water harvesting and shallow groundwater development for smallholder farmers' irrigation.

Implementation support:

ISGWID project Team plays a significant implementation support role. Capacity building will be given to experts in the Ministries (MoWE and MoA) and Regional Irrigation offices and cascaded down to Zonal and woreda water supply development offices and Irrigation Bureaus. The capacity building activities mainly consist of training regional implementers on radar technology and advanced remote sensing, utilizing of high value crop (HVC) selection tools and preparation of cropping calendar, operation and management of Solar powered irrigation pumps and drip systems among others. For proper implementation of the ISGWID project results and recommendations, it needs shallow ground water utilization policy framework and implementation guidelines. So, the team jointly with MoWIE team reviewed the national water policy and integrated the shallow groundwater sustainable utilization in the exiting water policy which also suit for small scale irrigation development.

Linkage and coordination:

ISGWID has taken on the role of coordinating and implementing several key interventions for the project, working closely with regional bureaus and other partners. The validation and distribution of Shallow Groundwater Mapping (SGWM) results to the relevant woredas were coordinated by ATI in collaboration with regional bureaus. Based on the availability of shallow groundwater, the ISGWID project was implemented in 30 SGW-potential woredas across four regions. As a result, ATI distributed and installed 247 solar pumps to promote energy-efficient and water-saving technologies, paving the way for nationwide project scaling to boost high-value crop (HVC) production. National and

Regional Oversight Committees have been established to oversee, manage, and guide the implementation of the project.

3.2 Progress towards Project Goal

The ISGWID project has significantly contributed to sustainable production, productivity, and income for male and female smallholder farmers by increasing irrigation practices and expanding irrigable areas. The project mapped 234,772 km², surpassing the initial target of 200,000 km², and identified a total of 27.01 billion cubic meters of water enough to irrigate over 3 million hectares of land, benefiting more than 6 million households sustainably. It also strengthens development efforts and addresses food security challenges through the development of shallow groundwater resources and applying energy efficient and water saving technologies as it evidenced by installed 247 solar pumps.



Outcome 1: Enhanced access to applied knowledge and information that enables sustainable utilization of SGW resources

This outcome focuses on providing accurate information on the availability of SGW to government institutions, smallholder farmers and private institutions, and on building capacity for regulating SGW development and protecting against water resource depletion.

As a major component of the project, shallow groundwater mapping was planned to cover an area of 200,000 sq.km with more reliable and dependable mapping technology with a scale of 1:50,000. During the mapping, cost-effective technologies and new mapping approach were implemented to achieve the reasonable range of accuracy. More than 234,772 sq.km areas covered at the depth of 30m to attain more accessible ground water for irrigation development at small scale level (annex1).

The outcome of SGW mapping showed that 27.01 billion cubic meter available shallow groundwater (recharge) quantified and qualified in the project areas which can irrigate 3,088,395 hectares of land and benefiting 6,176,898 households. To provide firsthand result and create awareness for the stakeholders, integrated national groundwater resource map developed, 263 shallow ground water Atlases are produced, published & distributed to 193 woredas through training and workshops.

To realize the economic sustainability of shallow groundwater resource development for household irrigation (HHI), two groundwater monitoring wells were properly installed at two woredas in Oromia and Sidama regions. The regulated groundwater quantity and quality naturally have a pivotal position to effectively utilize groundwater without causing reasonable harm and to avoid crop failure due to groundwater depletion, which has been further complemented by promoting 3R (recharge, retention, reuse) approach.

In line with the capacity building, ISGWID team provided detail purpose oriented technical training on shallow groundwater exploration technologies (navigational tools,

geophysical instrument like Tromino) to strengthen the field skill and implementation capacity of regional, zonal and woreda experts. Stakeholder awareness creation conducted to establish and develop irrigation water use association.

In collaboration with Ministry of Water, Irrigation and Electricity (MoWIE), ISGWID team had procured, installed, and established sophisticated and comprehensive groundwater database. Accordingly, Hydro-GeoAnalyst software was installed at ATI head office and MoWE servers as tool to strength groundwater database management. The groundwater database facilities will be utilized further to organize, analyze, and visualize all water related data at national level. This initiative helps to establish interactive groundwater database for monitoring and backup of groundwater data, which is the basic requirement for many groundwater resources and hydrogeological studies in providing clear pictures in the future development and utilization of groundwater, and planning of water resource related development for policy and decision makers.

Generally, the training or capacity building was given for 386 experts from woredas with relatively high shallow groundwater potential. To enhance the assessment of shallow groundwater drilling sites, 169 navigational tools were provided for potential woredas in the target areas. Along with the promotion of HHI, 56 water test kits were delivered to Amhara, Oromia, Tigray and SNNP Regions Water Development Office to assess the suitability of groundwater for drinking purposes and to improve the sanitation and hygiene of smallholder farmers.

For proper implementation of the ISGWID project results and recommendations, it needs shallow ground water utilization policy framework and implementation guidelines. So, the team jointly with MoWIE team reviewed the national water policy and integrated the shallow groundwater sustainable utilization in the exiting water policy which also suit for small scale irrigation development.

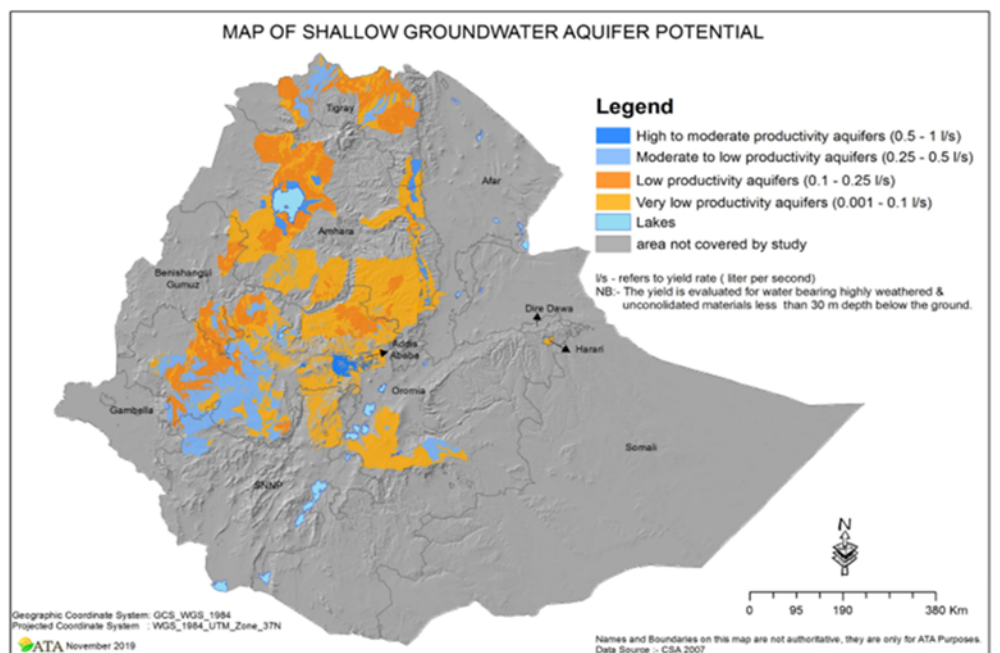


Figure 1: Map of shallow groundwater aquifer potential over 234,772sq.km

Table 1 : Shallow Groundwater Potential Study Results by Region

Region	Area Covered by the Study (KM ²)	Number of Woredas Covered	Amount of Rechargeable Shallow Groundwater (BM ³)	Irrigation Potential (ha)	Number of Potential Beneficiary Households (0.5ha/HH)
Oromia	110,820.72	191	15,491.20	866,990	1,865,682.00
Amhara	67,994.65	127	7,508.05	2,077,967.78	3,977,006.00
Former SNNPR	24,593.79	75	1,671.19	60,019	167,386.00
Tigray	21,601.92	39	1,115.34	45,913.3	91,802.00
Harari	331.93	4	12.82	497.9	995.00
Beneshangul Gumuz	8,730.45	11	1,198.20	36,375.6	72,765.00
Afar	698.55	7	10.00	631.1	1,262.00
Total	234,772.96	454	27,006.81	3,088,395.53	6,176,898



Figure 2: Practical training to track the location using Lenovo Yoga 3 tablet GPS



Figure 3: Hydro-Geo-analyst software trainees and trainer (expat)



Figure 4: Water quality test kits handed over to Amhara Region



Figure 5: Installed groundwater monitoring device to regulate water level fluctuation and measure salinity of groundwater



Figure 6: Community engagement participating on 3R(recharge retention and reuse) structures for enhancement of groundwater recharge.



Outcome 2: Improved access to job among youth (male and female) and enhanced access to irrigation technologies to smallholder farmers, through the promotion of business groups around shallow groundwater development

The ISGWID project intends to contribute and increased income for all male and female SHFs through increased sustainable production, productivity, irrigation practices and irrigable areas. This project component was designed to achieve four main outcomes, namely enhancing access to applied knowledge and information to enable sustainable utilization of SGW resources, improving access to job among youth and enhance access to irrigation technologies to SHFs through increase irrigation area, market driven high value crops production and productivity, and enhance adoption of energy efficient and water saving technology to small holder farmers. It is the promotion of business groups around SGW development which aims to strengthen the supply chain for irrigation technologies and services, increase adoption of technologies, and increase well-drilling service availability by identifying viable well drilling technologies.

Promotion of business group around or organizing youth entrepreneurs at shallow ground water potential areas is aiming to strengthen the supply chain for irrigation technology and service, increase adoption of technologies, and increase well-drilling service availability. Through this approach 77 Enterprises (MSMEs) consisting 296 (18F) members have been trained on well drilling techniques and provided about 2,500 well drilling service to SHFs for production of high value crops and marketing. The other business group promotion activities were related to establishing 90 Enterprises (MSMEs) and providing training for 183 (21F) members on Surface engine and submersible pump maintenance and eventually they started providing 4,067 engine and submersible pumps maintenance service to SHFs. Similarly, 59 Enterprises (MSMEs) consisting 116 (15F) members have been trained on manual pump

manufacturing and started manufacturing of 1779 Manual pumps and provided maintenance service to SHFs.



Figure 7: Well driller trainees from Oromia and SNNP on practical training



Figure 8: Three Well Drilling Group Trained for a month at SNNP, Hosaena



Outcome 3: Increased market-driven high-value crops (HVC) production and productivity while maintaining quality and reducing post-harvest loss

Increased market-driven high-value crops (HVC) production and productivity is mainly focused on market oriented and high value crops production through prioritization, woreda specific crop calendar for farmers income generation by marketing the crops throughout the year. The project team developed software package useful for crop prioritization and area specific crop calendar development. A total of 1179 woreda experts (M&F) and SMSs & DAs (M&F) capacitated on defining HVC tools, localized cropping calendar development, irrigation water management and irrigation agronomy. Farm gate level zero energy storage technology also demonstrated to reduce post-harvest loss and to increase farmers storage capacity before marketing.



Figure 9: HVCs Selection Tool & Localized Crop Calendar Training



Five zero energy cool chambers (ZECC) constructed to demonstrate technology that helps to minimize post-harvest in Amhara Oromia and SNNP regions. ZECC technology is a cost-effective, eco-friendly and zero energy requiring technology for storage and improves the quality and productivity of vegetables and fruits by reducing field heat, increasing shelf life, and checking post-harvest losses, respectively.



Figure 10: Zero Energy Cool Chamber (ZECC) Demonstration



Outcome 4: Enhanced adoption of Energy Efficient and Water Saving Technologies among SHFs (female and male) in the four Regions

Demonstrating energy efficient water lifting and saving technology is the other project outcome which is focused on solar pumps and drip irrigation technology promotion for irrigation. The technology is full-fledged for changing the livelihoods of the farmers by lifting the water for irrigation and drinking, for household appliances and other productive use in each farmer's level. It is installed and demonstrated at 247 model farmers and farmers training centres (FTCs) for high value crops production and marketing in four regions (Oromia, Amhara, SNNPR and Tigray). To improve sustainability, on job training provided and awareness were created for 6555 farmers. Based on the demonstration, follower farmers are purchasing and installing from the local supplies to utilize the groundwater for irrigation.



Figure 11: Solar pumped drip irrigation system



Figure 12: Practical-based solar pump operation and maintenance training



Figure 13: Energy efficient and water saving technologies demonstration

Explanation of Variance:

3.3 Indicator Tracking Table and Finance Report

3.3.1 Indicator Tracking Table

Results Level	Result/objective statements	KPIs	Unit	Baseline value	Overall Target	Achievement To date	%	Remark
Impact	Contribute to improved environmentally sustainable farm practices and increased production, productivity and income	% increase in productivity (yield/ha)	%					
Objective	The overall objective of the project is to contribute towards enhancing access of smallholder farmers to groundwater-based irrigation practices to increase the production and productivity of vegetables, field crops, and fodder. It seeks to enable smallholder farmers to adapt to climate change by reducing dependence on increasingly erratic rainfall.	# of SHFs applying groundwater-based irrigation practices and irrigation technology	#					
Outcome1	Enhanced access to applied knowledge and information that enables sustainable utilization of SGW resources	# of woredas where enabling environment for sustainable SGW development is supported	#	114	274	263	97	
		# of atlas of shallow groundwater is developed for each selected sub-basin and shared for at least four regions	#	114	274	263	97	
		# of regulating wells for which a centralized SGW use tracking database is developed and SGW related information in the potential 200,000 km2 area is tracked	#	0	15	2	13.33	Budget constraint
Output 1.1	SGW mapping conducted, and potential irrigation command area identified.	Area covered under the SGW mapping in km2	Sq.Km	168,189	200,000	234,772	100	
		Area (ha) of potential irrigable land identified	Ha	2,207,741	2,207,741	3,088,395	100	

Results Level	Result/objective statements	KPIs	Unit	Baseline value	Overall Target	Achievement To date	%	Remark
Output 1.2	SHFs received trainings and advisory services on productive drilling sites	# of SHFs that received trainings and advisory services	#	-	1,000,000	444,422	44	Budget constraint
Outcome 2	Improved access to job among youth (male and female) and enhanced access to irrigation technologies to Smallholder farmers, through the promotion of business groups around shallow groundwater development	# of MSMEs engaged and supported via ISGWID related businesses	#	-	360	229	64	Budget constraints
Output 2.1	Access to finance created for SHF, well drillers, wholesalers, retailers and other service providers, as a means to finance irrigation equipment and well drilling services	# of SHF (M&F), well drillers and service providers aware of available financial schemes	#	-	512,000	60	0.01	No evaluation was conducted
		# of SHFs (M&F) who took loans	#	-	40,000	60	0.15	Budget constraints
		# of well drillers and service providers who took loans	#	-	180	0	0	Budget constraints & weak engagement of sectoral offices
		% increase in savings of SHFs (M&F)	%		150	-	-	No evaluation was conducted
		# of manufacturers, well drillers and service providers supported on business planning	#	-	3000	595	20	Budget constraints
		# of irrigation after-sales service providers (M&F and public/ private/ coops)	#	-	90	30	33	Budget constraints
Output 2.2	Capacitated woredas and well drilling groups to increase farmers' access to SGW	# of woredas using SGW navigation tools	#	-	66	169	100	
		# of woreda experts capacitated on SGW mapping and utilization	#	-	120	386	100	
		# of existing/new well-drilling groups using existing/new well drilling	#	7	23	10	43	Budget constraints

Results Level	Result/objective statements	KPIs	Unit	Baseline value	Overall Target	Achievement To date	%	Remark
		technology (semi-automatic drilling technology)						
		# of regions on which ITT's well drilling technology (semi-automatic well drilling technology) is tested	#	-	3	3	100	
		# of additional viable well drilling technologies implemented	#	-	1	1	100	
		# of farmers that participated in the demonstration of the new well drilling technology	#	-	46	14	30	Budget constraints
		# of platforms created to link well drillers and service providers (i.e. spare parts providers, MFIs etc.) by ATA	#	-	4	1	25	Budget constraints
Outcome 3	Increase in irrigated area, market-driven High value crops (HVC) production and productivity while maintaining quality and reducing post-harvest loss	Hectares of land under HVC using irrigation technologies	Ha	-	100,000	153,148	100	
Output 3.1	Enhance the capacity of SHFs to use improved irrigation practices and linked to potential market.	# of SMSs (M&F) trained on defining HVC tools	#	-	598	535	89	
		# of woreda experts (M&F) trained on localized cropping calendar development	#	-	598	486	81	
		# of SMSs & DAs (M&F) trained on irrigation water management and irrigation agronomy	#	-	186	158	85	
Output 3.2	Enhance the capacity of market actors linked to market	# of woreda experts (M&F) trained on market linkage	#	-	186	81	43	Budget constraints
		# of cooperatives linked with potential buyers	#	-	120	10	8	Budget constraints

Results Level	Result/objective statements	KPIs	Unit	Baseline value	Overall Target	Achievement To date	%	Remark
Outcome 4	Enhanced adoption of Energy Efficient and Water Saving Technologies among SHFs (female and male) in the four Regions	# of SHFs (M&F) that have adopted energy efficient water saving technology (solar pumps and drip irrigation)	#	-	160	247	100	
		Hectares of land irrigated using environmentally friendly and better technology	#	-	32	80	100	
Output 4.1	Enhanced capacity of piloted SHFs to adopted solar pumps and drip systems technologies	# of SHFs accessing energy efficient and water saving technologies promoted	#	-	1000	247	24.7	Budget constraints
		# of field days organized	#	-	5	4	80	
		# of pilot training conducted in piloted woredas	#	-	4	12	100	
		# of Woreda experts and DAs (M&F) trained	#	-	294	82	28	Budget constraints
		# of SHFs (M&F) trained	#	-	360	260	72	
		# of installation, operation and maintenance manuals developed	#	-	1	1	100	
		Document of scaling up strategy produced	#	-	1	0	0	Evaluation was not conducted
Output 4.2	Increased farmers' awareness and access to cost effective solar pump technologies	# of farmers that are aware of the cost-effective solar pump technologies	#	-	1050	6,555	100	
		# of cost-effective solar pump technologies demonstrated	#	-	3	2	67	Budget constraints
		# of cost-effective solar pump technologies sourced from available market	#	-	1500	247	16.4	Budget constraints
		# of farmers trained on solar pump utilization	#	-	100	170	100	
		# of SHFs accessing energy efficient and water saving technologies promoted	#	-	100	247	100	
		# of trainings conducted in target woredas	#	-	30	23	77	Budget constraints

Results Level	Result/objective statements	KPIs	Unit	Baseline value	Overall Target	Achievement To date	%	Remark
		# of Woredas experts and DAs (M&F) trained	#	-	294	82	28	Budget constraints
		# of SHFs (M&F) trained	#	-	100	260	100	

Finance Report

a) Budget Summary

Project Name	Project Number	Year-to-date Budget	Year to date Actual	Variance	Variance %
Integrated Shallow Groundwater Irrigation Development (ISGWID)	1505	201,410,391.51 Birr	95,753,240.52 Birr	105,657,150.99 Birr	47.54%

NB: project actual expenditures to be verified

b) Financial Narrative

While the project has achieved considerable progress in most areas, there are a few variances to note. The engagement of youths in the business groups was lower than expected, with only 595 individuals trained, compared to the target of 3,000. This shortfall is attributed to logistical challenges and the limited availability of suitable training programs. Similarly, the installation of solar pumps fell short of the target due to financial constraints, limiting the number of farmers who could benefit from this technology. Despite these challenges, the project remains on track to achieve its broader objectives, with ongoing efforts to address these variances through targeted interventions and resource reallocation. The

ISGWID project has demonstrated careful financial management, with a year-to-date expenditure of 95,753,240.52 birr against a planned budget of 201,410,391.51 birr. This results in a variance of 105,657,150.99 birr, which represents a 4.3% underspend.

3.4 Community Engagement and Contribution to Outputs and Outcomes

Effective community engagement is essential for the successful implementation of integrated shallow groundwater irrigation development. By actively involving local communities, the project ensures that the needs and knowledge of farmers are incorporated into the planning and execution processes. This participatory approach not only enhances the relevance and sustainability of irrigation solutions but also empowers communities to take ownership of their water resources. As a part of key stakeholders, local communities have taken a great role in supporting shallow groundwater mapping team by providing access route and invaluable indigenous knowledge to identify available water volume, command area and beneficiaries.

Following shallow groundwater mapping or water source identification, local communities have engaged in sustainability of shallow groundwater resources by participating in construction of 3R (recharge, retention and reuse) structures to enhance groundwater recharge to sustain groundwater-based irrigation without affecting the natural hydrologic cycle. Community members also contribute valuable insights into local water availability, land use patterns, and agricultural practices, which are critical for designing irrigation system for climate smart agriculture. Meanwhile, their participatory role and involvement in accepting and adopting water lifting technologies and energy efficient technologies allowing installation and demonstration of 247 solar pumps and drip irrigation system to produce high value crops.

This participatory approach not only enhances the relevance and sustainability of groundwater-based irrigation solutions but also empowers communities to take ownership of their water resources and irrigation infrastructures. Moreover, the integration of traditional knowledge with modern irrigation technologies can lead to more effective and culturally appropriate solutions.



Figure 14: Community Participatory in construction of 3R at Anigacha and Lemo Woredas



Figure 15: Community participation and consultation to introduce shallow groundwater-based irrigation practices

3.5 Sustainability of Project Outcomes

The ISGWID project has significantly contributed to sustainable production, productivity, and income for male and female smallholder farmers by increasing irrigation practices and expanding irrigable areas. Ensuring the sustainability of outcomes in integrated shallow groundwater irrigation development is crucial for delivering long-term benefits to smallholder farmers and the wider community.

Empowering local communities through training and capacity building is vital for the ongoing management and effective implementation of irrigation systems. By creating awareness on the entire value chain of ISGWID and equipping farmers with the skills to develop shallow groundwater wells, engage in watershed development to enhance groundwater recharge, maintain and operate solar pumps and drip systems, practice crop calendaring, and select high-value crops to boost income and livelihoods, the project fosters a sense of ownership and responsibility. This approach ensures that the systems remain functional and effective over time.

To achieve the economic sustainability of shallow groundwater resource development for household irrigation (HHI), ATI planned to uniformly install groundwater monitoring systems across all potential areas. However, this effort was halted by budget constraints and as a result only two groundwater monitoring wells were successfully installed in two woredas in the Oromia and Sidama regions. Monitoring groundwater quantity and quality is crucial for effectively utilizing this resource without causing significant harm or risking crop failure due to groundwater depletion. Augmentation and managing groundwater resources is fundamental to the long-term success of irrigation projects. Sustainable water use practices, such as monitoring water levels and implementing efficient irrigation technologies, help preserve groundwater resources and

prevent over-extraction. Promoting environmentally sound practices ensures that the project contributes to ecological balance and the resilience of agricultural systems.

The sustainability of the project outcomes is further reinforced by integrating the project's initiatives into national water policy and strategy. To achieve this, the team, in collaboration with MoWIE, reviewed the national water policy and incorporated provisions for the sustainable utilization of shallow groundwater, aligning it with small-scale irrigation development. Securing strong support from local governments, the Ministry of Agriculture, the Ministry of Water and Energy, and other relevant institutions is essential for ensuring the provision of necessary resources, guidance, and oversight.

Establishing clear linkages and coordination within ISGWID is crucial to ensuring the long-term sustainability of the project's benefits. In line with this, ATI procured advanced data storage and processing software to create an interactive groundwater database for monitoring and backing up groundwater data. This database is a fundamental tool for various groundwater resource and hydrogeological studies, providing critical insights for future groundwater development and utilization, as well as aiding policy and decision-makers in planning water resource-related projects.

The economic sustainability of the project is linked to its ability to enhance farmers' productivity and income. By increasing access to reliable water sources, the project enables farmers to cultivate high-value crops and extend growing seasons, leading to improved livelihoods. Ensuring that irrigation systems are affordable and accessible to smallholder farmers is key to maintaining their long-term use and success.

Name of Sustainability Driver	Actions taken to Strengthen Sustainability
Local Ownership	For the sustainability of the project, capacity building trainings of regional, zonal and woreda working groups were performed on the concept of the project and other HHI related technical issues. MoA, Small Scale Irrigation Directorate and regional stakeholders was fully involving during piloting phase and was leading the scaling up of the concept and hence have full knowledge about the initiative and help the smooth handing over of the project.
Partnering	• Czech development agency helped the pilot mapping of shallow groundwater that covered over 20,000 sq.Km • DANIDA supported the implementation of ISGWID projects
Transformed relationships (Among group members)	• The project has been managed by ATI in close collaboration with the Ministry of Agriculture (MoA) and with additional support from the Ministry of Water and Energy (MoWE), Regional Irrigation and Water Offices, as well as Zonal and Woreda Irrigation and Water Bureaus. These organization have changed project progress through the established task force and convene on a bi-annual, quarterly, and bi-weekly basis to ensure the successful implementation of activities and the achievement of project outputs and outcomes.

Name of Sustainability Driver	Actions taken to Strengthen Sustainability
Household and family resilience	Understanding the changing climate, the farmers adopt practices that make their fields more resilient to droughts and unpredictable weather. They experiment with drought-resistant crops and adjust their planting schedules to align with shifting weather patterns.
Local and national level advocacy	- Local leaders organize workshops and training sessions, teaching farmers about sustainable water use. They learn about efficient irrigation techniques like drip irrigation, which uses less water while keeping their crops healthy. The farmers also discover the benefits of planting a variety of crops, some of which require less water, helping to ease the strain on their wells. - In the long term, the owner of the outputs of this assignment including shallow groundwater maps with all development and management tools, and guidelines will be MoWE, MoA, RBOA, Regional Irrigation Development Authorities/agencies, and regional BoWR. - To ensure everyone's voice is heard, the community forms a water management committee. This group includes farmers, elders, and local officials, all working together to plan how the groundwater will be used and protected. Decisions are made collectively, ensuring that everyone has a stake in the outcome.

3.6 Integration of Cross-cutting Issues

Cross-cutting issues	Successes	Challenges
Gender	Potential SGW development for household irrigation highly involves women and creates a better chance to increase their income and ensure food security by producing HVC like vegetables. Women are beneficiaries of household irrigation schemes. Growing garden vegetables increases the chance for family consumption and nutrition sensitive agriculture. The recommended equipment and tools are selected based on women friendliness.	Despite the efforts and introduced affirmative actions, since project evaluation has not undertaken it is difficult to determine the intended plan.
Youth	The project targets youth during implementation, with the aim including youth farmers to benefit from the increased income of irrigated agriculture and this trend is expected to continue in the coming project implementation. To improve access to job and enhance access to irrigation technologies, 595 youths (20% against planning) trained on well drilling techniques, Surface engine and submersible pump maintenance, and manual pump	Budget constraints is a major challenge encountered

Cross-cutting issues	Successes	Challenges
	manufacturing and ultimately provided services for 6856 smallholder farmers.	
Environment	- The project will promote the safe and sustainable use of groundwater with the establishment of ground water and soil testing sites in each of the 30 woredas. This will ensure that salinity will not affect productivity of farmers which may occur due to an extended use of irrigation. The test will also include potability test of the groundwater safeguarding the health of farmers. In addition, DAs with the support of woreda experts, will be able to utilize SGW maps to preserve and protect the aquifers onto which wells will be installed, providing sustainable water supply for neighbouring farmlands. Therefore, an atlas of shallow groundwater was developed for each selected sub-basin and shared for at least four regions, two groundwater monitoring wells installed, 3R (recharge, retention and reuse) approach promoted. - EE&WS project responds well to the environment. The solar pump is called green as it doesn't use diesel or petrol and doesn't emit carbon to the environment. Water saving technologies like, drip irrigation systems directly contribute to climate smart agriculture as they use water efficiently and reduce the risk of salinity to the land and the groundwater. Furthermore, the project directly contributes to greenhouse gas emission reduction due to renewable (solar pumps) utilization and climate change adaptation and efficient utilization of water. The project contributes to an output of the "greening agricultural transformation" agenda: input supply chains and services for (environmentally friendly) HHI enhancement.	Groundwater monitoring wells were not installed as per the plan due to budget constraints
Nutrition	- The project contributes to gender equality as the nature of HHI naturally is of small land size (including backyard), and hence, it is mostly managed by women. Furthermore, the project will include in its checklist to assess challenges and opportunities for female farmers benefiting from project intervention and address findings and ensure women will be targeted as beneficiaries of irrigation schemes as well as different interventions. - Most of the HVCs for HHI are vegetables which are believed to improve the nutritional status of HHs. The use of IVR, HVC selection tool and moderator-based SMS extension advisory services bring women on board. Hence, this project will partially support nutrition-sensitive agriculture.	It should be verified by project evaluation report

4. Project Management

4.1 Project Management Arrangement

The project has been managed by ATI in close collaboration with the Ministry of Agriculture (MoA) and SSID, with additional support from the Ministry of Water and Energy (MoWE), Regional Irrigation and Water Offices, as well as Zonal and Woreda Irrigation and Water Bureaus. Initially, the ISGWID project was implemented in four regions: Oromia, SNNP, Amhara, and Tigray. However, upon request from the Harari region, shallow groundwater mapping was expanded to other regions. This expansion was carried out with the supportive supervision of various governmental organizations, including Addis Ababa University (AAU), the Geological Survey of Ethiopia (GSE), the National Meteorological Agency (NMA), the Ethiopian Mapping Agency (EMA), and Regional Water Works Design and Supervision Enterprises. Additionally, non-governmental organizations such as the International Water Management Institute (IWMI) and the Japan International Cooperative Agency (JICA) were also involved. These organizations have been organized into a National Oversight Committee, a Regional Oversight Committee, and project implementation teams.

The National Oversight Committee, consisting of representatives from the Ministry of Agriculture (MoA), Ministry of Water and Energy (MoWE), Geological Survey of Ethiopia (GSE), International Water Management Institute (IWMI), Japan International Cooperative Agency (JICA), and ATI, is responsible for overseeing the overall steering and management of the project. Their duties include making key decisions, developing a regulatory framework for project implementation, validating the results of the mapping exercise, and providing overall technical guidance. The Regional Oversight Committee, comprising members from the Regional Bureaus of Agriculture (RBoA) and Regional Bureaus of Water (RBoW), is tasked with overseeing and guiding the project's implementation and performance evaluation at the regional level. They also support field investigations in collaboration with woreda officials. Similarly, the project teams are responsible for coordinating and managing the overall implementation, as well as facilitating relationships between different project stakeholders. The project implementers, including RBoA, Zonal Bureaus of Agriculture (ZBoA), and Woreda Bureaus of Agriculture (WBoA), are accountable for executing responsible interventions and working in collaboration with regional and federal ATI and public bureaus. The project management groups convene on a bi-annual, quarterly, and bi-weekly basis to ensure the successful implementation of activities and the achievement of project outputs and outcomes.

The Procurement Management Plan outlines the description and details of items to be procured, including unit, category, currency, quantity, unit cost, and total cost. It also specifies the selection method, key performance indicators (KPIs), work streams, activities, the date the purchase requisition (PR) was initiated, and the expected contract signing date. The ISGWID project team, with support from Implementation Support, handles project monitoring, evaluation, and reporting to ATI's ACC Vertical and PPMO. The PPMO is responsible for ensuring that project progress is accurately captured within its monitoring framework and for assessing the project's contribution to achieving the transformation agenda's deliverables. To support this, the ISGWID project result framework has been developed, detailing the project's goal, purpose, outputs, and activities.

4.2 Project Integration with Other Projects

Basically, a project by itself is the integration of the outcomes within the project that comprises water resources, land and energy which are the benchmark for all projects designed to achieve or promote food security, access to safe water and sanitation or catalyse economic development. As water is the basic need of life, SGWM result can be accessed by FPC grain and Horticulture, livestock, FARM, ADEY, and DREAM projects. Contribution delivered from AgriHub is significant for promotion of business groups around shallow groundwater development. Similarly, HVC production is closely work with FPC grain and Horticulture, ADEY, DREAM and FARM projects. As renewable energy has a linear relationship with all development projects, it integrated with DREAM, FPC grain and Horticulture, ADEY, DREAM, Livestock, Mechanization, AgriHub and FARM projects. ISGWID projects has involved in generating idea, initiation and formation of 8028 hotline which contribute significant roadmap for the evolution and development of digital agriculture.

4.3 Project Evolution

The Integrated Shallow Groundwater Irrigation Development (ISGWID) project evolved from household irrigation (HHI) initiatives and was established to improve smallholder farmers' access to shallow groundwater-based irrigation, with the goal of boosting production and productivity of high-value crops (HVCs). The ISGWID project was fully ratified in January 2020 G.C., incorporating four key components: Shallow Groundwater Mapping, Supply Chain Development around shallow groundwater, Sustainable HHI full Value Chain Interventions, and Energy Efficient & Water-Saving (EE WS) measures. ISGWID project Initially designed to cover 200,000 sq. km, to identify shallow groundwater potential, to identify 500,000 hectares of irrigable land that benefit 1 million smallholder farmers across 150 woredas. However, following a project change request approved on February 24, 2020, G.C., the scope was narrowed to 30 woredas.

4.4 Project Evaluation Findings

A comprehensive project evaluation for integrated shallow groundwater irrigation development has not yet been conducted; it is scheduled for October 2024. However, a partial evaluation was completed for the Energy Efficient & Water-Saving (EE WS) component. This evaluation primarily identified functional challenges and maintenance needs. The findings highlight the critical need for implementing robust maintenance and repair strategies, along with training and awareness programs, to ensure the sustainability and effectiveness of the irrigation solar units.

4.5 Key Encountered Challenges and Mitigation being implemented/Proposed Mitigations

Action

Key Encountered Challenges	Mitigations being Implemented/Proposed Mitigations Action/s
Technical complexity specially under SGW and lack of credible reports and data specific to SGW resources before this project	Shallow groundwater mapping (SGWM) was carried out in collaboration with task forces formed from key partners. SGWM differs somewhat from conventional hydrogeological mapping, which typically covers all aspects of hydro-stratigraphy. The primary objective of SGWM is to identify shallow groundwater sources at depths of up to 30 meters, making them easily accessible with manpower and light machinery. During the initiation of the mapping process, it was challenging to obtain precise aquifer characteristics directly applicable to development. However, with the involvement of organizations such as GSE, MoWE, and IWMI, these challenges were addressed, leading to the technical identification of significant volumes of shallow groundwater and potential irrigation command areas.
Lack of commitment on supporting development and promotion of acknowledged technologies and interventions	The HVCs assessment tool was developed to identify the most feasible crops for HHI and is now being used nationwide to enhance the commitment of development agents. Simultaneously, efforts were made to create awareness and encourage the adoption of new technologies that enhance the production of high-quality crops. To support this, an Excel-based local cropping calendar development tool was created, aimed at answering key economic questions: what to produce, when to produce, how much to produce, and for whom to produce. This tool is part of broader capacity-building efforts to facilitate the acceptance and use of new technologies.
Lack of reliable and sustainable improved input provision system for HVCs and poor market linkage system	Before the establishment of AOSS, accessing improved inputs for HVCs was challenging. The difficulty in obtaining quality seeds can be addressed by raising farmers' awareness about using high-quality inputs and by linking them with AOSS. However, significant challenges remain in ensuring tangible access to markets and finance for well drillers and smallholder farmers.

4.6 Risk Management Status

Identified Risks	Risk magnitude	Risk Response plan	Current Status
Shortage of funds: SGW mapping requires relatively large budget	High	Mobilize funding based on the result of pilot and use for irrigation development (benefits to SHFs as well as environmental sustainability)	SGWM was successfully completed, and the achievement was beyond the planned coverage, which is about 234,772Sq. Km.
Over exploitation of resources like groundwater depletion, forestland for agriculture expansion	medium	Planned interventions that help maintain sustainable utilization of the identified resources	15 observation wells were planned to be drilled and monitoring devices installed, but due to budget constraints, it was not implemented. Only two observation wells drilled at Oromia and Sidama regions.
Poor governance structure for the SGWR mapping assignment	Medium	Establishing National advisory group, regional task force, Zonal & woreda working groups	National advisory group, regional task force, Zonal & woreda working groups were established and SGWM was validated with these task forces.
Farmers fail to apply new technology to achieve high quality crop production	Medium	Adequate training, management, and marketing should be provided to farmers and farmer associations	Training was provided on crop calendaring, HVC selection and water management to improve farmers awareness to accept new technologies to boost their production of high-quality crop.
Water users Association (WUA) proclamation regulation may not include ground water irrigation conflict resolution and also may not be implemented as required	Medium	Conduct Advocacy and follow up the implementations with federal and regional stakeholders	The advocacy workshop conducted and followed - up works are ongoing in Amhara region and due to the budget constraints in other regions not yet.
Local level skill & financial capacity gaps may hinder promotion of irrigation supply chain business service	Medium	Bring on board Financing Institutions to arrange credit scheme for potential service providers	Discussion with financial institute was started in Oromia but due to budget constraint other regions unable to do the same as per the response plan.
Theft of Property (solar panels after installation) may lead loss of equipment and interrupting the pilot demonstration	Medium	Design a system that solves this problem	The necessary precautions are ongoing and so far, no damage happened/reported

4.7 Key Lessons and Reflections from the Project Team

The ISGWID project is highly suitable for scaling and continuation due to its proven impact on enhancing smallholder farmers' access to irrigation and improving agricultural productivity through sustainable use of shallow groundwater. The project's integrated approach combining resource mapping, capacity building, promotion of energy-efficient technologies, and market-oriented crop production, demonstrated its ability to address critical challenges in small-scale irrigation. With the successful mapping of shallow groundwater resources across a significant portion of the country and the quantification of its potential to benefit millions of households, the project has established a solid foundation for scaling. Additionally, the engagement of youth-led enterprises and MSMEs in well-drilling services, pump maintenance, and irrigation technology supply chains highlights a replicable model for creating employment and ensuring service availability in rural areas.

However, challenges encountered during the initial implementation, such as budget constraints, limited follow-up evaluations, and gaps in institutional support, must be addressed for successful scaling. Sustainable funding mechanisms, stronger extension linkages, and robust monitoring and evaluation systems are essential to maximize the impact of the project in future phases. Moreover, policies that prioritize groundwater governance and facilitate farmer access to technologies, such as solar pumps and drip irrigation, will be critical for achieving long-term sustainability. In conclusion, the ISGWID project has demonstrated strong potential for scaling, provided that its implementation framework is refined to address existing challenges and enhance its sustainability and outreach.

4.8 Conclusion and Considerations for Future Implementation or Scale-up

The ISGWID project is highly suitable for scaling and continuation due to its proven impact on enhancing smallholder farmers' access to irrigation and improving agricultural productivity through sustainable use of shallow groundwater. The project's integrated approach combining resource mapping, capacity building, promotion of energy-efficient technologies, and market-oriented crop production, demonstrated its ability to address critical challenges in small-scale irrigation. With the successful mapping of shallow groundwater resources across a significant portion of the country and the quantification of its potential to benefit millions of households, the project has established a solid foundation for scaling. Additionally, the engagement of youth-led enterprises and MSMEs in well-drilling services, pump maintenance, and irrigation technology supply chains highlights a replicable model for creating employment and ensuring service availability in rural areas.

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