Climate Smart Village Initiative (CSVI)

Building Climate Resilience in Pakistan's Agriculture

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AUGUST

MONDAY **04** 9 AM-3PM

2025

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Prepared By: **Aiman Aziz**
Sustainability Executive, SAWiE

Pakistan's food system under accelerating Climate Change crisis

Bank Alfalah

Smallholders dominate Pakistani agriculture and are the most exposed to climate shocks. The new **Digital Agricultural Census (2024)** shows **~97% of farmers operate under 12.5 acres**, limiting economies of scale and resilience to weather extremes. Fragmentation and thin margins make it harder to absorb input price spikes, pest/disease outbreaks after wet spells, or replanting costs after floods.

Pakistan's food system is now experiencing faster, more erratic swings between flood and drought than in the past decade, clear signals of the intensifying impacts of climate change. Rising global temperatures are amplifying monsoon variability and heat extremes across South Asia, and Pakistan sits on the frontline. This sequence of flood–drought shocks illustrates how climate change is reducing predictability, shortening recovery times, and deepening risks for smallholder farming systems.

Heat stress during key crop stages is increasingly frequent and damaging. Peer-reviewed analyses for Punjab indicate rising maximum/minimum temperatures during the wheat season, accompanied by a yield penalty, particularly around flowering/grain-filling. Together, these shocks translate into yield losses and crop damage for both food and fiber crops via heat-induced grain shrinkage, lodging, flood-related washouts/waterlogging, and moisture deficits during establishment.

Climate-Smart Agriculture (CSA) offers a pathway to reorient Pakistan's agriculture under changing climatic realities. The CSA approach integrates three key objectives: **increasing productivity, building resilience (adaptation), and reducing or removing GHG emissions (mitigation).** In Pakistan, CSA practices have gained prominence through interventions

Soil Conservation

Integrated Pest Management

Diversified cropping systems

Water Management

Renewable energy

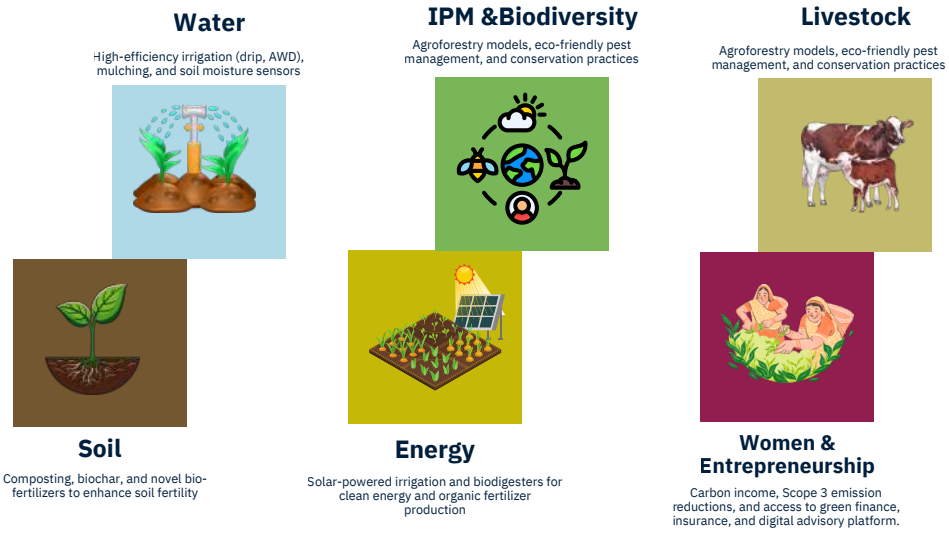
These measures demonstrate that CSA is not an abstract framework but a portfolio of practical, locally adapted interventions that can be scaled up. However, mainstreaming CSA requires institutional innovation, enabling finance, and multi-stakeholder partnerships, areas where the Climate Smart Village Initiative (CSVI) by SAWIE seeks to create systemic change.

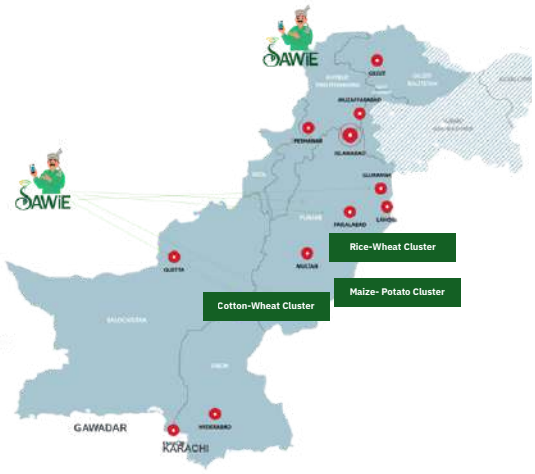
Climate Smart Village Initiative (CSVI)
A New Approach

Climate-Smart Villages (CSVs) are real-world **"living labs"** where communities, local institutions, and partners co-design, trial, and scale nature-based solutions (NbS).

Climate-smart agriculture (CSA) practices have evolved to include options combining agronomic practices (e.g., water-saving, heat/drought-tolerant seeds**, IPM),** climate services and digital advisories, risk financing (insurance, safety nets), and inclusive local governance. The CSV concept was developed and tested by the **CGIAR CCAFS** program across Asia and Africa as a structured pathway. Evidence from CSV pilots highlights the value of multi-actor co-implementation, farmer-led testing, and strong climate-information services for adoption and scaling.

The **Climate Smart Village Initiative (CSVI)**, by **SAWiE Ecosystems Pvt. Ltd. i**n partnership with **Bank Alfalah**, embodies a regenerative model of climate-smart agriculture tailored for Pakistan's smallholder farmers. Instead of treating CSA as a set of isolated practices, CSVI integrates digital innovation, regenerative agriculture, and green finance into a holistic framework.





Three Climate Smart Villages (CSVI)

SAWiE and Bank Alfalah have jointly pioneered three Climate Smart Villages (CSVs) across 3 major cropping systems in Pakistan: Rice-Wheat, Maize-Potato, and Cotton-Wheat. These CSVs serve as live demonstration hubs for regenerative practices, digital tools, and green finance integration. Since January 2025, the CSV initiative has directly engaged 200 farmers, building capacity for sustainable production and improved market access.

The framework is structured around 6 core pillar, with crop-specific interventions designed under each pillar.

Through these pillars, CSVI aims not only to strengthen farm-level resilience but also to integrate smallholders into emerging climate finance and carbon markets, positioning them as active stakeholders in global mitigation efforts.

6 CORE PILLARS OF CSVI

REGENERATIVE AGRICULTURE APPROACH

SAWiE

Bank Alfalah

IN ALIGNMENT WITH UN SUSTAINABLE DEVELOPEMENT GOALS (SDGS)

1. Water

Why it matters ?

Water scarcity is the single greatest challenge to Pakistan's agriculture. With over **90% of national freshwater** withdrawals going to farming, the country faces mounting pressure as climate change drives more erratic rainfall, glacial melt, and prolonged droughts. The **2024–25** season alone highlighted this vulnerability: after severe flooding damaged nearly **60,000 acres** in Sindh and Punjab during the 2024 monsoon, a rainfall deficit of more than **40%** struck the following winter and early spring. Such rapid swings between extremes reduce the predictability of water availability, weaken soil health, and heighten crop failure risks for smallholders. Traditional flood irrigation methods are increasingly unsustainable, leading to enormous losses **FAO estimates up to 60% of irrigation** water never reaches crops. Unless farming transitions towards more efficient and climate-resilient water management, food security and rural livelihoods will remain under constant threat.

CSVI Interventions

- **Ridge & Raised-Bed Planting**
  Water saving, reduced waterlogging, and enhanced crop resilience.
- **Drip & Sprinkler Irrigation**
  Save 40–60% water compared to traditional flood irrigation.
- **Mulching**
  Conserves soil moisture and reduces surface evaporation.
- **AWD Tubes for Rice**
  Cut water use by ~30% and lower methane emissions.

2. Healthy Soils

Why it matters ?

Soil degradation is a silent crisis threatening Pakistan's agricultural sustainability. Continuous nutrient mining, erosion, waterlogging, and salinity are depleting soil fertility at alarming rates, with the **Pakistan Agricultural Research Council** estimating annual fertility losses of **1.5%**. At the same time, climate change magnifies these pressures through intense rainfall, flash floods, and heatwaves that accelerate erosion and organic matter loss. Depleted soils reduce productivity, diminish water retention, and leave crops more vulnerable to climatic shocks. Without urgent investment in soil restoration, yield gaps will widen, forcing farmers into greater dependence on costly chemical inputs, further undermining sustainability. Building healthy soils is therefore central to climate-smart agriculture boosting yields, improving resilience, and **enhancing carbon sequestration**.

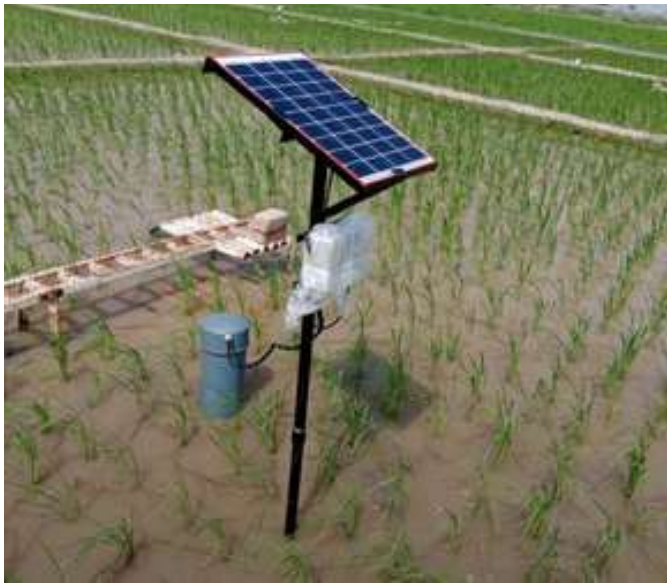
CSVI Interventions

- **Composting & Biochar**
  Restore organic carbon and improve soil fertility.

- **Novel Biofertilizers**
  Boost nutrient efficiency through microbial and nano inputs.

- **Crop Residue Management**
  Enhance soil structure and avoid emissions from burning.

3. Clean Energy



Why it matters ?

Energy insecurity is a growing obstacle for farmers in Pakistan, where unreliable grid power and high diesel costs drive up production expenses and limit irrigation access. Agriculture is also a major contributor to greenhouse gas emissions, with livestock and energy use together accounting for nearly half of the sector's footprint. Climate change makes this reliance on fossil fuels even riskier, as rising fuel prices and disrupted energy supplies threaten farm viability. Transitioning to renewable energy is therefore essential not only to cut costs but also to reduce emissions and enhance resilience. By integrating clean energy solutions into farming systems, Pakistan can simultaneously address climate mitigation and improve livelihoods in rural areas.

CSVI Interventions

01	02	03
Solar-Powered Pumps	**Biogas & Biodigesters**	**Energy-Efficient Irrigation**
Solar-powered irrigation pumps to replace diesel engines.	Biogas/biodigesters producing clean cooking fuel and organic fertilizer.	Energy-efficient irrigation systems reducing both costs and emissions.

4. IPM & Biodiversity

Why it matters ?

Biodiversity underpins the stability and resilience of Pakistan's agricultural landscapes, yet it is rapidly being eroded. Forest cover has fallen to less than 5% of total land area, while monocropping and intensive chemical use have sharply reduced on-farm biodiversity. This decline has far-reaching consequences: the loss of pollinators lowers productivity in fruits, oilseeds, and vegetables, while the disappearance of natural pest predators leaves crops vulnerable to outbreaks. Climate change compounds these pressures by altering pest and disease dynamics and degrading natural habitats. Restoring biodiversity through integrated approaches like agroforestry, intercropping, and eco-friendly pest management strengthens ecosystem services, stabilizes farm incomes, and contributes to long-term climate resilience.

CSVI Interventions

- **Agroforestry & Intercropping**
  Enhance ecosystem services and diversify farm products.
- **Eco-Friendly Pest Management**
  Apply IPM, pheromone traps, and botanical pesticides.
- **Pollinator-Friendly Practices**
  Establish field margins and flowering strips to support natural pollinators.

5. Livestock

Why it matters ?

Livestock underpins rural livelihoods in Pakistan, providing food, draft power, and income yet it is also highly vulnerable to climate change. Rising temperatures, erratic rainfall, and fodder scarcity intensify heat stress and reduce productivity, while disease outbreaks linked to changing weather patterns add further risks. At the same time, poorly managed livestock systems contribute to land degradation, overgrazing, and greenhouse gas emissions. Regenerative approaches in livestock management, particularly improved grazing systems, offer a pathway to reverse this cycle. By restoring degraded rangelands, enhancing soil carbon, and integrating livestock more effectively into cropping systems, farmers can increase resilience, improve animal health, and unlock carbon income opportunities.

CSVI Interventions

- **Improved Fodder & Feed**
  Drought-tolerant fodder, and balanced rations to raise productivity and cut methane.

- **Rotational Grazing**
  Managed grazing to restore pastures, boost biodiversity, and store soil carbon.

- **Agro-Pastoral Integration**
  Use crop residues and cover crops for livestock feeding and nutrient recycling.

6. Women & Entrepreneurship

Why it matters ?

Women are the backbone of Pakistan's agriculture, making up **nearly 45% of the sector's labor force**, yet they remain largely invisible in decision-making, land ownership, and access to finance. Their contributions from sowing and harvesting to livestock care and household food security are vital, but often undervalued and under-supported. Climate change disproportionately impacts rural women, as they shoulder additional burdens of food provision, water collection, and caregiving when shocks strike. Empowering women with knowledge, tools, and financial access is central to building climate-smart farming systems. By strengthening their role in entrepreneurship and CSA adoption, women not only secure household livelihoods but also drive broader community resilience.




CSVI Interventions

Digital Advisory (SAWiE)

Tailored mobile-based services for women farmers.

Green Finance (Bank Alfalah)

Access to microcredit, insurance, and cluster-based lending.

Women-Led Enterprises

Composting, biochar & kitchen Gardening

Training & Capacity Building

Skills in regenerative farming and value-added products.

CLIMATE SMART VILLAGE INITIAIVE

Empowering Farmers through Climate-Smart Agriculture and Carbon Farming

THE LAUNCH EVENT PROCEEDINGS

SAWiE

Bank Alfalah

The launch event, held on **4 August 2025** at **Lok Virsa Hall in Karor, Layyah**, convened the active participation of over **250 stakeholders** from provincial agriculture departments, local government, academia, private agri-input suppliers, financial institutions, NGOs, and farmer organizations. The program was structured into three main sessions, complemented by an opening plenary and closing reflections.

Welcome Note by Mr. Fritz Boehmler, CEO SAWiE

At **SAWiE** we believe that smallholder farmers are at the heart of building climate resilience. Through our Climate Smart Village initiative, we are promoting nature-based solutions that restore soils, conserve water, enhance biodiversity, and reduce emissions. The SAWiE digital platform leverages AI and machine learning to deliver early warning systems, real-time crop monitoring, timely irrigation guidance, and crop protection advice, enabling farmers to enhance productivity, product quality, and resilience. By integrating these digital services with regenerative practices, we aim to empower rural communities, strengthen their livelihoods, and connect farmers to fair trade markets creating a pathway towards a fairer, greener, and climate-smart future. Furthermore, by exploring opportunities in the voluntary carbon markets, we are working to incentivize farmers to adopt climate-smart agriculture & to build a sustainable future together

The urgent need of CSA in Pakistan – Dr. Khalid Mahmood, Co-founder of SAWiE Ecosystems

Dr. Khalid Mahmood introduced CSVI as a "convergence model" of regenerative agriculture, digital technologies, and climate finance. He highlighted the role of pilot villages as testbeds for innovation and scaling. He also emphasized that digital advisories, early warning systems, and localized training are central to the success of the initiative.

He highlighted that erratic rainfall, recurring floods, and prolonged heatwaves are no longer isolated events but recurring challenges that demand integrated responses. He particularly stressed farmer capacity building, digital knowledge platforms, and partnerships between academia, the private sector, and development agencies to accelerate the adoption of climate-smart practices.

SESSION 01

Climate Change Impacts on Agriculture and Adaptive Practices

Banking and Finance Pathways for Climate Resilience – Mr. Yahya Wahla, Agri Head, Bank Alfalah

Mr. Muhammad Yahya Wahla outlined the bank's commitment to facilitating the transition to sustainable agriculture. He highlighted the development of climate-aligned financial products and customized credit lines that encourage smallholder investment in adaptive technologies.
He emphasized that without accessible financing, small farmers will be unable to invest in modern irrigation, resilient seed varieties, or renewable energy solutions.

Zero Tillage, Soil Health Improvement, and Novel Fertilizers – Prof. Dr. Abdul Wakeel, University of Agriculture Faisalabad

Prof. Dr. Abdul Wakeel discussed the role of zero tillage practices and soil health improvement, highlighting how the use of novel fertilizers can enhance nutrient efficiency and support sustainable crop production. He emphasized the role of zero tillage in conserving soil moisture, reducing erosion, and improving organic matter.

Sustainable Management of Cotton Pests in Pakistan – Prof. Dr. Shafqat Saeed (Dean, MNSUAM, Multan)

Prof. Dr. Shafqat Saeed spoke on the sustainable management of cotton pests in Pakistan, emphasizing integrated approaches to reduce chemical dependence and promote eco-friendly pest control solutions. He advocated for (IPM) strategies that combine biological control, pheromone traps, and reduced pesticide reliance.

SESSION 02

Scope 3 Emissions and Carbon Credit Opportunities

Regional Perspectives on Scope 3 Emission Reduction – Dr. Ishaq, Asian Development Bank (ADB)

Dr. Ishfaq Ahmad delivered a session on the role of agriculture in carbon markets. He provided an overview of carbon pricing mechanisms, including both compliance and voluntary market structures, and discussed agricultural practices with high additionality potential.

He explained how export-oriented crops like cotton and rice are under scrutiny from international buyers who are setting carbon reduction requirements. He outlined financing opportunities through multilateral agencies, including blended finance, carbon funds, and results-based payment models that reward emission reduction and regenerative practices. He stressed that aligning Pakistan's agriculture with these standards is not only a climate necessity but also a market opportunity.

Carbon Credits and Regenerative Agriculture Pathways – Dr. Tasneem Khaliq, Director Regenerative Agriculture, SAWiE

Dr. Tasneem Khaliq presented the emerging opportunities for farmers to participate in voluntary carbon markets through regenerative agriculture. She explained how practices such as cover cropping, residue management, agroforestry, and improved manure handling can generate verifiable carbon credits.

Dr. Khaliq emphasized the importance of building farmer cooperatives and digital MRV (Monitoring, Reporting, Verification) systems to ensure transparency and credibility in carbon trading. Her talk demonstrated how linking carbon finance with rural entrepreneurship can create new income streams while advancing climate-smart agriculture.

SESSION 03

Women's Leadership and Inclusive Growth

Youth and Women at the Heart of Climate-Smart Villages – Ms. Somia Atta Shahani, Member of the Punjab Assembly

Ms. Somia Atta Shahani commended the CSVI for its inclusive design, which places youth and women at the center of transformation. Ms. Shahani urged that the CSVI model should be replicated in underserved rural areas where women farmers and youth have fewer opportunities but face the brunt of climate impacts. She also highlighted the need for provincial development policies to mainstream CSVI principles, ensuring that government strategies actively support women-led adaptation and innovation in agriculture.

Women's Entrepreneurship in Rural Economies – Ms. Shakeela Bano, President, Chamber of Commerce, Layyah

Ms. Shakeela Bano underscored the vital role of rural women entrepreneurs in driving sustainable agricultural growth. She advocated for targeted policies and partnerships to expand women's economic opportunities through cooperatives, skill development, and micro-enterprises linked to CSA practices such as composting, biochar, and food processing.

Reflections on Climate-Smart Agriculture – SAWiE Team (Ms. Aiman Aziz, Sustainability Executive & Ms. Sundas Abbas, Project Manager)

SAWiE team, represented by **Ms. Aiman Aziz** and **Ms. Sundas Abbas**, warmly hosted the launch event and guided participants through the proceedings. Together, they emphasized the vision behind the Climate Smart Village Initiative, highlighting its role in addressing Pakistan's pressing climate challenges while empowering farmers with knowledge, digital tools, and innovative practices.

SESSION 04

Cotton-Specific Discussions

Cotton Value Chain Resilience and Advisory Services – Dr. Javed Hassan, Cotton Advisor, APTMA

Dr. Javed Hassan discussed strategies for building resilience across the cotton value chain, from seed selection to market access. He underscored the role of climate-smart seeds that can withstand heat stress and pest pressure, alongside better irrigation scheduling and soil fertility management.

He also emphasized the importance of connecting farmers with global textile supply chains, where sustainability certifications and emission reporting are becoming mandatory. His presentation concluded with a call for multi-stakeholder collaboration to ensure cotton remains competitive in global markets under climate change.

Farmer Perspectives on Cotton and Climate Challenges – Chaudhary Waheed Arshad, Ex-Chairman, PCGA & CEO, Ittefaq Cotton Industries

Chaudhary Waheed Arshad shared a ground-level view of the cotton sector's current challenges, particularly the losses experienced during the recent floods and heatwaves. He highlighted the economic vulnerability of small cotton farmers and called for urgent policy support to stabilize incomes. He stressed the need for farmer-led cooperatives to improve access to inputs, credit, and markets, and pointed out that digital advisory services like SAWiE can play a key role in reducing knowledge gaps.

SESSION 05

Partnerships and Institutional Support

Soil Health and Regenerative Practices for Climate Resilience – Prof. Dr. Ishfaq Ahmad Chattha, Vice Chancellor, Ghazi University

Prof. Dr. Ishfaq Ahmad Chattha highlighted the central role of soil health in building climate resilience for Pakistan's smallholder farmers. He emphasized that without locally adapted regenerative practices, agricultural productivity will continue to decline Dr. Chattha also commended SAWiE's efforts in bringing research-driven, community-level solutions into practice, noting that such platforms bridge the critical gap between academic knowledge and farmer adoption.

Financial Inclusion for Climate-Smart Agriculture – Mr. Muhammad Faheem Arshad, Deputy Director, Financial Inclusion, State Bank of Pakistan

Mr. Muhammad Faheem Arshad introduced the State Bank of Pakistan's new Financial Inclusion Program, designed to expand rural credit access and support innovative green financing products. The program aims to close this gap by promoting digital agri-credit, insurance schemes, and concessional financing aligned with climate-smart agriculture. Mr. Arshad also commended the partnership between SAWiE and Bank Alfalah, describing it as a model for linking financial innovation with sustainable farming initiatives at scale.

SESSION 05

Partnerships and Institutional Support

Artificial Intelligence and Predictive Analytics for Climate-Smart Farming - Dr. Muhammad Hanif from Ghulam Ishaq Khan Institute (GIKI)

Dr. Muhammad Hanif highlighted the transformative role that digital technologies can play in building resilience within Pakistan's agriculture. He explained how artificial intelligence, remote sensing, and predictive analytics can provide farmers with early warnings on climate risks such as droughts, floods, or pest outbreaks. By combining satellite imagery with localized data, these tools can forecast yield trends, optimize irrigation schedules, and guide fertilizer use with far greater accuracy than traditional methods. He stressed the importance of integrating these technologies into platforms like SAWiE, which can make advanced analytics accessible to smallholder farmers through simple mobile applications.

Promoting Climate-Smart Practices through Extension Services – Dr.Shuaib Kaleem, Deputy Director (SS) Agronomy, Adaptive Research Farm, Agri Department Karor(Layyah Zone)

Dr. Shuaib Kaleem emphasized the critical role of agricultural extension in scaling climate-smart practices across Punjab. He noted that while research institutions generate valuable knowledge, it is the extension system that ensures these innovations reach smallholder farmers in practical and timely ways. He highlighted ongoing departmental efforts to promote water-saving irrigation, improved seed varieties, and integrated pest management at the community level.

Mr. Shoaib also stressed the importance of farmer training and field demonstrations, which help build trust and accelerate adoption of new practices.

SESSION 05

Partnerships and Institutional Support

Climate Challenges and Resilient Farming in Balochistan – Dr Samiullah Khan
Associate Professor Balochistan University of IT, Engineering and Management Sciences, Quetta

Dr. Samiullah Khan shared insights on the unique climate challenges faced by farmers in Balochistan, where water scarcity, recurrent droughts, and soil degradation are more severe than in other regions of Pakistan. He highlighted the need for region-specific climate-smart solutions, such as efficient water harvesting systems, drought-tolerant crops, and improved grazing practices for livestock. Dr. Khan emphasized that building resilience in Balochistan requires both technological innovation and community-based resource management, noting that the province's arid landscapes offer opportunities for piloting adaptive models that can later be scaled to other vulnerable regions.

Mudassar Hussain- Olive Farming and Carbon Credit Opportunities – Founder of Al-Zatoonia

Mudassar Hussain shared his experience as an olive farmer and advocate for sustainable agriculture. He explained how olive farming not only provides high-value crops suited to Pakistan's drylands but also plays a significant role in carbon sequestration and regenerative practices. He stressed that initiatives like Zatoonia demonstrate how climate-smart entrepreneurship can link local farming with global sustainability goals, creating both economic and environmental benefits for rural communities.

Way Forward

The following next steps were agreed upon to guide the expansion and institutionalization of the Climate Smart Village Initiative, focusing on climate-vulnerable and underserved farming communities.

EXPANSION

SAWiE and Bank Alfalah will scale CSVI to additional agroecological zones, with a focus on climate-vulnerable and underserved farming communities.

DIGITIZATION

Farmer cooperatives will be digitally enabled to enhance access to advisory tools, regenerative inputs, and carbon finance opportunities.

PARTNERSHIPS

Partnerships with universities, fintech providers, insurers, and development agencies will be strengthened to scale innovation and de-risk adoption.

EMPOWERMENT

Dedicated training and leadership development programs will be initiated to engage rural youth and women in climate-smart and regenerative agriculture.

The launch of the Climate Smart Village Initiative is a timely and much-needed step toward building climate-resilient and sustainable farming systems in Pakistan. It successfully brought together diverse stakeholders to discuss regenerative agriculture, digital innovation, and inclusive rural development. The initiative reflects strong potential for empowering smallholder farmers, especially women and youth, through localized solutions. While the event focused on knowledge sharing and vision setting, future engagements can further benefit from hands-on demonstrations to deepen community adoption. CSVI represents a promising model for transformative change in Pakistan's agricultural sector.

Event Gallery

Group Photo of Major Stakeholders at the Launch of CSVI

Ms. Shakeela Bano Founder Chamber of Commerce , layyah

Ms. Somia Atta Shahani, Member of the Punjab Assembly

Field Team, Bank Alfalah

Dr. Khalid Mahmood with Team RewellX

Muhammad Faheem Arshad – Deputy Director, Financial Inclusion, SBP

Group Photo of Invited Guests

Event Gallery

Ms. Somia Atta Shahani, MPA Visting stalls at the launch of CSVI

Team SAWIE Ecosystems

Mian Ghulam Yasin, Director Agriculture , Agricultural Training Institute Karor Lal Eason District Layyah

Dr. Javed Hassan- Cotton Advisor & Prof Afzal Hussain Lodhra, Advisor Sawie

Sawie Team with Guests

Mr. Yahya Wahla, Agri Head & Mr Ahmad Yar (Bank Alfalah)

Event Gallery

Highlights of Farmers Participation at Launch Event (CSVI)

Get In Touch

+92-606-811812
Info@sawie.net
www.sawie.net
NIC Faisalabad
+92-304-5072115

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