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P@SHA
Pakistan IT Industry Association

AgriTech Frontiers

SCALING SMART FARMING IN GILGIT-BALTISTAN
AN IMPLEMENTATION ROADMAP

Background & Context

Gilgit-Baltistan, located in Pakistan's high mountain ranges, has long relied on subsistence agriculture, yet faces unique constraints. The region spans over 72,000 km² but has extremely limited cultivable land (under 3%) due to its rugged terrain. Of this small agricultural area, only about 1% is presently farmed.[1] Nevertheless, GB's farmers produce high-value crops – including grains (wheat, maize, barley), potatoes and other vegetables, and a variety of fruits (apricots, cherries, apples, almonds, etc.) – prized for their quality. A notable success illustrating GB's potential is the recent export of GB-grown cherries to China, demonstrating that with the right support, remote farmers can reach lucrative markets.

Despite its potential, GB's agriculture remains under-developed and fragile. Geographic isolation and a patchy road network make it difficult for farmers to obtain inputs or sell produce beyond local markets. A short growing season (due to harsh winters and high altitude) limits cropping cycles and increases climatic risks. Inadequate infrastructure – from irrigation channels to cold storage facilities – contributes to high post-harvest losses and food insecurity. Socio-economic factors compound these issues: many farming communities have limited access to education, financing, and modern farming knowledge, which has led to low productivity and out-migration of youth.

To address these challenges, stakeholders have begun laying groundwork for innovation. As part of the GB Development Agenda, programs like the Economic Transformation Initiative Gilgit-Baltistan (ETI-GB) (a $120 million IFAD-supported project) have made significant strides in basic infrastructure and land development. ETI-GB, active since 2016, has irrigated over 50,000 acres of new land and built 385 km of farm-to-market roads across all 10 districts of GB, greatly expanding agricultural areas and connectivity.[2] The Aga Khan Rural Support Programme (AKRSP), working since 1982, has similarly promoted sustainable agriculture and community-driven development, introducing practices like tunnel farming (greenhouses), post-harvest value addition, and climate-resilient crops.[3] These institutional efforts provide a foundation that AgriTech solutions can build upon.

In May 2025, a high-impact roundtable titled "AgriTech Frontiers: Scaling Smart Farming in Gilgit-Baltistan" was held during the Gilgit Startup Summit, co-hosted by P@SHA (Pakistan Software Houses Association) and Accelerate Prosperity. This forum convened diverse stakeholders – GB farmers and local traders, AgriTech startup founders from Islamabad, government officials, researchers, and development experts – to discuss how innovation and technology could transform GB's agricultural Landscape.[4] The dialogue was informed by national insights from the **P@SHA Agri-Tech Report 2024,** which surveyed Pakistan's agri-tech ecosystem and identified gaps in technology adoption. Participants from AKRSP and ETI-GB shared their experiences and expressed commitment to integrating AgriTech into ongoing programs, seeing it as a way to amplify impact in areas like crop advisory, climate-smart farming and market linkages.

[1] https://fwegb.gov.pk/forest/#:~:text=These%20extreme%20climatic%20conditions%20restrict,and%20Stat
[2] https://www.etigb.com.pk/economic-infrastructure/
[3] http://akrsp.org.pk/index.php/programmes/economic-pillar/
[4] See appendix A for participants names and organizations.

Crucially, private sector voices – including founders of AgriTech startups – highlighted both success stories and hurdles. Successful practices in Pakistan and South Asia were showcased, such as mobile-based advisory services delivering real-time agronomic advice, low-cost IoT sensors monitoring soil health, and localized weather forecasts to guide planting/harvesting. These digital tools have helped smallholders elsewhere increase yields and reduce input costs, proving their relevance to GB's context. At the same time, entrepreneurs pointed out operational difficulties in serving remote areas like GB: unreliable internet connectivity, low digital literacy among farmers, bureaucratic delays in approving new tech (e.g. drones or biotech), and the logistical challenge of distributing hardware and providing support in far-flung villages. Local farmers and traders in the roundtable added firsthand perspectives – citing the absence of cold storage, exploitation by middlemen, and inability to access larger markets as pressing problems that technology and policy innovation need to solve.

The stage is set for a concerted push to modernize GB's agriculture through technology. There is awareness at both grassroots and policy levels that conventional approaches are insufficient – systemic innovation is needed to overcome GB's economic and geographic hurdles that makes it prone to the climatic events in the face of changing weather patterns. The following sections of this paper analyze the key challenges and opportunities identified, and propose strategic, implementation-driven recommendations to scale smart farming in Gilgit-Baltistan. The focus is on practical, project-oriented steps that stakeholders can take, aligned with a shared vision: a tech-enabled, resilient agricultural future for GB that improves livelihoods and food security while engaging the region's youth and entrepreneurs.

Key Challenges in Scaling AgriTech in GB

Bringing AgriTech solutions to Gilgit-Baltistan must address a confluence of challenges. These span physical infrastructure gaps, socio-economic and educational barriers, as well as policy and climate issues. Below, we outline the major challenges that any scaling strategy must overcome.

Geographic Isolation & Infrastructure Deficit

GB's mountainous terrain and scattered settlements mean many farms are remote and hard to reach. Basic infrastructure is lacking – many villages are connected by narrow, weather-prone roads (if at all), impeding transport of inputs and produce. Limited electricity in some areas and an inconsistent power supply hinder the use of electric or IoT equipment. Additionally, rural broadband internet is sparse or unreliable, resulting in patchy connectivity that stymies digital services. Without improved roads, power, and the internet, farmers remain cut off from innovations and markets.

Limited Market Access and Post-Harvest Losses

Due to isolation and the absence of storage and processing facilities, GB farmers struggle to sell beyond local markets. Middlemen often exploit the situation, offering low farm-gate prices. Cold storage is practically nonexistent in GB, causing high spoilage of fruits and vegetables before they can be sold. Perishable high-value crops (like apricots and cherries) have short shelf lives and require timely marketing or refrigeration. The weak supply chain means even if one area has surplus produce, it's difficult to distribute it to deficit areas or external buyers. These gaps lead to significant post-harvest losses and income loss for farmers, undermining their incentives to invest in increased production.

Short Growing Season & Climate Risks

GB's agro-climatic calendar is constrained – a limited window for cultivation (often a single crop per year) at high altitudes. This makes agriculture inherently risky; a missed rain or early frost can devastate the annual harvest. Moreover, climate change is amplifying risks: the region faces rising instances of floods, glacial lake outburst floods (GLOFs), unpredictable snowfall, and landslides. Such events not only damage crops but also frequently block roads for weeks, cutting off communities when support is most needed. The changing climate may be shortening growing seasons further and introducing new pest/disease pressures for which farmers have little warning. Overall, climate volatility exacerbates the fragility of GB's farming systems.

Digital Divide and Low Literacy

Most GB farmers have limited exposure to modern technology. Digital literacy is low, particularly among older farmers – many are unfamiliar with smartphones or agricultural apps. While mobile phone ownership is common, a significant portion use basic phones rather than internet-enabled devices. Language and education barriers also exist: farmers

may not be comfortable with English or Urdu text interfaces, given local languages and dialects. Illiteracy (especially among older and female farmers) means that even SMS-based information needs to be supplemented with voice or visual aids. This digital divide means that introducing high-tech solutions requires robust on-ground training and user-friendly, localized designs; otherwise, uptake will remain low.

Regulatory and Institutional Hurdles

Introducing innovative AgriTech (drones, new seed varieties, fintech services for farmers, etc.) often faces bureaucratic red tape. Startups at the roundtable noted complex approval processes – for instance, getting permission to deploy drones for crop monitoring, or unclear regulations around digital financial services for farmers. The policy environment hasn't fully caught up with agri-innovation, creating uncertainty. Additionally, GB's local institutions may lack capacity or mandate to promote AgriTech, resulting in fragmented efforts. There is also no dedicated coordination body to align government, private sector, and donor initiatives in AgriTech. These institutional gaps can slow down the scaling of new projects and discourage private investment.

Limited Access to Finance

Most GB farmers are smallholders with modest incomes and virtually no access to credit or insurance. Traditional banks have minimal presence in remote areas, and farmers typically lack collateral to secure loans. This makes it hard for them to afford AgriTech tools (like sensors, solar dryers, farm machinery) or even quality inputs. The financial divide also affects AgriTech entrepreneurs – investing in an unproven remote market like GB can seem unattractive without risk-sharing. Without innovative financing (micro-loans, leasing, subsidies) to make technology affordable, and crop insurance to manage weather risks, farmers are unlikely to adopt new tools at scale.

Human Capital Flight and Gender Gaps

GB's rural communities are experiencing youth out-migration – many young people leave farming villages for education or jobs in cities, which reduces the local talent available to champion new initiatives. The farming population skews older, and older farmers may be more hesitant to change traditional practices. Meanwhile, women play a major role in GB's agriculture (as in the rest of Pakistan, where 70% of employed women work in agriculture), yet they have even less access to training and technology than men due to cultural and resource constraints. If AgriTech programs do not deliberately include and empower women farmers (through female extension agents, women-focused training, etc.), a large segment of the agricultural workforce could be left behind, perpetuating gender disparities.

> These challenges underscore that scaling AgriTech in Gilgit-Baltistan is not merely a matter of introducing gadgets or apps. A holistic approach is needed – one that improves infrastructure, builds local capacity, adapts to cultural contexts, and enacts enabling policies. In the next section, we turn to the opportunities and strategic entry points that can be leveraged to overcome these hurdles.

Existing Opportunities

Despite the challenges, there are powerful opportunities to harness technology for GB's agricultural development. The region stands to benefit immensely from targeted AgriTech interventions, and several factors work in its favor:

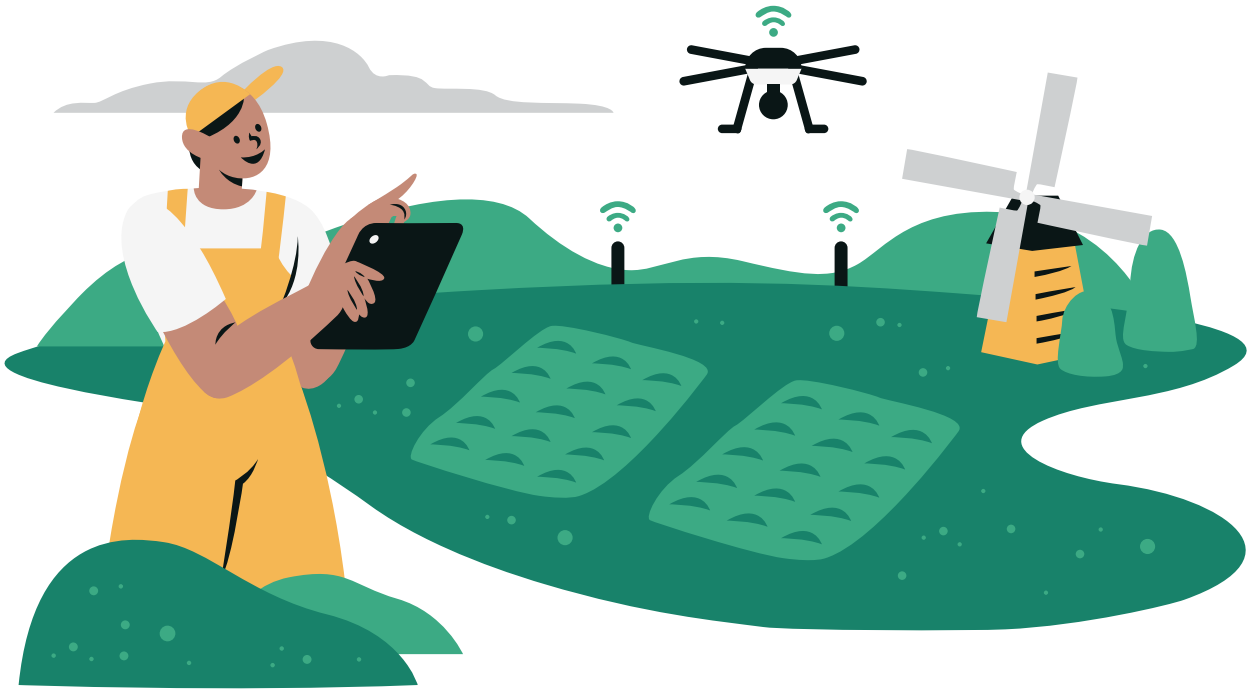
01 Untapped Potential of High-Value Crops

GB's unique climate allows it to grow premium produce (fruits, nuts, off-season vegetables) that could fetch high prices in national and export markets. Improving cold chain logistics and market linkages can capitalize on this, as shown by the cherry export pilot. In June 2024, the first shipment of six tons of fresh cherries was sent to China in a reefer container.[5] About 5,000 tons of cherries in 14 different varieties are produced in Gilgit-Baltistan per season. Over 100 cherry orchards in Gilgit-Baltistan, along with a cold storage and packing facility are now registered with China's General Administration of Customs (GACC), enabling direct export.[6] This certification ensures compliance with Chinese quality standards and allows farmers to access premium prices in international markets. Expanding such success stories with tech-enabled value chains is a major opportunity – for instance, developing affordable cold chain services and transparent digital marketplaces can plug GB's farmers into bigger markets and significantly boost their incomes. What are currently local surpluses could become marketable products across Pakistan and beyond, if quality is preserved and buyers are connected online.

02 Game-Changing Impact of Technology

Modern agri-tech solutions have demonstrated dramatic improvements in productivity and resource efficiency. Analysis suggests that if Pakistan's farms adopt tools like precision irrigation, AI-based advisory, and IoT monitoring, yields could rise by up to 30% and cultivation losses drop 75%, translating into billions of dollars of added value.[7] For GB's constrained farming area, these gains are especially critical – squeezing more output from each acre and reducing waste. Even simple interventions (e.g. solar dryers for apricots, drip irrigation systems, or SMS alert services) can yield outsized benefits in a context where baseline productivity is low. The low-hanging fruit of AgriTech adoption provides an opportunity to quickly demonstrate results (higher incomes, better crop survival), which in turn can fuel further uptake.

[5] https://www.dawn.com/news/1838279
[6] See appendix B for hypothetical increase in income after undertaking certain value addition measures.
[7] https://www.pasha.org.pk/wp-content/uploads/P@SHA-Agri-Tech-Report-2024.pdf



03 Growing Digital Foundation in Pakistan

Nationally, digital infrastructure and usage have expanded rapidly in recent years. Pakistan now has over 100 million 3G/4G subscribers and far deeper mobile penetration than a decade ago. While GB's connectivity lags behind, ongoing investments (e.g. fiber optic cable through Karakoram Highway, expanding telecom coverage) are gradually improving internet access in the region. The government and telecom companies are also interested in bridging the digital divide in regions like GB. Meanwhile, dozens of Pakistani AgriTech startups have emerged – offering services from farm management software to e-commerce for crops – creating a vibrant ecosystem of solutions that can be localized for GB. This momentum means GB doesn't have to innovate from scratch; it can import and adapt tested ideas from the broader Pakistan and regional AgriTech space.

04 Youthful Demographics and Entrepreneurship

GB has a young population, and many educated young people from GB are keen to improve their communities. If given the right support, tech-savvy youth can become drivers of agricultural innovation – as agripreneurs developing local AgriTech businesses, or as "digital agriculture champions" who help their villages adopt new tools. Engaging youth in smart farming initiatives also creates local employment, which can reduce the pressure of migration to cities. There is an opportunity to establish innovation hubs, training programs, and startup incubators in GB to tap into this demographic energy. Notably, the participation of NIC (National Incubation Center) representatives at the roundtable and Accelerate Prosperity's investments in agribusinesses indicate that the groundwork for fostering entrepreneurship in GB's agri sector is being laid.

05 Women's Role and Inclusion

As noted, women contribute extensively to farming in GB (from planting to post-harvest processing). This presents an opportunity to design AgriTech interventions that specifically target and empower women, yielding high social returns. For example, digital advisory services and agri-finance delivered via women's community organizations could dramatically increase women farmers' knowledge and resources. Successful inclusion of women through AgriTech can improve household nutrition and income (since women typically reinvest in family wellbeing) and also double the reach of financial and information services by bringing female farmers into the formal fold. There are emerging examples, like Pakistan's first woman-owned Safina Cold Store in Balochistan, which show that women-led agribusiness is possible and can inspire others. Focusing training and credit programs on women in Gilgit-Baltistan can unlock a significant, underutilized segment of the agricultural workforce, driving broader agri transformation.

06 Support from Government and Partners

There is growing policy recognition that regions like GB need special support to achieve food security and economic uplift. The Government of Pakistan has prioritized agriculture in national strategies (e.g. treating food security as a pillar of national security and climate resilience plans). Specific programs (such as the PSDP projects and possibly CPEC-related investments) are earmarking funds for GB's agriculture and connectivity. Development partners (European Union co-sponsored the GB AgriTech roundtable, IFAD and others fund local projects) are interested in backing innovative approaches in GB. The roundtable concluded with consensus on pursuing a shared vision via adaptive policy and investments. This alignment of stakeholder will is an opportunity to secure the needed public-private partnerships and funding to implement AgriTech initiatives at scale.

Strategic Priorities & Recommendations

Given these opportunities, we outline below the strategic priorities and recommendations to capitalize on them. These priorities form the pillars of an implementation road-map for scaling smart farming in GB. Each priority area addresses specific challenges identified and leverages the opportunities discussed.

01 Improve Infrastructure for Connectivity and Storage

A fundamental step is to strengthen both digital and physical infrastructure to create an enabling environment for AgriTech.

Rural Broadband and Telecom

Extend reliable internet and mobile network coverage to farming communities. Innovative approaches like community-managed networks (as exemplified by the "Digital Dera" model, discussed in detail below) can be used in remote valleys until commercial broadband reaches them. Subsidizing telecom companies or using USF (Universal Service Fund) can accelerate tower installations and fiber optic extensions in GB. The goal is to ensure that every major village or farming cluster has access to at least a basic 3G/4G internet connection, so that digital advisory services, mobile payments, and sensor data transmissions become feasible. Concurrently, providing solar power solutions or mini-grids can supply the electricity needed to run telecom equipment and on-farm devices.

Farm-to-Market Roads and Transport

Building on ETI-GB's work, further investment in rural roads, bridge repair, and all-weather connectivity is critical. Even the best e-marketplace cannot function if produce physically cannot move. Thus, strategic road links from high-production pockets to main highways, and improving transport services (such as reefer trucks or bike couriers for produce) are priorities. The medium-term plan should ensure that each district has at least one viable route to downstream markets, reducing the isolation of farmers. Development partners can co-fund these with the government under climate-resilient infrastructure programs, considering the threat of floods and landslides.

Cold Storage and Processing Facilities

To cut post-harvest losses, GB needs modular cold storage units and food processing centers at key aggregation points. These could be small community-run cold rooms powered by solar, or larger facilities in district towns. Establishing such infrastructure enables farmers to store surplus and time their sales for better prices, rather than being forced to sell immediately at low prices. For instance, a project in Balochistan modernized a cold store to help fruit growers reach year-round markets – similar interventions in GB could allow apple or apricot growers to maintain quality and sell beyond the harvest glut. Public-private partnerships might establish cold stores, with the private

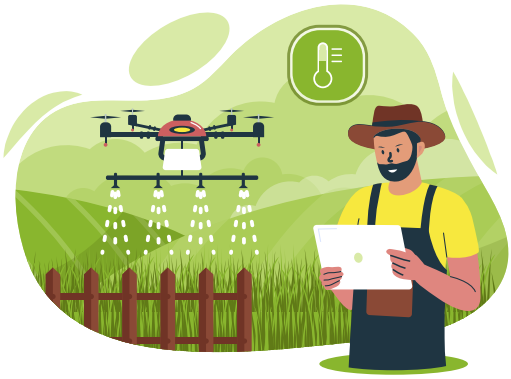
sector operating them sustainably while farmers' cooperatives or local entrepreneurs manage day-to-day usage. Additionally, simple processing (drying, pickling, juicing) units can add value and shelf-life to GB produce; these should be introduced alongside to diversify income sources.

Logistics and Market Access

Beyond infrastructure hardware, GB farmers need integration into value chains. This means setting up collective marketing centers or digital platforms where farmers can pool produce and connect with buyers directly. The use of e-commerce for agriculture (for example, apps where urban consumers or wholesalers can order produce from GB) should be piloted. A B2B produce marketplace like Tazah demonstrates how tech can streamline supply chains: Tazah's platform connects farmers directly with retailers to reduce inefficiencies, lower waste, and ensure farmers get fair compensation. Adapting such a model for GB – perhaps initially for one or two crops (e.g. a cherry or potato marketing app) – could significantly improve market access. This also invites third-party logistics providers to offer services in GB (last-mile delivery, aggregation, etc.), stimulated by matching grants or concessionary financing to lower the risk of entering a remote area.

02 Deploy Smart Farming Technologies & IoT Solutions

With enabling infrastructure coming online, the next strategic priority is the deployment of modern agricultural technologies tailored to GB's context. These technologies can significantly improve on-farm decision making, resource use, and yields.



Precision Agriculture with IoT

Introduce affordable Internet of Things (IoT) devices – such as soil moisture sensors, weather micro-stations, and smart irrigation controllers – to GB farms. IoT sensors can provide real-time data on local conditions (soil humidity, temperature, etc.), enabling farmers to optimize water and fertilizer use. In a pioneering pilot in Sindh, Pakistan, small farmers used IoT soil probes combined with weather data to reduce water usage by 37% and cut fertilizer and pesticide use by 27%, while increasing crop yield by 27%. This "more with less" outcome is exactly what GB's resource-constrained farmers need. Deploying similar climate-resilient precision farming projects in GB (perhaps with support from innovation funds like the GSMA grant used in Sindh) could help farmers adapt to shorter growing seasons and water scarcity. Notably, these systems can be paired with cloud platforms that analyze the sensor data and send simple advisories to farmers (e.g. "Time to irrigate plot A" or "Frost expected tonight, cover your crop"). Ensuring the interface is user-friendly – SMS alerts in local language or automated voice calls for those with basic phones – is crucial so that low-literacy users benefit.

Localized Weather and Climate Advisory

Expand the network of weather stations and leverage satellite data to provide hyper-local weather forecasts and climate advisories for GB farmers. The mountainous microclimates of GB mean conditions vary greatly over short distances. By installing automated weather stations in each valley (possibly in collaboration with Pakistan Meteorological Department and using IoT connectivity), precise forecasts can be generated. Startups can be engaged to develop farmer-oriented forecast apps (for instance, sending an SMS if heavy rain is likely in a specific valley, so farmers can delay harvest). Additionally, climate advisory services (early warning for floods/GLOFs, seasonal outlooks) should be integrated into agri advisory platforms so farmers can make planting choices with knowledge of upcoming conditions. Over time, accumulating local climate data will also aid research and planning (e.g. identifying new crop varieties suitable for shifting climate zones).

Digital Crop Advisory and Pest Management

Leverage mobile phones (feature and smartphones) to deliver agronomic advice and pest/disease alerts. This can be done via services like BaKhabar Kissan (BKK) – a nationwide digital agriculture platform that already reaches millions of Pakistani farmers via a call center, app, and SMS knowledge base. BKK provides weather info, expert advice, and a community forum in local languages, and has a network of 11+ million farmers across Pakistan. Extending such a platform's content to include GB-specific crops and scenarios would give GB farmers instant access to best practices and expert guidance. For instance, a potato farmer in GB could send a picture of a diseased plant through an app and receive a diagnosis and treatment recommendation from an agronomist. Real-time alerts can also be pushed – if there's a locust sighting or an outbreak of fruit fly in a region, all farmers in that district can be warned via SMS to take preventive measures. Digital advisory helps overcome the shortage of on-ground extension agents by virtually connecting farmers to expertise.

Satellite Imagery and Remote Sensing

Employ satellites and drones to gather macro-level data for planning and insurance. High-resolution satellite imagery (as used by Pakistani startup Farmdar) can monitor crop growth over large areas, identify pest infestations or stress early, and even estimate yields. For GB's scattered terraced fields, having a "bird's eye view" through remote sensing can help optimize resource deployment – e.g. determining which valleys might face drought and need water trucking, or mapping which slopes are suitable for expanding cultivation. Drones, where permitted, could be used for targeted tasks like spraying on steep terrain or assessing flood damage to farms quickly. Partnerships with organizations like SUPARCO or private geo-intelligence firms can bring these advanced tools to GB. Furthermore, the data collected can support innovative insurance or credit products (e.g. satellite-based index insurance for crops, or credit scoring based on field health) to improve farmers' financial resilience.

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03 Strengthen Market Linkages and Value Chains

For AgriTech to translate into economic gains, farmers' increased production must reach profitable markets. Thus, a priority is to strengthen the value chains that connect GB farmers with buyers, both within and outside the region.

Digital Marketplaces and E-Commerce

Establish platforms that allow GB farmers (individually or through cooperatives) to sell produce beyond their local area. An online marketplace for GB agricultural products can aggregate supply and advertise it to large buyers (wholesalers, processors, supermarkets) in Pakistan's urban centers. For example, a web/mobile platform could list weekly available quantities of Hunza apricots, Nagar apples, Gilgit potatoes, etc., and enable remote buyers to place orders. Logistics partners would then ship the goods. This reduces the layers of middlemen and ensures farmers get a better share of end prices. The Government and donors can support the development of such platforms, perhaps building on existing ones like National Agri Market or partnering with private startups like Mandi Express. Key to success will be quality assurance (branding GB produce for its organic or mountain-grown qualities) and coordination with cold chain/logistics so that orders are fulfilled reliably. Over time, this can evolve into a virtual farmer's market for GB, accessible on smartphones, bringing transparency and fair pricing.

Farmer Cooperatives and Aggregation

Given most GB farmers are smallholders, organizing them into cooperatives or producer companies is vital for market power and economies of scale. Cooperatives can collectively market produce, run storage facilities, or even negotiate contract farming deals with buyers. Support should be given to form and strengthen such groups in each valley or crop cluster. These bodies can also be the focal points for training and for interfacing with AgriTech firms (for example, a cooperative can contract an AgriTech company to set up a shared packhouse with sensor-monitored storage). Collective action will help farmers meet the volume and consistency requirements of bigger markets, and improve their bargaining position. Policies that provide legal recognition, seed grants, or tax incentives for farmer producer organizations in GB could encourage their formation. Additionally, linking these cooperatives with microfinance and banks will help them invest in local value-addition (e.g. packaging equipment, local processing).

Cold Chain and Transport Solutions

This ties closely with infrastructure, but with a specific market focus: developing third-party logistics services specialized for GB's agriculture. Encouraging private logistics companies to operate refrigerated trucks or vans on the GB-Islamabad route (possibly through viability gap funding initially) would solve a major bottleneck. Innovative ideas like portable cool boxes or pack-and-ship centers where farmers drop produce that then gets collectively transported can also help. As an example, affordable cold chain logistics services were highlighted as a needed solution in the roundtable. Partnering with existing courier companies or startups to pilot "Farm to Market" delivery from GB (with produce maintained in cold storage during transit) would directly address the spoilage and quality deterioration that currently occurs. It's worth noting that investing in cold chains has proven returns: by upgrading storage and handling, Safina Cold Store in Balochistan enabled local farmers to reach wider markets with fruits that retain freshness and command higher prices, boosting profits. GB can replicate such successes for its high-value crops.

Value Addition and Agri-Processing

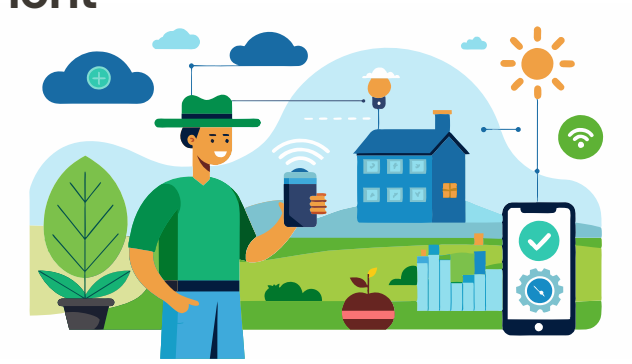
Transporting raw produce out of GB is one model, but another opportunity is to bring processing industries into GB to create finished products, which reduces the volume to transport and increases value retained locally. For example, setting up small plants to produce dried fruits, jams, juices, or walnut oil can turn perishable crops into longer-lasting, branded products. AgriTech can assist here by providing food processing technology suited for cottage industries – e.g. solar dehydrators (with IoT thermostats to ensure consistent drying), small-scale fruit pulp extractors, vacuum sealing machines for packaging, etc. There is potential for public-private ventures where private companies invest in processing units in GB (at source) and train local people to operate them, while the government provides incentives like infrastructure support. Additionally, linking GB's clean, green image with organic or high-quality product certification can fetch premium prices. Projects to help farmers get organic certification or develop Geographic Indications (GI) for "Hunza Apricots" or "Gilgit Chilies" could differentiate GB products in the market.

Market Information and Price Transparency

Farmers often suffer from lack of information on prevailing prices beyond their village. Digital solutions can fix this by sharing daily market rates (for key commodities in regional markets) via SMS or local radio. Knowing that potatoes are selling for X rupees per kilo in downstream markets, a farmer cooperative can negotiate better with traders. AgriTech platforms can integrate such features easily. In fact, P@SHA's report emphasizes using simple SMS alerts for market prices as an impactful tool since many farmers still rely on basic phones. This also builds farmers' confidence in engaging with markets directly, as it breaks information asymmetry.

04 Enhance Skills, Digital Literacy & Community Engagement

For any technological initiative to succeed at scale, the human element is paramount. In GB, raising awareness, improving skills, and building trust in AgriTech among the farming community is a strategic priority.



Farmer Training and Demonstration Projects

In the short term, launch awareness campaigns and on-farm demonstration pilots across GB. These should showcase the tangible benefits of AgriTech to skeptical farmers. For instance, a demonstration plot in each district could implement a suite of interventions (sensors, improved seeds, advisory services) and compare results with traditional practices – letting local farmers witness yield improvements or cost savings firsthand. Field days and farmer festivals can be organized where these results are shared, and farmers are invited to interact with new tools (e.g. trying out a smartphone app with guidance). This hands-on exposure is critical to break the initial inertia. Government agriculture extension departments, along with NGOs like AKRSP, can lead these efforts, given their community relationships. Accelerate Prosperity and other partners who have invested in GB agribusiness could sponsor some pilots, aligning with their mission to support entrepreneurial solutions.

Digital Literacy and ICT Training

To bridge the digital divide, incorporate basic digital skills training into agricultural extension programs. For example, teaching farmers (and their family members) how to use a smartphone, how to look up weather forecasts, or use WhatsApp to seek advice on crops. Community centers, schools, or libraries in GB can host regular training sessions where younger, tech-savvy individuals coach older farmers on phone use. We should particularly encourage youth and women participation – training young people as "village digital agri-experts" who can assist others. The Digital Dera project in Punjab offers a model: it sets up a community center with internet where farmers receive guidance in local language and training on new tech and e-commerce. GB can establish similar "digital hubs" or telecenters in

each valley, possibly leveraging existing schools or local government offices, where farmers can come for internet access, educational videos (in Shina/Burushaski/Balti languages as needed), and meet extension staff or tech company reps on scheduled days. Over time, improving digital literacy will make farmers more independent in using apps and online resources, reducing their reliance on in-person help.

Local Champion Programs

Identify and support local champions – progressive farmers or community leaders who are early adopters of AgriTech – to serve as evangelists. If one respected farmer in a village successfully uses an IoT-based advisory service and boosts his income, neighbors are far more likely to follow. Thus, programs should include incentives for lead farmers (e.g. giving a few farmers free sensor kits or solar pumps in return for them sharing their experience widely). Similarly, youth interns or recent agriculture graduates from GB can be deployed in their communities as extension interns, combining traditional knowledge with new tech training. These champions and interns can troubleshoot technology on the ground and gather feedback to improve services. Engaging religious or social leaders to endorse beneficial innovations (for instance, a local imam speaking about the importance of seeking knowledge and new farming methods) can also help overcome cultural resistance.

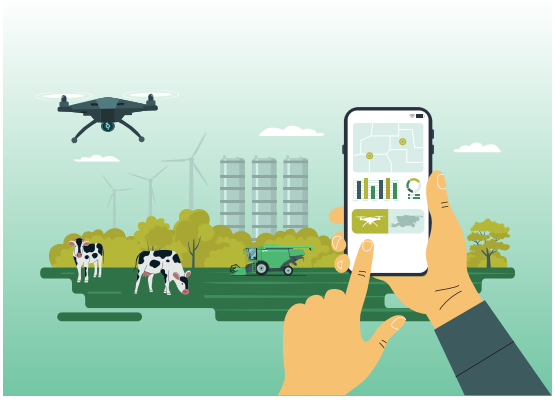
Culturally Appropriate Content and Language

Ensure that all digital content, user interfaces, and support services are provided in languages/dialects spoken in GB, and consider oral/visual content for low-literate users. Voice-based services – like an IVR (interactive voice response) system that farmers can call to hear the daily advisory in their language – could greatly increase inclusivity. Agritech providers should recruit or partner with locals in GB who can translate and contextualize advisories (for example, pest alerts should reference local crop varieties and traditional pest names). The P@SHA report noted that voice and SMS in local languages are key to reaching basic phone users; this is especially true in GB where literacy rates and Urdu proficiency are lower in rural areas. Hence, an investment in developing localized knowledge libraries (possibly by digitizing the knowledge of seasoned GB farmers with help from experts) is very useful. Radio can also be leveraged – a weekly "Smart Farming Hour" on GB radio in local language could disseminate tips and success stories, further blending traditional communication with new ideas.

Empowering Women and Youth

Make special efforts to involve women in training and technology adoption. For example, set up women-only training sessions led by female agronomists or social mobilizers, focusing on areas like kitchen gardening with drip irrigation, poultry or dairy management apps, etc. Provide smartphones to women farmers or set up shared devices in women's community centers so they can access advisory information directly. Encourage formation of women's producer groups who can collectively engage with AgriTech solutions (like a group of women apricot dryers using a solar dryer system and marketing online). Similarly, harness the enthusiasm of youth: include agricultural entrepreneurship modules in local colleges, run hackathons or innovation challenges in GB on solving local agri-problems (with winners supported to implement their ideas). When local youth and women become active contributors and beneficiaries in AgriTech projects, the sustainability of these initiatives increases manifold, and community buy-in solidifies.

05 Policy Reform, Enabling Environment and Investment



An enabling policy environment and proactive support from government and development partners are critical to scale AgriTech in GB. The following strategic measures are needed:

Financing Mechanisms for Sustainability

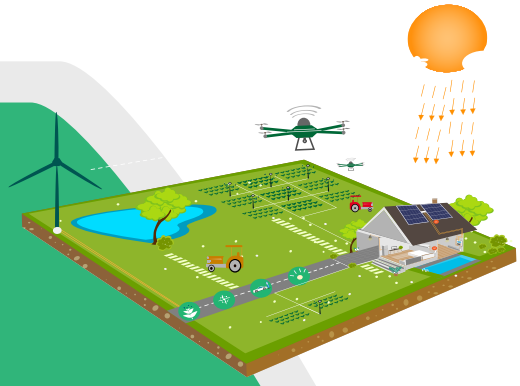
Scaling and sustaining AgriTech will require innovative financing beyond one-off grants. The medium-term plan should establish blended financing vehicles – combining donor funds, government money, and private capital – to support agribusiness and agri-tech in GB. For example, a blended fund could provide partial risk guarantees to banks to encourage them to lend to GB farmer cooperatives for equipment purchase, or provide venture capital to AgriTech startups expanding to GB, de-risked by donor contributions. In the long run, outcome-based financing models could be adopted: investors (public or private) fund interventions and are repaid based on outcomes like yield increases or income gains for farmers. Such models ensure accountability and attract impact investment. Additionally, engaging microfinance institutions and development finance institutions (DFIs) to open operations in GB will fill the finance gap for farmers – perhaps linked with digital credit scores derived from platform data (like Farmdar's approach of using AI to assess farm credit risk). Crop insurance schemes – possibly supported by the government initially – should also be introduced to provide a safety net, as insured farmers are more confident to try new methods.

Incubation and Research in GB

To embed innovation locally, establishing an AgriTech incubator/accelerator in Gilgit-Baltistan is a strategic long-term move. This could be a branch of an existing NIC or a new center, but located in GB (for instance, in Gilgit or Skardu) to nurture startups that solve mountain agriculture problems. The incubator can provide mentorship, labs, and links to investors, as well as act as a hub connecting GB farmers with national tech talent. Additionally, strengthening local research institutions (such as the Karakoram International University's agriculture department or the agriculture research stations in GB) to work on local adaptive research is crucial. Areas like high-altitude agronomy, pest control in cold climates, and water-efficient techniques should be researched in GB, ideally in collaboration with international experts. Embedding climate-smart agriculture priorities into regional development frameworks ensures that government planning consistently budgets for and integrates these new practices.

> It bears emphasizing that coordination among all relevant stakeholders is the key: for example, a government incentive is only effective if private companies respond to it; a training program only works if farmers attend and practice the learnings; financing only helps if entrepreneurs step up to utilize it. Therefore, a recurring recommendation is to maintain collaborative forums and communication channels among all actors (possibly via the proposed GB AgriTech Task Force or periodic summits). The spirit of partnership and co-ownership that was evident in the May 2025 roundtable must continue through implementation.

Case Studies
and Examples



To illustrate how these strategies can work in practice, we highlight a few pertinent examples and case studies from Pakistan's AgriTech and IT ecosystem. These cases offer insights and lessons that can inform implementation in Gilgit-Baltistan.

BaKhabar Kissan (BKK): Scalable Digital Advisory

BaKhabar Kissan is one of Pakistan's largest AgriTech platforms, providing a centralized hub for weather forecasts, pest alerts, expert agronomic advice, and input e-commerce. Its services are delivered via mobile app, SMS, and IVR in local languages, reaching over 11 million farmers nationwide. Designed for inclusivity, BKK is accessible to both smartphone and feature phone users. A GB-focused extension of BKK, customized for high-altitude crops like cherries, potatoes, and off-season vegetables, could offer tailored advice to thousands of farmers. P@SHA and local stakeholders could collaborate with BKK to create a dedicated GB AgriTech portal. The platform's multi-language capability and mobile-friendly design make it ideal for regions with low digital literacy and uneven internet access.

Farmdar: AI and Satellite Monitoring for Precision Agriculture

Farmdar leverages AI and multispectral satellite imagery to monitor crop health, assess soil conditions, and predict yields. The data enables early detection of pest outbreaks, water stress, or nutrient deficiencies allowing timely, data-driven interventions. By late 2024, Farmdar had mapped over 120,000 farms across Pakistan and partnered with major firms like FFC and Bayer. In GB's mountainous terrain, where physical field visits are challenging, Farmdar's remote sensing tools can provide critical crop intelligence. Seasonal crop health reports could be shared with local extension services, enabling valley-specific interventions. Additionally, satellite data can support innovative credit and insurance schemes based on farm performance, addressing financing gaps for GB's smallholders.

Crop2X: IoT-Based Climate-Smart Farming for Smallholders

Crop2X piloted Pakistan's first IoT-enabled smart farming project for smallholders in Sindh. By deploying soil and weather sensors, the system offered real-time, localized agronomic guidance. Participating farmers cut water usage and seed rates by half, reduced input costs by about 30%, and increased cotton yields by 27%. The project used multilingual mobile apps, SMS, and calls to communicate with farmers and was funded through a climate resilience grant (GSMA). This model is highly replicable in GB, particularly for climate-sensitive crops like potatoes, wheat, and fruits. Similar pilots could be supported through climate adaptation funds or donor grants, while training programs can adapt Crop2X's multi-channel communication approach to local dialects and literacy levels. The project also shows that older farmers can adopt tech when clear benefits are demonstrated.

Tazah: Tech-Enabled Market Linkages and Logistics

Tazah developed a B2B digital marketplace that directly connected farmers with retailers, streamlining the supply chain and reducing post-harvest losses. While Tazah has since pivoted, its initial platform helped farmers secure better prices and improve delivery efficiency. The model included logistics coordination and embedded financial services such as advance payments. A GB-specific digital marketplace could help fruit and vegetable farmers market their products beyond local intermediaries. For example, a seasonal e-platform for cherry or apricot sales could connect GB cooperatives with urban buyers. The key lesson from Tazah is that digital sales platforms must be supported by logistics and working capital to be effective, suggesting a bundled service model for GB.

Digital Dera: Community-Led Digital Literacy and Access

The Digital Dera initiative in Punjab established community internet centers with free access to online agricultural resources. It trained local youth as "Network Champions" who supported farmers in using the internet for extension advice, market prices, and e-commerce. This model addressed both connectivity and human capacity challenges simultaneously. Replicating this model in GB through "Digital Dera" centers, especially in digitally excluded districts like Ghanche or Astore could bridge the digital divide. These hubs could serve as training, advisory, and access points for farmers, women's groups, and youth. They could also function as decentralized nodes for AgriTech service deployment and support, amplifying digital inclusion in agriculture.

These cases, among others, demonstrate that the components of success are already visible in Pakistan's landscape: digital advisory platforms, precision farming pilots, supply chain innovations, and community connectivity projects. The task ahead for Gilgit-Baltistan is to integrate and localize these proven solutions, scaling them up in a coordinated way that addresses GB's unique challenges. Drawing on these examples, stakeholders in Gilgit-Baltistan can accelerate the region's AgriTech transition and set new benchmarks for mountain agriculture globally.

Conclusion

Gilgit-Baltistan stands at the threshold of an agricultural transformation. Through the strategic adoption of AgriTech and smart farming practices, the region can convert its geographic isolation, limited arable land, and climatic challenges into a competitive advantage producing high-value crops, reducing post-harvest losses, and integrating smallholder farmers into national and international markets. This white paper outlines a practical roadmap to achieve that vision, emphasizing inclusive innovation, targeted infrastructure development, improved market access, and the empowerment of local communities. Crucially, the success of this transformation depends on visionary policymaking, sustained investment, and strong multi-stakeholder collaboration spanning government, private sector, academia, and development partners. Inclusivity must be central: ensuring that women farmers, youth, and digitally disconnected communities are not only included but positioned as drivers of change. By focusing on digital literacy, cooperative models, and culturally relevant service delivery, GB can build a tech-enabled agricultural ecosystem that uplifts all. With the right policy push, localized solutions, and community ownership, Gilgit-Baltistan can emerge as a national exemplar of climate-smart, knowledge-intensive farming where tradition meets innovation, and where the region's natural potential is matched by its human resilience. The time to act is now to convert collective resolve into measurable impact, and to ensure that the high peaks of GB also mark the summit of sustainable agricultural progress in Pakistan.

Annex A

List of Participants

Sr. No	Name	Designation	Organization
1.	Kashif Hussain (Moderator)	Policy & Research Lead	P@SHA
2.	Zain Tariq (co-moderator)	Industry Engagement Manager	P@SHA
3.	Ayaz Khan	Manager Investment	Accelerate Prosperity
4.	Muhammad Zaman	Program Manager Agriculture & Food Security and Climate Resilience.	AKRSP
5.	Javed Iqbal	Director Agriculture Research	ETI-GB
6.	Aiza Imran	Sr. Brand and Sustainability Specialist	Khaity Technologies
7.	Khadija Javed	Salesperson	Islamabad Farmers Market
8.	Shahid Karim	Lead Farming and Farms	Apex and Co.
9.	Zeeshan Shahid	Project Director	NIC Faisalabad
10.	Saleem Khan	Founder	Chitrali Natural Blends
12.	Umar Farooq	CEO	AARUN Enterprises Private Limited
13.	Asim Ishaq	Project Director	NIC Peshawar
14.	Tabasum Karim	Founder	Hunza Farmers
15.	Amna Masood	CEO	Maven Logix

Annex B

Hypothetical Income Gains from Value Addition in GB's High-Value Fruit Farms

Fruit Type	Value Addition	Baseline Income per farm	Projected Income per farm	% Increase
Cherries	Cold chain + export	PKR 750,000	PKR 1,500,000	100%
Apricots	Solar drying + packaging	PKR 400,000	PKR 800,000	100%
Apples	Grading + crate sales	PKR 480,000	PKR 720,000	50%
Pears	Juice processing	PKR 147,000	PKR 262,500	78%

P@SHA

Pakistan IT Industry Association

Daftarkhwan Alpha, Old Airport Rd,
Chaklala Cantt, Rawalpindi, Punjab, Pakistan

+92-51-8736624 | +92-51-8736625

policy@pasha.org.pk

https://www.pasha.org.pk