

GSMA



CASE STUDY



PAKISTAN

Leveraging digital technology for climate-smart farming in Pakistan

The GSMA Innovation Fund for Climate Resilience and Adaptation

The GSMA Innovation Fund grant for BaKhabar Kissan (BKK) has assisted farmers across Pakistan with access to localised weather information and agricultural advisory services.

Country: Pakistan

Sector: Agriculture

Business model: B2C

Resilience capacity: Climate adaptation, climate preparedness and planning

Digital channels: Mobile app, IVR

Problem addressed: Providing farmers in Pakistan with access to localised weather information and inclusive agricultural advisory services.

Stakeholders: Smallholder farmers, agricultural experts

Find out more: bkk.ag

BKK PROJECT OUTCOMES NOVEMBER 2022 TO APRIL 2024



25.8m

people reached



6.4m

farmers supported to adapt to and anticipate climate change shocks



91%

gained better access to localised weather information



155

new automated weather stations deployed



84%

say their knowledge has improved on topics like crop selection, soil health and plant disease

About BKK

BaKhabar Kissan (BKK) is one of Pakistan's leading agricultural start-ups, with a mission to empower farmers and revolutionise the farming sector through digital technology. BKK provides data-driven agricultural advisory, access to financial services and marketplace solutions to connect farmers with agribusinesses and customers alike. Their inclusive approach features a call centre staffed by agronomists, text and voice messaging services for weather alerts and actionable insights, alongside a mobile app offering hyperlocal weather information, crop management learning content, satellite imagery and crop photo analysis services. Available in multiple languages, BKK's platform supports farmers across Pakistan affected by climate change.



Introduction

Impacts of climate change on farmers in Pakistan

In Pakistan, climate change is driving more frequent and intense heatwaves, irregular rainfall patterns, flooding and prolonged droughts. Consistently ranked as one of the world's most vulnerable countries to the impacts of climate change, in 2022 devastating floods affected 33 million people and caused \$30 billion in damage.¹ As recently as 2024, intense heatwaves saw temperatures soar above a record high of 52° Celsius in Sindh province.² With high demand from an increasing population and agriculturally reliant economy, combined with poor water management practices across the country, water scarcity is also at a critical level.

These phenomena have a severe impact on the agricultural sector, which employs 36% of the country's workforce³ and accounts for 24% of gross domestic product (GDP).⁴ Smallholder farmers – the backbone of agriculture in Pakistan – are particularly vulnerable as they depend on predictable weather patterns for their crops and livestock. Extreme weather events destroy harvests, reduce soil fertility and deplete water resources, exacerbating food insecurity and rural poverty. Rising temperatures also threaten key crops like wheat and rice, critical for both local consumption and export.

Although Pakistan has developed national adaptation strategies and a national climate change policy,⁵ low literacy levels and limited access to climate-resilient practices, real-time data and technical support hamper the ability of farmers to adapt. Addressing these challenges is crucial to safeguarding Pakistan's agricultural economy and the livelihoods of millions of rural families.

1. World Bank. (2022). "Pakistan: Flood damages and economic losses over USD 30 billion and reconstruction needs over USD 16 billion - New assessment over USD 30 billion and reconstruction needs over USD 16 billion - New assessment". Press release.
 2. Soomro, A. and Shahid, A. (29 May 2024). "Pakistan temperatures cross 52 C in heatwave". Reuters.
 3. World Bank. (2022). "Employment in agriculture (% of total employment - modelled ILO estimate) - Pakistan".
 4. Pakistan Bureau of Statistics. (2023). Agriculture Statistics.
 5. Ministry of Climate Change - Government of Pakistan. (2021). National Climate Change Policy.



BKK is a passion-filled entity, made up of a team who is dedicated to empowering the farming community. We believe in the power of effective collaboration which is why we are delighted to partner with GSMA. Through our aligned vision, we are seeking to mutually integrate farmers in the agri ecosystem, enabling digital literacy, smart farming advisory, aiding financial inclusion and ultimately digitising the agri value chain - making it the perfect partnership.

Khizer Alam Khan, Co-founder and CEO

About the GSMA Innovation Fund project

BKK is one of the start-ups supported by the GSMA Innovation Fund for Climate Resilience and Adaptation, which was launched in 2022. This initiative is funded by the UK Foreign, Commonwealth & Development Office (FCDO), the Swedish International Development Cooperation Agency (Sida) and is supported by the GSMA and its members.

The project spanned 18 months from November 2022 to April 2024. With the support of the Innovation Fund, BKK developed an automatic speech recognition function to improve farmer access to advisory services and created a risk management system to aid in the detection of disease and pest-prone plants. The grant funding was also used to upgrade their service with new digital learning content on climate-smart farming practices and to enhance their weather service by deploying and integrating weather data from 155 new automated weather stations.

How does the solution work?

The BKK solution provides weather and agricultural advisory services through multiple channels to cater to the diverse needs of farmers. These channels include mobile apps, interactive voice response (IVR), SMS/WhatsApp and a call centre.

By offering these services across multiple platforms, BKK ensures farmers can access critical agricultural insights tailored to their needs through preferred communication channels.

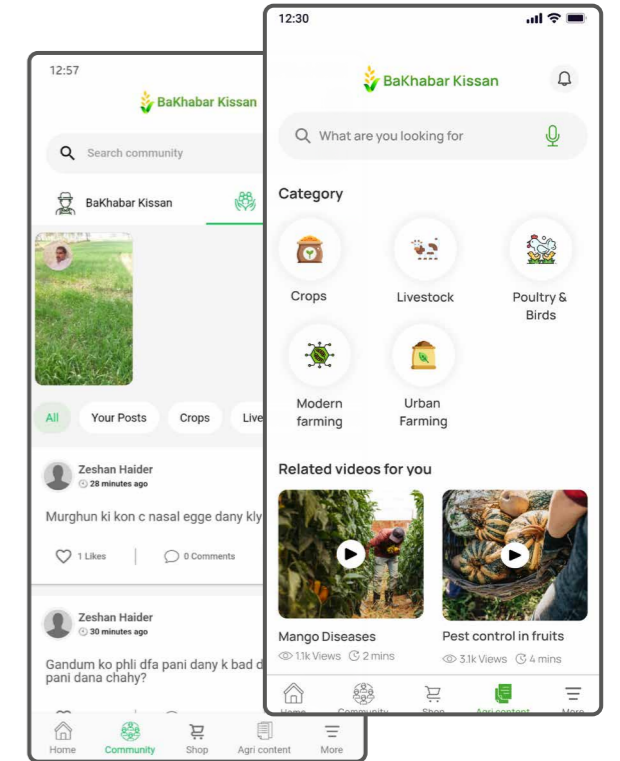
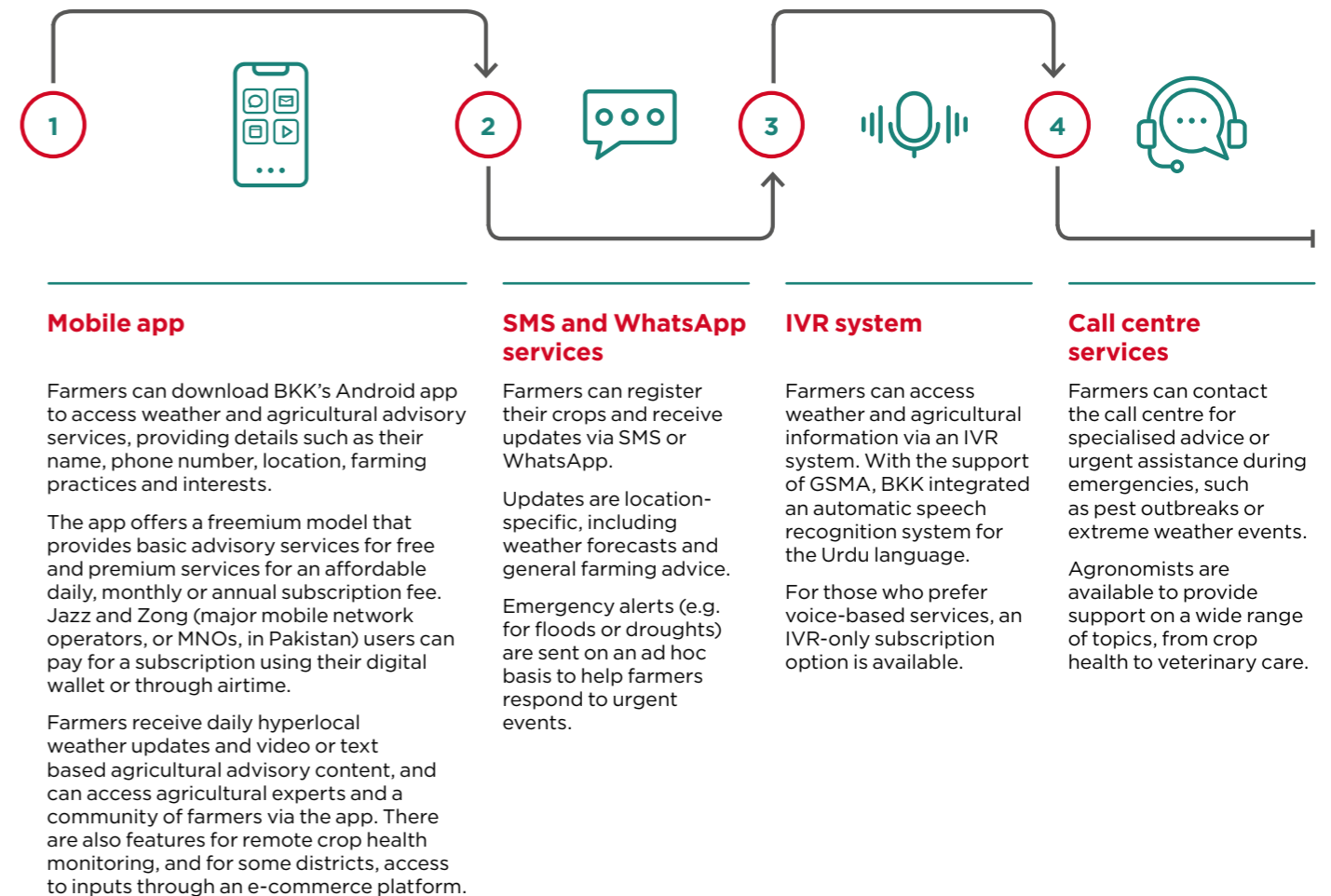
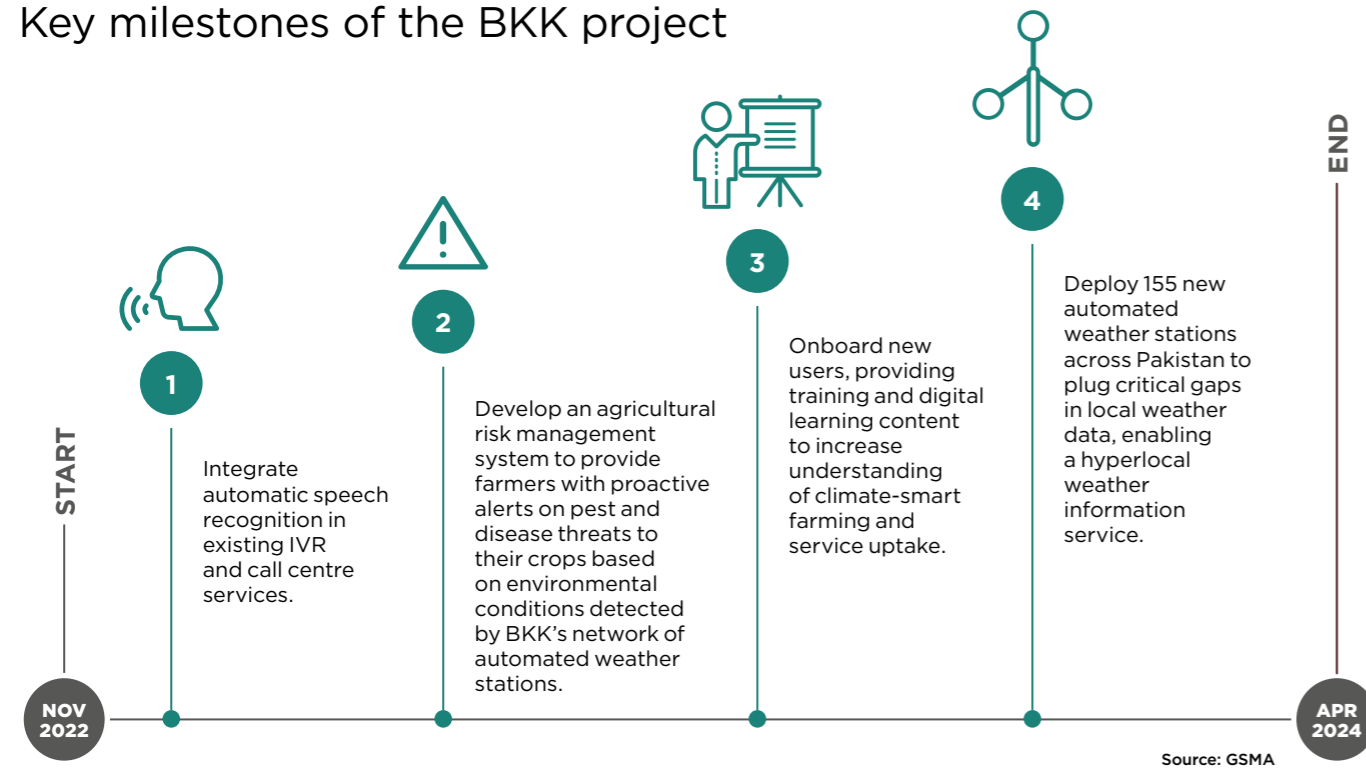


Figure 1
Using BKK's services



Key project activities

Figure 2
Key milestones of the BKK project



Source: GSMA

Enhancing IVR and call centre services with automatic speech recognition

BKK developed and piloted an automatic speech recognition system for the Urdu language to improve their IVR and call centre services. The system has been successfully deployed in three districts of the Punjab region. However, scaling to other areas, such as Khyber Pakhtunkhwa (KPK), has presented challenges due to Pakistan's diverse languages and dialects.

Lesson 1

Developing an automatic speech recognition system for a linguistically diverse country like Pakistan requires significant investment

With more than 77 languages spoken across the country, creating an automatic speech recognition system in Pakistan demands careful planning and substantial resources. BKK has learned through experience the importance of thoughtful product design, robust sample collection and extensive dataset preparation. Early investment in comprehensive data collection and anticipation of challenges were identified as critical to success.

BKK is taking time to learn from the pilot and to address these limitations before pursuing a scale-up of the service. They are focusing on expanding data collection to include a wider range of local languages and dialects, which will enable more comprehensive speech recognition capabilities that allow seamless interactions with a variety of customers who do not speak Urdu, or speak Urdu with distinct local dialects.

Developing an agricultural risk management system

To help farmers reduce yield losses and enhance productivity, BKK developed an advanced alert system that notifies farmers of potential pest and disease outbreaks. Using environmental triggers, the system integrates with BKK's mobile app to deliver real-time advisory via push notifications. Currently undergoing validation, the system's algorithm is being refined for greater accuracy.

BKK aligned technical and agricultural requirements by consulting with a business analyst, holding regular feedback sessions and fostering strategic partnerships with academia and industry to support validation and improve system reliability.

Lesson 2

Collaboration between technical and agricultural experts is key to successful product development

Bridging the knowledge gap between agricultural experts and the technical team was essential. The lack of reliable data on different crop varieties or local research on environmental factors affecting pests and diseases underscored the importance of academic collaboration. BKK's partnerships with both academic and industry stakeholders proved critical for system validation, as they provided the expertise and resources needed to improve the reliability and effectiveness of the risk management system.

Training female farmers

In rural Pakistan, farming is often viewed as a male profession with the role that women play in agriculture seen as supporting. Few women own or manage farms, yet many take on unpaid agricultural tasks alongside household responsibilities. BKK organised training workshops to empower women in Pakistan's agricultural sector. Aimed at rural female farmers, homemakers and female agriculture students, the workshops addressed topics such as climate change, food security, strengthening and diversifying livelihoods and capacity building.

Lesson 3 Building trust at the community level increased female farmers' engagement in training

Adapting training materials to accommodate different literacy levels was crucial in ensuring that the learning was accessible and effective for all users. Customised content improved participants' comprehension and retention of key information. Engaging local leaders and fostering community connections through an onsite BKK agent or agronomist also proved essential in building trust and encouraging greater participation among women.

BKK's approach to building community trust and engagement is rooted in its unique 'phygital' model of operations. BKK leverages geographic location data to engage farmers through a variety of channels, including SMS, IVR, mobile app, social media, call centre, in-person community contact, and physical shops.

Lesson 4 Community engagement and empowerment can help ensure physical assets are well maintained

Physical assets in remote areas are vulnerable to risks such as theft, equipment damage and connectivity issues, all of which can reduce their longevity and effectiveness. To address these challenges, BKK actively involved host communities and weather enthusiasts in the maintenance of weather stations.

This participatory approach fostered a strong sense of local ownership, ensuring better care of the equipment and resilience to these risks. By empowering stakeholders, the project was more sustainable and successful over the long term.

Deploying automated weather stations

To address the lack of reliable weather information in Pakistan, particularly in rural areas, BKK procured and installed 155 automated weather stations across the country to enhance the quality of weather data and improve farmers' access to real-time, hyperlocal weather updates. Despite economic challenges such as currency devaluation and import restrictions, BKK adapted by working closely with suppliers.

Expanding the weather station network and developing a localised weather model tailored to Pakistan's geography were crucial for robust forecasting. The extensive weather station network boosted the accuracy of weather forecasting, overcoming challenges such as limited coverage and real-time updates. In future, the use of artificial intelligence (AI) in data analysis may enhance the predictive capabilities of the forecasts.

Building climate resilience

Overall impact

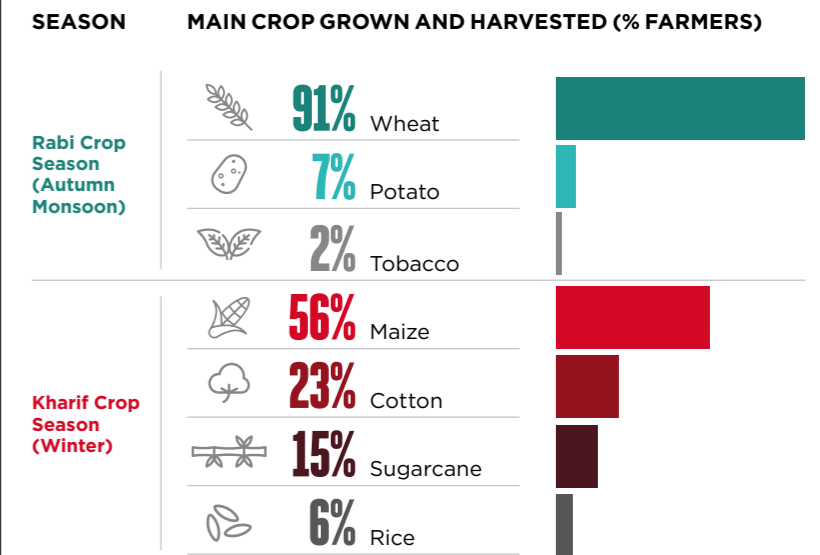
BKK supported Pakistan's farming communities in building resilience to climate change. By providing accessible, climate-smart agricultural advisory services, the start-up improved the capacity of farmers to adapt to changing climate conditions. Additionally, hyperlocal weather information - enhanced by the deployment of a network of new weather stations - improved their ability to anticipate climate shocks and stressors. Interviews with BKK's operations team and a sample of BKK users revealed the following achievements during the grant period:

- Approximately 6,457,000 farmers received support to adapt to climate change through SMS, IVR and call centre services
- Automatic speech recognition was piloted in Urdu, improving inclusive access to agricultural advisory
- 40,162 farmers were supported in adapting to climate change through the BKK mobile app
- 155 new automated weather stations were deployed and integrated with the BKK weather forecasting service
- The average percentage of error in quarterly rainfall forecasts fell to 3%

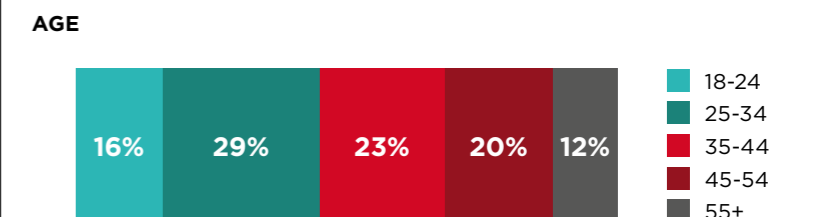
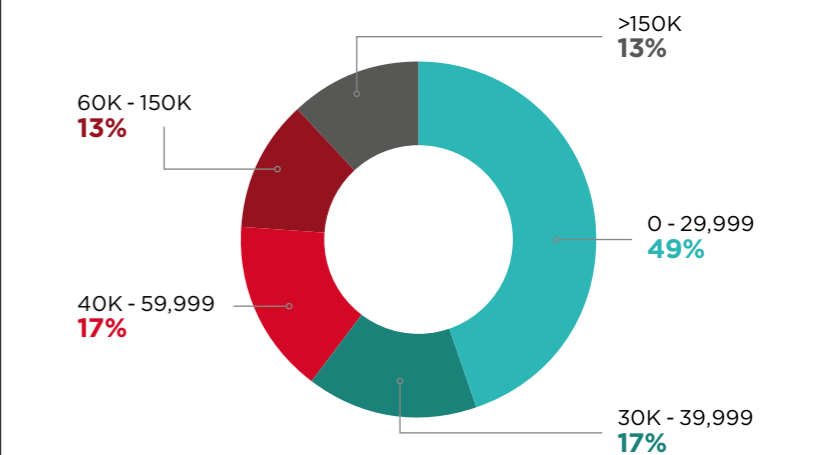
BKK user profile

A typical user of BKK services is a male smallholder farmer who is approximately 37 years old, most likely to cultivate wheat and have a personal monthly income of less than PKR 61,000 (\$220).

Figure 3
BKK user statistics



Average Monthly Income (PKR)



Most farmers report changing weather patterns, particularly in Punjab

The GSMA's research found that 90% of farmers said they had noticed changes in weather patterns and extreme weather events over the past five years, and 67% said they had personally felt the impacts of climate change on their daily lives. However, farmers in the Punjab region, the agricultural heartland of Pakistan which suffers from extreme heat, unpredictable rainfall patterns and water insecurity, were more likely to have witnessed the impacts of climate change. In Punjab, 97% of farmers noticed changing weather patterns and 79% felt they had been directly affected.

Outcome 1: BKK helps farmers anticipate climate shocks and stressors

Hyperlocal weather information can improve farmers' resilience to climate change by enabling them to anticipate and prepare for extreme weather events, such as droughts, floods or storms. With timely access to accurate weather forecasts, farmers can adjust their planting schedules, irrigation practices and crop management techniques to mitigate potential damages and losses caused by adverse weather conditions. Weather information can also help with decision-making about appropriate crop varieties to grow and the implementation of climate-smart agricultural practices.

Some BKK users were surveyed to explore whether the weather information service was helping them anticipate climate shocks and stressors. The following results were found (see also Figure 5).

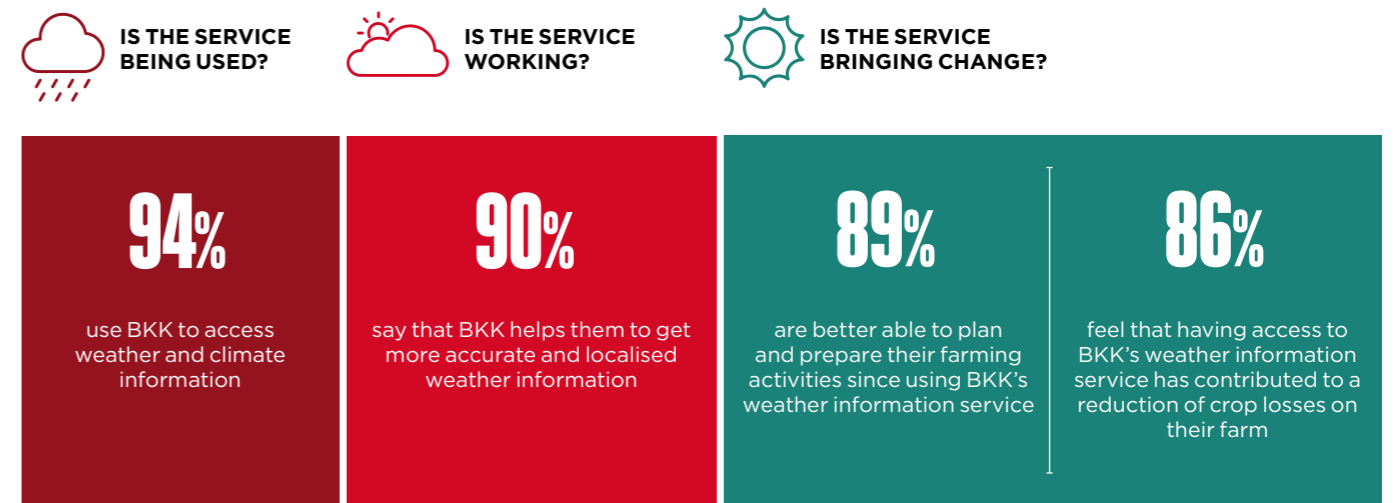
There were some notable regional differences in the overall positive feedback. Although farmers in both Punjab and KPK found the weather information service effective in areas such as forecast accuracy, predicting major weather events and supporting farming decisions, some farmers in KPK found the service exceptionally effective and, therefore, had a higher satisfaction level.

Lesson 5 Hyperlocal weather information proved effective in helping farmers plan and prepare

The BKK weather information service significantly improved the ability of farmers to anticipate climate shocks. BKK's app, SMS, IVR and call centre services were the most popular sources of weather information among farmers, with 94% saying they used BKK in comparison to other more conventional methods such as the internet (41%) or television and radio (36%). 90% of users reported better access to localised weather information and being able to better anticipate major weather events, while 87% believed that BKK forecasts were either accurate or highly accurate. These findings indicate the app is effective in providing relevant data for farmers to prepare and plan.

Figure 4

Change in capacity to anticipate climate shocks



Outcome 2: BKK helps farmers adapt their farming practices to a changing climate

Climate-smart agricultural advisory services can benefit farmers in Pakistan by providing them with guidance on sustainable farming practices tailored to local climate conditions and challenges. This includes advice on crop rotation and pest and disease management. Some BKK users were surveyed to explore whether the climate-smart agricultural advisory service was helping them adapt to climate change. The results are shown in Figure 6.

Their support is invaluable in terms of agricultural advisory services. They've really helped us improve our crop yields, even after sowing the same old crops year after year. BKK's support is like having a trusted partner in agriculture.

Male farmer.

Figure 5

Change in capacity to adapt to climate change



6. Food and Agriculture Organization of the United Nations (FAO). (2017). *Climate-Smart Agriculture Sourcebook: Summary*. Second Edition.

What's next?

Strengthening commercial viability

During the grant period, BKK saw their number of paid customers go down. This was due to several factors, including increased prices linked to higher operational costs. Despite this, BKK's weather and agricultural advisory service experienced substantial growth, reaching 34,000 new monthly subscribers. Close to a third of BKK's total user base has actively used the service in the past 30 days. The start-up has rapidly grown to more than 12 million users, with 6.4 million new users onboarded during the grant period. This was following BKK's strategic investment in a community engagement and promotional campaign for the improved weather station network and forecast accuracy. Strategic partnerships with MNOs and data-sharing agreements also extended BKK's reach into rural areas despite political and economic hurdles.

Revenue streams were bolstered by subscription fees and commissions from agricultural input sales. Strategic pricing adjustments successfully mitigated local inflationary pressures, maintaining steady revenue and broadening the customer base. Additionally, BKK piloted direct engagement with farmers

Lesson 6 BKK scaled rapidly with the support of MNO partners, including in rural areas

BKK's ongoing partnerships with two MNOs – Jazz and Zong (China Mobile) – played a significant role in BKK being able to scale up quickly during the grant period. The GSMA project, and BKK's automatic speech recognition technology in particular, sparked the interest of MNOs, with BKK securing a partnership with Zong that allowed them to market their digital services to Zong's large rural user base.

for agricultural input distribution, streamlining access to essential supplies. Revenue generation has also improved the sustainability of the start-up, with the weather advisory service becoming profitable and the agricultural input service breaking even. Partnerships, including the one with the GSMA, have helped BKK unlock new opportunities.

The introduction of features like the agricultural risk management system diversified offerings, driving revenue growth and helping the service to be profitable. Product enhancements, including pest advisory services for additional crops and doorstep delivery of agricultural inputs, strengthened customer value, engagement and retention.

Lesson 7

In addition to the typical barriers to scale for start-ups, BKK faces unique political and economic challenges in Pakistan

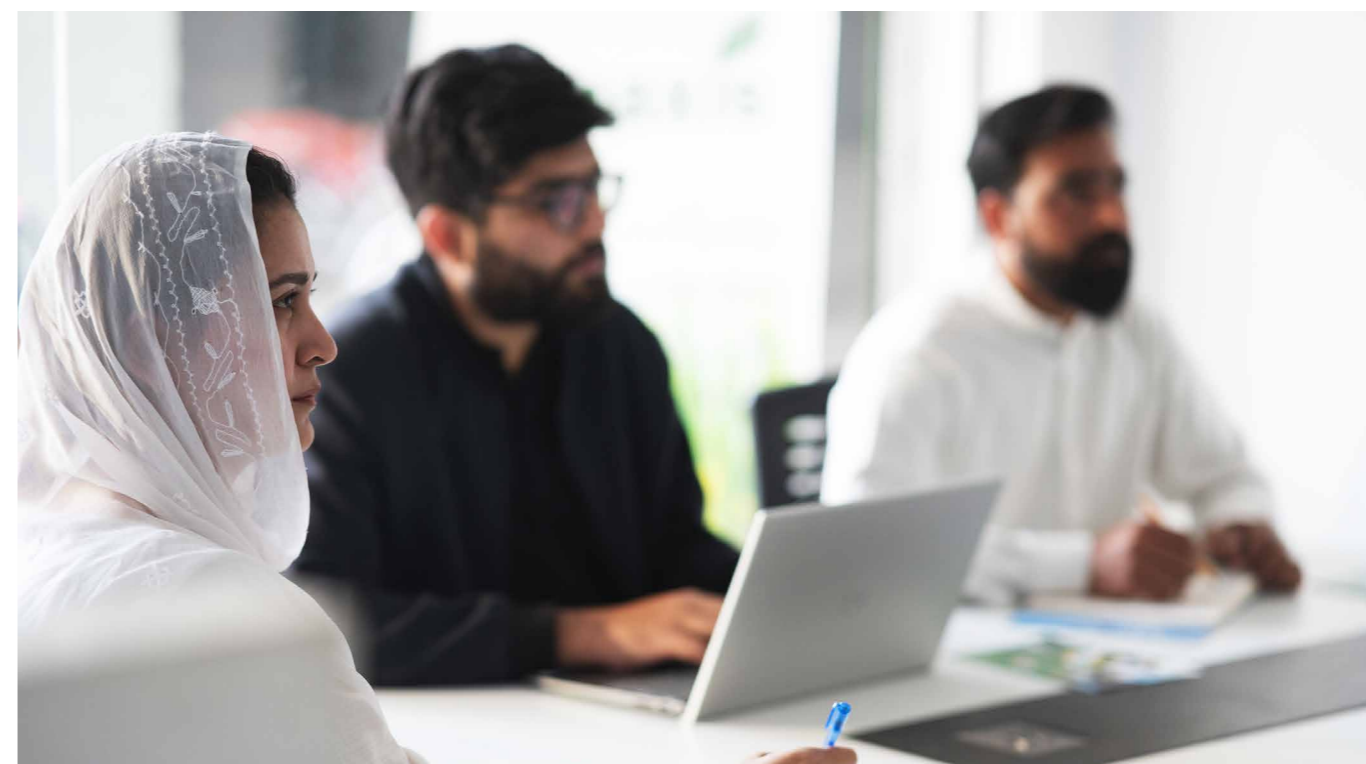
BKK faces a range of systemic challenges to delivering equitable solutions to smallholder farmers in Pakistan. Limited government support and inadequate infrastructure hinder the scalability of their services, particularly in rural areas. The reliance on feature phones among low-income farmers restricts access to more advanced digital tools, perpetuating a digital divide. The inclusion of women remains a significant challenge, as socio-cultural barriers often limit women's participation in agriculture and access to technology-driven solutions.

Economic constraints also play a pivotal role, with smallholder farmers struggling to afford higher-tier services despite their potential to enhance productivity. Addressing these inequities not only requires tailored solutions, such as premium services that align with farmers' financial realities, but also a concerted effort to improve digital literacy. This would empower farmers to maximise the benefits of both basic and advanced digital tools, ensuring broader and more sustainable adoption across different demographics.

Looking ahead

BKK plans to consolidate their user base and venture into new markets by expanding weather stations and integrating pest and disease models. Long-term goals focus on innovation and market diversification while addressing challenges like economic instability and low digital literacy among rural users. Future growth hinges on precise market targeting, proactive partnerships and innovation-driven services. Stability in resource planning ensures resilience amid economic fluctuations.

Over the next five years, BKK plans to scale its phygital model to 20 districts across Pakistan, creating a robust ecosystem for farmer engagement. By 2026, they aim to establish direct market linkages and output procurement, streamlining supply chain. Additionally, BKK is prioritising financial inclusion by integrating credit and insurance solutions into its platform, empowering farmers with access to essential financial services.





Conclusion

With the support of the GSMA Innovation Fund for Climate Resilience and Adaptation, BKK has successfully addressed the pressing climate-related challenges faced by farmers in Pakistan. Through their mobile app, SMS, IVR and call centre services, BKK has provided vital support to smallholder farmers and facilitated easier and more inclusive access through automatic speech recognition technology. By expanding their network of weather stations and improving the accuracy of weather forecasts, BKK has enabled farmers to better plan and prepare their farming activities based on weather and climate changes.

Despite challenges with local political and economic instability, BKK has demonstrated the strong potential of a sustainable and scalable digital solution to build climate resilience and have a positive long-term impact on Pakistan's agricultural sector.

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