Food and Agriculture Organization of the United Nations

CONNECTED FARMERS

A CASEBOOK OF GOOD PRACTICES AND INSPIRING STORIES FROM EUROPE AND CENTRAL ASIA

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ABBREVIATIONS

AUCA	American University of Central Asia
CEU	Central European University
COM	Consumer Organization of Macedonia
CO_2	carbon dioxide
COVID-19	Coronavirus disease
FAO	Food and Agriculture Organization of the United Nations
FMS	farm management systems
GFA	Georgian Farmers' Association
RFID	Radio-frequency Identification
GPS	Global positioning system
ICT	Information and Communication Technology
IoT	internet of things
KGU	Kazakhstan Growers' Union
KPIs	key performance indicators
NDVI	Normalized Difference Vegetation Index
RGB	red green blue
UAV	unmanned aerial vehicle
USAID	United States Agency for International Development
UV	ultraviolet

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INTRODUCTION

Agriculture plays a pivotal role in the economies of countries in Europe and Central Asia, contributing significantly to rural livelihoods. However, the sector is currently facing multiple crises due to climate change, the war in Ukraine, and the ongoing impact of the COVID-19 pandemic. Challenges such as the depletion of natural resources, land degradation, soil erosion, intensified weather hazards, water pollution, and the spread of pests and diseases are posing significant obstacles. Supply chain disruptions, high input costs, and soaring fuel prices are affecting the growth of the agricultural sector and food security both regionally and globally.

Rural, small-scale farms in the region often operate within short value chains and face limited integration into international markets. The lack of knowledge and skills for sustainable and climate-smart agricultural practices is a common issue, with a shortage of quality education and training in many countries. Inadequate public infrastructure in rural areas, including inefficient road connectivity, poor irrigation systems, and deficient electricity and internet connectivity, further compounds the challenges faced by the agricultural sector in Europe and Central Asia.

Rural areas are experiencing demographic challenges, such as an ageing population and significant outmigration to urban areas and abroad, impacting the labour force and agricultural productivity. Rural poverty remains a concern, with lower incomes compared to urban areas and a gender dimension to poverty. Financial constraints and difficulty accessing credit hinder smallholder farmers from investing in their agricultural activities.

Digital technologies have the potential to drive new growth in the agricultural sector and rural areas across Europe and Central Asia. They can serve as tools to optimize production and processing, improve food quality and safety, increase yields, streamline trade and transparency, minimize environmental impact, utilize resources sustainably, and facilitate economic and social stability for farmers. However, while agrifood digitalization holds several promises, the benefits of these technologies may not be equally distributed, potentially widening existing disparities. Marginalized groups, including women, youth, the elderly, people with disabilities, and minorities, are particularly vulnerable to being left behind in the digital divide. To harness the benefits of digital technologies sustainably and equitably, it is imperative to avoid exacerbating existing challenges.

In Europe and Central Asia, farmers face various barriers to adopting digital technologies. In some countries, inadequate infrastructure, such as unreliable electricity supply and limited internet connectivity in rural areas, as well as the high costs associated with internet connections, hamper digital adoption. The lack of awareness about the existence of digital solutions, low digital literacy, poor skills, and a reluctance among rural smallholder farmers to embrace digitalization significantly hinder the widespread adoption and effective utilization of digital technologies in the agricultural sector.

Objective of this casebook

In light of the challenges confronting the agricultural sector in Europe and Central Asia, it becomes paramount to explore and showcase viable solutions that not only address these issues but also pave the way for sustainable and inclusive agricultural practices. The impacts of the multiple crises have underscored the urgency of finding innovative approaches to increase the resilience of agrifood systems in the region.

This casebook highlights the transformative power of digital technologies in agriculture by presenting 25 compelling case studies of farmers and agripreneurs who have successfully embraced digitalization. They shed light on practical solutions that enhance productivity, ensure food security, and foster economic development in rural areas.

By documenting the stories and experiences of those who have effectively integrated digital technologies into their agricultural practices, this publication seeks to inspire a broader adoption of digital solutions and empower others to overcome barriers hindering their access and utilization.

By exploring these case studies, we highlight not only the tangible benefits of digital technologies but also the diverse strategies employed by farmers and agripreneurs to overcome the specific challenges in the region.

By doing so, we hope to contribute to a collective understanding of how digitalization can serve as an accelerator for positive change in the agricultural landscape, fostering a more sustainable, resilient, and inclusive future for rural communities. Our aim is to inspire others to replicate and adopt these digital practices, encourage them to explore other digital solutions, and empower the adoption of digital technologies.

About the case studies

This casebook narrates 25 stories of small, medium, and large farmers and agripreneurs from Europe and Central Asia who have successfully embraced digitalization. Each case study provides a real-world example and underscores promising or good practices for the use of digital technologies in agriculture. Some have been tested and replicated across diverse contexts and can serve as recommended models; others show great potential for upscaling.

The case studies span several countries, specifically Georgia, Kazakhstan, Kyrgyzstan, North Macedonia, the Republic of Moldova, and Uzbekistan, offering insights into the methodology applied, tangible benefits, constraints faced, success factors, and lessons learned for each practice. To facilitate the reader”s navigation across the case studies, we have grouped them into five distinct use cases:

Digital knowledge and marketing: These practices feature the use of social media, instant messaging, and online platforms to share agricultural knowledge or market agricultural products.

Digital crop production: These practices involve the use of smart sensors powered by the Internet of things (IoT), satellite imagery, drones, or agrobotics that aid farmers' decision-making, helping them farm more precisely and with less human labour.

Digital greenhouses: These cases involve digital solutions specifically applied to controlled-environment agriculture, deploying systems that automatically control greenhouse conditions and automate operations such as fertilization, irrigation, and water disinfection.

Digital livestock management: These include digital technologies applied to monitor animal well-being and optimize overall livestock farm management. They vary from the use of sensors and smart ear tags, global positioning system (GPS) tracking, automated feeding and water systems, to disease surveillance software, etc.

Digital farm management: These practices encompass various digital solutions that track and manage inventory; assist in bookkeeping, budgeting and financial planning; automate tasks; and help maintain accurate records.

METHODOLOGICAL NOTES

A good practice, as defined by FAO, is a proven and replicated success that merits sharing as a model. The intention in sharing such practices is to promote their adaptation or adoption by a wide audience.

> **A good practice is a successful experience that has been tested and replicated in different contexts and can therefore be recommended as a model. Sharing such practices can promote their adaption and adoption by a wider audience.**
>
> **Source: FAO. 2023. FAO Capacity Development. Good practices. [accessed 12.11.2023]. www.fao.org/capacity-development/resources/good-practices/en/**

The framework for analysis is guided by FAO's practical tool “How to capture and share good practices", which follows a comprehensive step-by-step process including the key stages of identifying, framing, gathering, organizing, analysing, documenting and sharing practices. It is worthy of note that FAO highlights the evolution of a good practice through stages, underscoring the importance of initiating documentation when a practice is still a potential innovation and within the rapidly changing landscape of digital technology.

Recognizing the importance of the systematic analysis, documentation and sharing of best practices in digital agriculture, FAO sees knowledge sharing as instrumental in addressing the challenges related to food security.

A blend of methods is employed for the collection of data from within the digital realm, including desk reviews, stakeholder consultations, interviews, direct observations, ethnographic studies of instant messaging groups, digital solution analyses and on-site visits. FAO prioritizes participation and inclusion, engaging diverse stakeholders such as small-scale farmers, local communities, practitioners, digital users, solution providers and experts in different fields.

The format for the documentation of case studies draws upon FAO's “Good practice template”, which systematically guides the researcher through specific dimensions of the analysis, including the context, geographical coverage, the actors and stakeholders involved, and the target beneficiaries.

The template-guided process includes the identification of key success factors, challenges faced, sustainability, potential for replicability and upscaling, and lessons learned from the documented digital practice. The aim is not only to showcase successful initiatives, but also to extract valuable insights that may inspire digital practitioners, guide future digital agriculture projects, and harness the potential of technology as an accelerator to achieve sustainable development goals.

While the methodology outlined by FAO can be considered a robust framework for the capturing and sharing of good practices, acknowledging the inherent limitations and challenges within the digital agriculture landscape is vital. Constraints in data collection, the intricacy of validation, rapid changes in technologies and solutions, language barriers and contextual variations are all potential hurdles that demand the reader’s consideration.

DIGITAL KNOWLEDGE AND MARKETING

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PERSONAL BRANDING IN SOCIAL MEDIA: THE STORY OF DALEL'S AGRIBUSINESS SUCCESS

© FAO/Kamilla Tuleyeva

Kazakhstan, Aqmola region, Kurgaldjinsky district, Sadyrbai village

SUSTAINABLE DEVELOPMENT GOALS

OBJECTIVE

This case study focuses on the experience of a farmer from Kazakhstan who used personal branding in social media to promote his farm on the market. It traces the farmer's journey from his return to the village to the ways he established business connections on social networks. It also explores the impact the farmer's communications have had on his followers and how other farmers in Kazakhstan can begin to use these practices.

INTRODUCTION

Dalel Dzhuzbayev, a computer programmer by specialization, switched his office life to life as a farmer a few years ago. Dalel began managing his father's crop-growing farm in the Aqmola region. The farm produces soft and durum wheat, oats, barley, and linen. There are about 60 workers on the farm, most of them coming from the Kurgaldjinsky district.

Founded in 2001, over the past 20 years the farm has grown tenfold – from 1 300 ha to 16 000 ha. Along with the growth, the workforce requirement also increased. At the same time, young local specialists began to move en masse to the city. When Dalel began to manage his father's farm, he faced an acute shortage of personnel. Only 7 000 people now live in the area where the farm is located. Every year it becomes increasingly difficult to hire new workers, because many residents, young people in particular, do not want to stay in rural areas.

Dalel decided to popularize agricultural professions with the help of social net-works as social media is the main platform of communication for young people.

By introducing this technology, Dalel pursued the following goals:

- Change society's perception of farmers.
- Exchange knowledge and experience with fellow farmers.

According to Dalel, many people have the wrong image of farmers. He decided to show his audience that farmers can make good money, and that farming is a noble profession. He now has about 90 000 followers on Instagram. Thanks to Dalel's active outreach efforts on social media, many internet users are interested in his work on the farm. In addition, his social media presence has helped him find new business partners, from fertilizer suppliers to grain buyers.

GEOGRAPHICAL COVERAGE

Kazakhstan, Aqmola region, Kurgaldjinsky district, Sadyrbai village

Source: United Nations Geospatial. 2020. Kazakhstan. Cited 27 December 2023. https://www.un.org/geospatial/file/2015/download?token=wETZTp56

METHODOLOGICAL APPROACH

Dalel began to post about his farm work on social media in 2021. Two years later, with the introduction of stories, he began to use this tool more actively. Now he posts about 10-15 stories every day. These are short videos in which he demonstrates the results of his experiments with various fertilizers, checks soil moisture, and shows how grain is harvested.

Dalel wanted to show his followers that farming is not just a job, but a way of life. He shares with his readers not only professional observations, but also personal moments: He shows his family and recounts important life events.

VALIDATION

Dalel reports that an active social media presence has helped him connect with fellow farmers, fertilizer suppliers, and regular people.

ACTORS AND STAKEHOLDERS

- owner of a farm in northern Kazakhstan
- social media followers
- fertilizer suppliers
- grain buyers

© Dalel Dzhuzbayev

IMPACT

While Dalel has not experienced significant material benefits from his social media activities, he notes a considerable social impact. He gets a lot of responses to his posts. More experienced farmers give him advice on working with fertilizers, while younger colleagues ask him for advice on how to get started on their land. He was even able to convince several people to return to the village. Three people who learned about his experience from social media have visited his farm. Inspired by his example, they left the city and decided to help their parents on their farms. Some had worked in the civil service, and some in the private sector. One of them was a former resident of the Korgalzhyn district, where Dalel 's farm is located.

SUCCESS FACTORS

- The farmer had a clear goal: to spread the word about his work on social media and connect with ordinary citizens, colleagues, and business partners.
- The practice required no investment, just a smartphone with internet access.
- The farmer speaks and writes in three languages (Russian, Kazakh, and English), which allows him to ensure a wide audience reach.
- Born and raised in the countryside, and educated in the city and abroad, he is familiar with both rural and urban lifestyles, which helps him find common ground with both rural and urban residents.

SUSTAINABILITY

Through his posts and videos, Dalel promotes a positive image of the modern farmer in Kazakhstani society.

CONSTRAINTS

Dalel actively demonstrates on social media not only the success factors of farming, but also the main challenges. The main challenge he faces is the underdeveloped infrastructure in the rural areas of Kazakhstan. In many areas there is no 4G connectivity or water supply; roads are not paved everywhere. Internet access is available only on 20 percent of Dalel's land.

LESSONS LEARNED

- Social media can be a useful working tool for farmers to promote their activities and find business partners.
- Social networks help to create a positive image of the farmer in society, as young users see that working in agriculture can also be interesting and satisfy their ambitions.

REPLICABILITY AND UPSCALING

Unlike other practices using digital technologies, this one requires no initial investment. The main conditions are the desire to communicate and produce useful content. Farmers who want to follow Dalel's example can target both a wide audience and a narrow circle of specialists.

CONCLUSION

There are several beneficiaries of this practice. The farm owner established contacts with fellow farmers and business partners and promoted his enterprise in the marketplace. Through social media, other farmers learned about new ways of applying fertilizers. Ordinary people learned about the specifics of farm management in modern Kazakhstan and began to better understand the specifics of agribusiness.

Having a clear vision of his goal and being consistent in the process of achieving it proved to be instrumental to the successful results of this practice.

MORE INFORMATION

This case study was elaborated by the Kazakhstan Growers' Union (KGU) and the Food and Agriculture Organization (FAO).

It was developed through interviews with Dalel Dzhuzbayev, farmer and a blogger in 2021.

For further information about this case study, please reach out to FAO at REU-Digital-Agriculture@fao.org.

ETO'S GROWING DUCK FARMING BUSINESS: SOCIAL MEDIA AND E-COMMERCE PLATFORMS

© Soplidan

Georgia, Abashis Raioni region,
Didi Lilo town

SUSTAINABLE DEVELOPMENT GOALS

OBJECTIVE

This case study aims to learn from the experience of Kokorina farm to showcase how social media platforms and e-commerce can be utilized to promote a small farming business to build a brand, increase consumer reach and sales. The document follows the farmer's path on how she started and expanded her business using online knowledge, social media, and digital marketplaces.

INTRODUCTION

Eto Kapanadze, together with her family members, founded Kokorina, a family-managed duck farm in 2019. Located in Didi Lilo town, the farm raises ducks, produces duck eggs, and hatches ducklings. From the very start of her agricultural operations, Eto has actively used different social media and online sales platforms to have better access to the market and promote her farm activities. The farm has been operating for three years and it is on the way to increasing output and expanding its operations. Eto started her farm with 200 ducklings, and, currently, she has a regular standing stock of 1 000 ducks. By the end of 2022, she plans to increase it up to 2 000.

Before founding Kokorina, the family had a land plot and wanted to determine the optimal way to utilize it. Eto conducted online research, watched multiple YouTube videos and joined various Facebook groups of agricultural producers and sellers. After considering different options, she decided to start a duck farm and found a supplier for her farm through Facebook.

Using social media and e-commerce platforms is not common for Georgian agricultural producers. There are not many farms that promote their activities and attain a consumer base in the digital space. Eto's farm Kokorina is a good example of how a small agricultural business owner can grow their business through social media promotion and online selling.

Eto says that, in the modern world, small businesses can accomplish many goals by using the internet and social media platforms. Such tools help to collect information and accumulate knowledge, access a larger consumer base, and communicate with retailers and potential buyers within the country and abroad.

Eto's active promotion of her farm activities and family lifestyle on Facebook sparked interest in online customers and social media users. Multiple local TV channels interviewed Eto and broadcasted her story. In 2022, she participated in the TV program "Shark Tank Georgia", where she found a business partner. All this further increased the popularity of her farm.

As the current business model has been successful for Kokorina, Eto plans to expand her business on additional land to increase production and to start producing duck pate, as well as to invest in a smoking and a canning machine and to process feathers to create natural feather pillows.

GEOGRAPHICAL COVERAGE

Source: United Nations Geospatial. 2020. *Kazakhstan.* Cited 27 December 2023. https://www.un.org/geospatial/file/2015/download?token=wETZTp56

METHODOLOGICAL APPROACH

Eto actively uses different platforms to collect information to improve the production process. The Google search engine helped Eto to find books about growing ducks, whereas YouTube and Wikipedia provided her with the necessary information needed to start and expand a farm business. Eto and her family members actively seek relevant training and programs online to improve their knowledge. For example, within the framework of the UN Women program for economic empowerment of rural women, Eto attended training on poultry production.

ACTORS AND STAKEHOLDERS

- Soplidan.ge (e-commerce platform)
- business partners from Shark Tank Georgia TV show
- restaurants, hotels and other private consumers
- other smallholder farmers

In the first week of bringing ducks to the farm, Eto established a Facebook page, where she depicts a farmer's lifestyle with photos and information about the farm's activities.

In the beginning, the farmer used to sell directly to personal contacts and Facebook friends mainly at the farm's gate, but as production reached such levels that farm-gate sales were not enough, Eto decided to find customers – restaurants, hotels and other private consumers, etc. – online and through social media.

At first, the farmer actively started to spread information about the farm and family's products to different Facebook groups so that the page gradually gained popularity. Later on, Eto contacted e-commerce for agricultural products – Soplidan.ge – and offered to supply duck eggs for sale. Communication was successful: Soplidan.ge made a video story about Eto's farm and listed products on the website. These contributed to make Kokorina a strong and popular brand in Georgia.

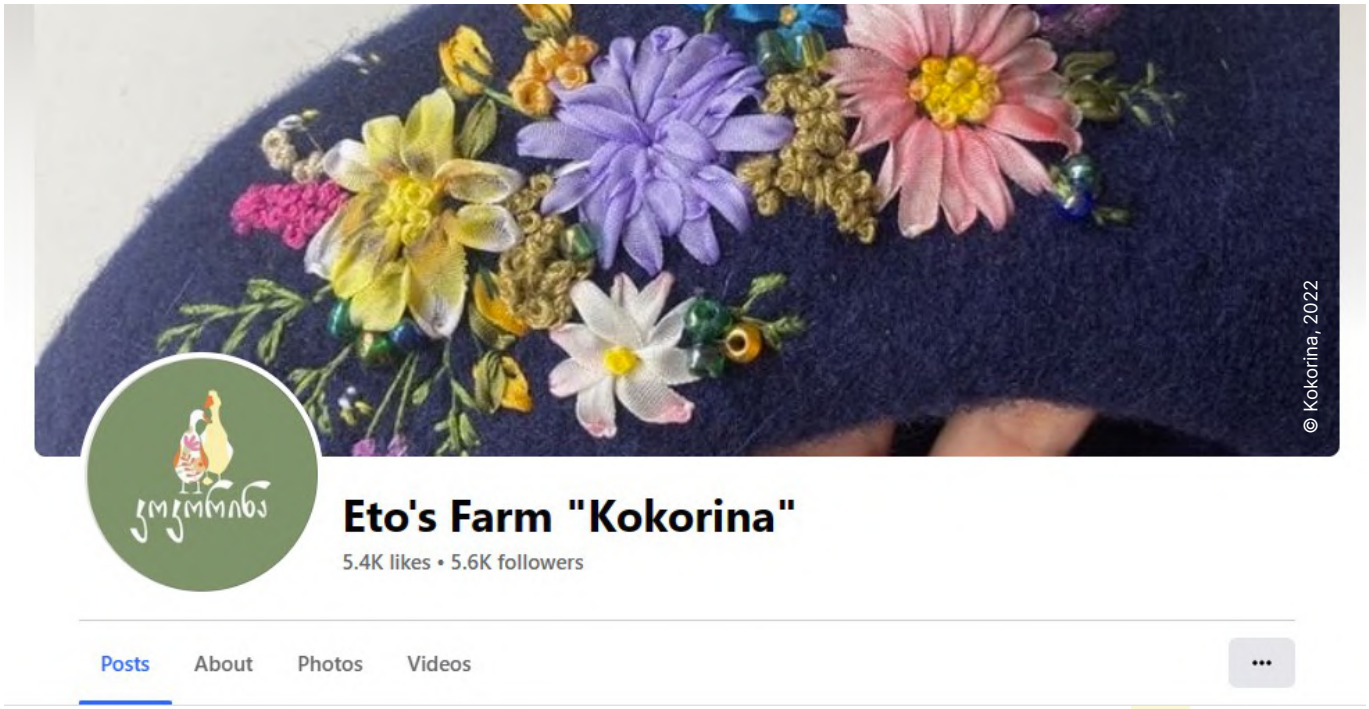
Especially during the seasons when production is higher than usual, and therefore the farmer has excess production, regular sales platforms do not provide enough demand. During such periods, Eto actively posts in various Facebook groups, contacts people from her existing consumer base, informs them that products are ready for sale, and provides information about delivery options to overcome excess supply.

VALIDATION

Kokorina's business model is validated by the market, as the demand for the products is usually higher than the current production capacity. Although Eto never paid for online promotion, her active involvement in social media platforms increased the popularity of her products and brand. Multiple consumers reach out via e-commerce and social media and even try to pre-order products from the farm.

SUCCESS FACTORS

- Choosing the proper marketing tool can help businesses succeed. In the case of Kokorina, amid the COVID-19 pandemic, many people shifted from the conventional way of shopping to online purchases. Thus, Eto leveraged this opportunity and made a decision to sell and promote products online. The sales of duck eggs, ducks, and ducklings increased together with the popularity of Eto's farm.
- Promoting business through social media channels from the very start of the operations can help facilitate market access and increase the customer base.
- Continuously conducting web research on potential partners and actively engaging training programs can provide a necessary knowledge base to establish, maintain and promote a farm business.
- Devoting a part of farmers' time, effort, and skills to maintaining a social media page or pages, engaging with potential customers, creating marketing materials, etc., can help start-ups to build a brand and gain popularity among customers and other important actors.



IMPACT

According to Eto, the popularity of the farm and its products are increasing, and more than half of the current production is sold using Facebook and the e-commerce site Soplidan.ge. Moreover, direct engagement with customers and positive and encouraging feedback received from online followers motivate Eto and her family to continue to grow their farming business, as well as to maintain their social media accounts.

SUSTAINABILITY

Over time, Kokorina built a strong consumer base. Even the COVID-19 pandemic did not have any negative impact on sales. On the contrary, during the pandemic, demand for Kokorina products showed a significant increase.

Although Kokorina has been operating only for three years, Eto became a point of reference and source of advice for other duck farmers on how to produce and market their products.

So far, Eto has not used any paid promotion, or advertisement for the business, although she considers this as an option when production increases to a level when organic promotion on social media platforms will not be enough.

CONSTRAINTS

Two primary constraints require consideration in Eto Kapanadze's farm, Kokorina, and demand the development of appropriate mitigation strategies:

- A substantial dependence on social media might limit the farm's outreach to a younger demographic exclusively.
- Despite the widespread use of the internet in Georgia, older generations may lack the necessary digital skills for active engagement on social media platforms.

LESSONS LEARNED

- Small business owners who educate themselves and actively use online selling platforms and social media can grow their demand at a fast pace, even without paid promotion.
- Freely available resources on the internet can be accessed and used to plan, manage and promote business activities.
- Using different online platforms helps businesses expand their consumer base so that products can reach additional consumers, even from distant locations.

REPLICABILITY AND UPSCALING

Using social media for promoting business activities and e-commerce to market agricultural products is becoming increasingly attractive for small agricultural producers. Online sales platforms and social media groups can be accessed by producers with ease and at no or relatively little cost. Kokorina's success has already been an inspirational example for farmers in Georgia to adopt similar business practices and business model.

© Kokorina

CONCLUSION

Small agricultural business owners can achieve several benefits and positive impact by proactively consulting resources online, using social media from promoting their activities and brand, and e-commerce platforms to increase their consumer base. Eto Kapanadze and her farm Kokorina are an example of online promotion good practices.

Kokorina is a small farm that started operations in 2019 and achieved multiple milestones with the help of social media promotion and e-commerce. By building a strong brand and consumer base online, Eto's farm keeps increasing its production. At the end of 2021, the farmer had a steady stock of 1 000 ducks and planned to double this number by the end of 2022. The farmer achieved higher demand for its products than its current production capacity. Eto was able to promote her activities online and on local television as well. The farm is growing, and its popularity increases with it.

Active promotion on Facebook and use of online sales platforms led a small farm to steady growth and increased popularity without any monetary investment in promotion activities.

MORE INFORMATION

This case study was elaborated by the Georgian Farmers' Association (GFA) and the Food and Agriculture Organization (FAO).

It was developed through interviews with Eto Kapanadze, farmer, in 2022.

For further information about this case study, please reach out to FAO at REU-Digital-Agriculture@fao.org.

SOCIAL MEDIA PROMOTION: REINA'S STORY OF SUCCESSFUL AGRITOURISM PROMOTION AND SALES OF MEAT PRODUCTS

© Reina Kench

Tepke, Issyk-Kul region, Kyrgyzstan

SUSTAINABLE DEVELOPMENT GOALS

INTRODUCTION

The Reina Kench family farm, funded in 1996 by two siblings a sister and a brother, has become one of the leading farms for cattle breeding in the Issyk-Kul region of Kyrgyzstan. For several years the founders have focused on livestock production. Later, in 2012, they expanded their farming business into the area of agritourism and they strongly relied on social media promotion to expand their business.

In 2014, founders of Reina Kench started breeding Aberdeen Angus, a Scottish breed of small beef cattle which yielded greater profitability compared to raising the native Kyrgyz breed. Aberdeen Angus can better adapt to inhospitable climate conditions, exhibit higher rates of fecundity, and yield meat of greater quantity and superior quality. Reina Kench assists over 200 regional farmers in breeding and raising Aberdeen Angus cattle. Many of them become the company's suppliers, helping to satisfy the growth in demand for Reina Kench's meat products. The farm actively and successfully uses social media to promote and sell its products to new and existing customers by sending updates on products and information on available discounts. Social media activities also attract tourists to the farm. Reina Kench is one of the first farms in Kyrgyzstan to open its doors to visitors who want to experience life on a farm, as well as to local and international tourists who want to experience the Kyrgyz culture, learn the country's traditions, and appreciate the beauty of its natural landscapes. Among many activities, the farm offers the experience of living on the farm, tasting local food, going on horseback walks, hiking, picnics and folk shows.

OBJECTIVE

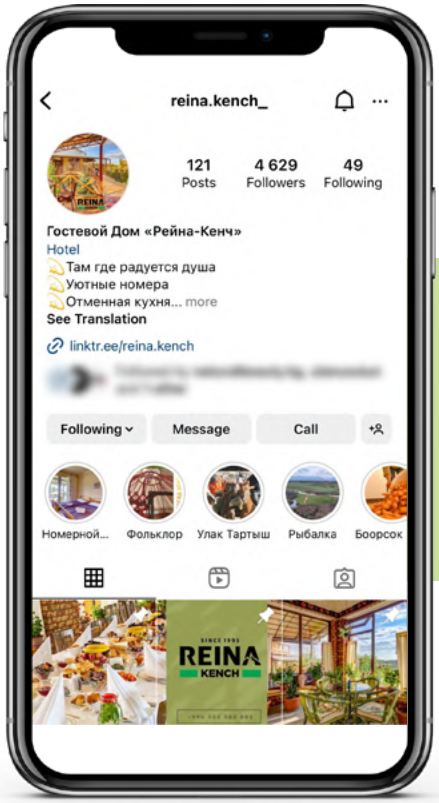
This case study focuses on the experience of two siblings from the Issyk-Kul region who use social media to advertise their farm, their meat products, and agritourism services. They heavily rely on marketing through social networks, websites, WhatsApp and Instagram social media platforms, and tourism web portals such as Tripadvisor, Hotellook, and Nomadsland.

ACTORS AND STAKEHOLDERS

- livestock producers
- meat suppliers and buyers
- food consumers
- tourists
- supermarkets chains
- food services sector

The social media promotion attracted other farmers, including smallholder growers, from the neighbouring areas to breed the Aberdeen Angus so that Reina Kench started providing them with training and support on breeding and growing the Scottish cattle. The company established its own school, and the Reina Kench team often visits villages and nearby districts to introduce other farmers to the basics of supply and demand for products, the benefits of digital marketing and how this can positively affect sales.

Thanks to the growing demand and supply of this cattle breed, in 2020 the company expanded its business further by adding a meat processing facility to provide the new breeders with slaughtering and processing services. The establishment of this facility enables the farm to complete the whole production cycle – primary and secondary production – within the company.



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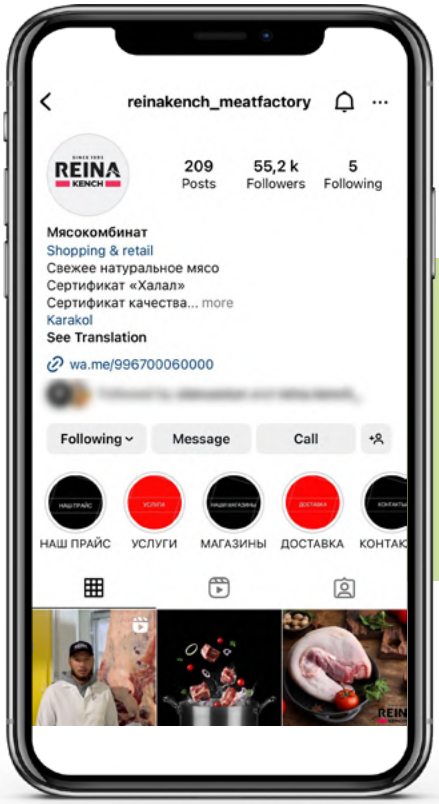
GEOGRAPHICAL COVERAGE

Source: United Nations Geospatial. 2011. *Kyrgyzstan.* Cited 27 December 2023. https://www.un.org/geospatial/file/2036/download?token=ACIAKvzw

METHODOLOGICAL APPROACH

Since 2015, leveraging on the fast-paced spread of internet and social media usage in Kyrgyzstan, Reina Kench started focusing on building its social media presence to promote and advertise its business. Reina Djanybekova, co-owner of the family business, manages all the tourism-related activities as well as the company's digital presence with the support of a social media specialist, whereas her brother and co-owner, Nurmukhamed Askarbekov, manages the meat processing plant.



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The farm established separate social media pages for its meat production factory and for its agritourism services, targeting respective groups of consumers. The "Reina Kench Meat Factory" Facebook and Instagram pages promote meat production and meat processing services. These services are sold to other businesses such as restaurants and supermarkets (referred to as "business-to-business") as well as to private consumers ("business-to-consumer"). In contrast, the "Reina Kench" Facebook and Instagram pages promote agritourism services, targeting local and international tourists. By differentiating between two social media pages, the company can better tailor its social media communication to the different consumer groups.

The Reina Kench meat factory launched its Instagram account in February 2021, and as of October 2022, it counts more than 55 400 followers. The account features pictures of meat products, videos of cattle grazing around the farm, images of farm workers, as well as information on the safety and quality measures in place. Users can access meat prices through a link in the account's bio and place orders or learn more about the farm via WhatsApp.

Reina Kench's agritourism business is also promoted on Facebook and Instagram. The Facebook page has over 2 400 followers, while the Instagram account has 4 000. Users can access exclusive offers and book services such as accommo-dation, conference rooms, wedding receptions, and excursions through a link in the Instagram account's bio. Clients can communicate with the business directly via WhatsApp on the Facebook page.

In addition to social media, Reina Kench promotes its agritourism services on platforms like Tripadvisor, Planet of Hotels, Nomadsland, and Hotellook to attract international customers.

To expand its reach, increase coverage, and raise awareness, Reina Kench also utilizes paid promotion via Ads Manager for Facebook and Instagram. Despite its relatively low posting rate of one to five times a month, the company consistently communicates across its social media channels and has a high number of followers, fulfilling its purpose effectively. The language and visual content are thoughtfully curated, with carefully selected logo and colour schemes clearly displayed. The messaging conveyed through pictures, videos, and overall content, aims to reflect values of safety, family, love for nature, and care for animals, resulting in improved brand awareness and a positive reputation for the business. The content is in Russian language to resonate with both local and international audiences.

According to Reina Djanybekova, who manages the social media presence:

We recently conducted a survey on the factors that consumers consider important when selecting meat. Our subscribers prioritize safe and environmentally sustainable meat products, and our processing plant is committed to producing such high-quality meat. Additionally, we are dedicated to promptly addressing any concerns and ensuring the quality of our products.

In addition to promoting specific offers, our Instagram account also serves as a platform for education, awareness raising, and information sharing. One topic we frequently discuss is food nutrition, including the benefits of various types of meat. Beef, in particular, is a popular choice in our country for good reasons. It's rich in essential nutrients such as iron, zinc, selenium, vitamin B, potassium, and calcium. Regular consumption of beef has numerous health benefits such as strengthening bones and muscles, improving memory and vision, promoting a healthy nervous system, and boosting the immune system.

SUCCESS FACTORS

- Reina Kench actively and consistently uses its social media platforms and WhatsApp to communicate about its activities and to manage orders for both its agritourism services and meat production.
- Its social media accounts present a coherent brand that communicates the value of safety, family, love for nature and farm life.
- Posts are regular, despite the low frequency. The language and visual content are meticulously curated, and the brand is communicated consistently across its social media and website.
- Reina Kench is open and proactive in cooperating with neighbouring farmers to share the company's experience and provide training on how to grow the special breed that has now turned into a new business opportunity, providing meat processing services.
- Collaborating with new breeders has gradually helped to match the growing demand for meat products and provide income opportunities for neighbouring smallholder growers. The allure of collaborating with Reina Kench stems from its ability to sell its products, which is facilitated by creating social media strategies.

VALIDATION

Reina Kench's owners report that the increasing number of followers on social media, combined with high-quality products and services, lead to a growing reputation of the company and knowledge awareness of its activities. This is evidenced by an increasing number of growers, including smallholder livestock producers, that have started breeding the special type of Scottish cattle introduced by Reina Kench's co-owners.

National journalists have written articles, produced special reports, and filmed the farm for traditional media. The positive reviews from both national and international consumers on online booking platforms and social media pages further prove the value and benefits of self-managed social media promotion.

IMPACT

Social media communication has simplified information provision, booking, ordering and distribution processes for meat products, while also expanding the consumer base and ensuring the financial sustainability of the business.

Reina Kench's meat factory and success stories about the Aberdeen Angus breed have inspired local farmers to raise and breed this type of cattle, leading to a new business opportunity for Reina Kench's owners who opened a meat processing facility to offer small breeders the chance to sell their own cattle or receive processing services. This generates additional income for both Reina Kench and smallholder farmers who supply meat to meet the growing customer demand.

Reina Kench is a prime example of how women in Kyrgyzstan are driving online marketing, with the woman co-owner managing the farm's online presence, increasing market shares and company income by reaching a wider customer base through digital marketing.

CONSTRAINTS

There are two key constraints to Reina Kench farm's approach that need to be considered, and for which appropriate mitigation strategies must be developed:

- Heavy reliance on social media may limit their reach, predominantly targeting a younger audience. Despite the widespread use of the internet in Kyrgyzstan, older generations may lack the digital skills needed to be actively engaged on social media platforms.
- Online marketing strategies should be reviewed and adjusted to emerging trends. For instance, if there is a decrease in the number of users on a particular platform, companies should seek out new platforms to maintain visibility. Furthermore, the rise of social media algorithms has added another layer of complexity to online advertising. These algorithms prioritize content that is deemed to be of higher quality or relevance to the user, making it crucial for companies to create compelling and targeted content. Failing to adjust strategies accordingly could result in a missed opportunity for effective advertising.

SUSTAINABILITY

Social media has increased Reina Kench's overall sustainability by helping the company diversify its business through agritourism and meat processing services. While users may change their preferred online platforms, social media's popularity is expected to endure. As the company increases its number of followers, it can achieve even greater reach, as their posts will be visible to users who are not yet followers. In the years to come, companies that rely on traditional marketing strategies are likely to lose market share and be overtaken by more digitally-savvy and proactive entrepreneurs.

REPLICABILITY AND UPSCALING

Social media marketing and selling are becoming the norm, and their presence and importance cannot longer be ignored by businesses striving to scale up and offer their produce to local or international customers. With increasing availability of such tools, rising levels of digital literacy and changed customer habits, farmers who wish to increase their sales and expand their pool of customers are provided with an opportunity to promote their goods and services online. At the same time, social media offer the opportunity not only to place products, but to observe the changes in customers' preferences. Since creating and maintaining non-business social media accounts is free of charge, the approach can be replicated also by smallholder farmers if certain demand basic conditions (such as connectivity, mobile phone penetration and digital skills) are met.

CONCLUSION

Reina Kench has maintained a large and growing customer base thanks to their proactive social media engagement and attentiveness to the preferences of their individual and other customers, including hotels, restaurants, and cafes in the local area as well as in the capital city of Bishkek. Since 1996, the company has not only achieved financial sustainability, but has also become one of the largest meat producers in the Issyk-Kul region, with many smallholder cattle breeders depending on its success and relying on its linkages with other actors in the value chain. While its primary focus is on cattle breeding, Reina Kench has successfully diversified its portfolio by engaging in agritourism and promoting Kyrgyz traditions, showcasing daily life on a farm online and targeting international audiences. Their success can largely be attributed to their excellent digital marketing strategy, awareness of customer preferences both locally and internationally, and a willingness to adapt to new ways of doing business and embracing digital technologies.

LESSONS LEARNED

- Using social media platforms to their full potential can be a crucial factor in distinguishing successful businesses from less successful ones. Solely relying on traditional marketing methods may hinder high-quality producers from reaching local or international customers, scaling up production or diversifying their economic activities.
- Generating compelling and relevant online content that meets the needs of the target audience requires certain skills and keeping up-to-date with shifting trends on the internet. Synergising platforms that cater to different groups of users, including international and older customers, can maximize outreach and secure financial viability.
- Openness and proactivity in cooperating with neighbouring farmers and reputation built through social media can turn into new revenue streams.

MORE INFORMATION

This case study was elaborated by the American University of Central Asia (AUCA) and the Food and Agriculture Organization (FAO).

It was developed through interviews with Reina Djanybekova, co-owner of the family business Reina Kench in 2022.

For further information about this case study, please reach out to FAO at REU-Digital-Agriculture@fao.org.

PROMOTING ORGANIC FARMING: THE MOBILE APP OF THE CONSUMERS ORGANIZATION OF NORTH MACEDONIA

Skopje, North Macedonia

SUSTAINABLE DEVELOPMENT GOALS

INTRODUCTION

Despite the over 900 organic food producers registered in North Macedonia, the domestic market for organic products remains inadequately developed. Addressing this gap and promoting the growth of the organic sector demands the development of various strategies and initiatives targeting market expansion, consumer awareness and producer support. The challenges faced by this market include:

- lack of consistency among producers in the labelling of organic food
- lack of broader marketing
- lack of a professional network facilitating collaborations between producers, retailers and consumers
- lack of control mechanisms ensuring consumer protection (regarding the labelling of products, retail market outlets, etc.)

To address the challenges at hand, the Consumers Organization of Macedonia (COM) has proactively launched the "Organic World" online platform (www.organskisvet.mk) to bridge the gap between consumers and organic food products. COM's initiative also encompasses the development of the "Organic Way" mobile application and an interactive map that serves as a curated travel aid highlighting organic food production centres, retailers and restaurants, as well as organic-friendly accommodation. Through these innovative tools, COM strives to improve consumer access to organic food options and to promote sustainable consumption practices throughout North Macedonia.

OBJECTIVE

The objective of this case study is to showcase the proactive approach taken by the Consumers Organization of Macedonia (COM) in addressing existing challenges related to consumer access to organic food products. In response to these challenges, COM has initiated the "Organic World" online platform (www.organskisvet.mk) with the aim of bridging the gap between consumers and organic food options. This initiative extends to the development of the "Organic Way" mobile application and an interactive map, serving as a comprehensive travel guide highlighting organic food production centres, retailers, restaurants, and organic-friendly accommodations. The overarching goal of these innovative tools is to enhance consumer access to organic food choices and promote sustainable consumption practices across North Macedonia. Expert developers were then brought in to integrate all the collected data into the app, leading ultimately to the launch of a successful application bearing the hallmark of the unwavering support of COM's dedicated employees.

The Organic World website was first launched under the "Improve Food Choices and Save the Environment" project initiated by COM in 2016, the core objective of which was to establish a robust network of producers, retailers, restaurants, tourism facilities and consumers. Consumers were thus supported in making well-informed decisions in the food market based on reliable information, with a long-term goal of facilitating the development of a thriving organic food ecosystem and the expansion of the local market. COM has reported a mounting interest among commercial chains to incorporate organic products into their product ranges, driven primarily by consumer demand, particularly among the younger population.

"For several years now, we have been informing consumers that organic food is safer for consumption and its production pollutes the environment less", says COM.

GEOGRAPHICAL COVERAGE

The mobile app "Organic Way" covers the entire territory of the Republic of North Macedonia

Source: United Nations Geospatial. 2020. *North Macedonia*. Cited 27 December 2023. https://www.un.org/geospatial/file/3020/download?token=n-klsQNW

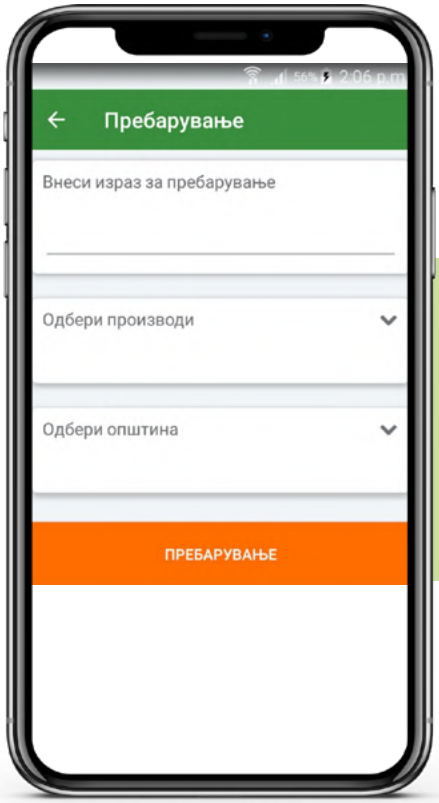
METHODOLOGICAL APPROACH

In its initial phase, the app offers mapping, tagging, validation and descriptions of all the shops, restaurants, accommodation providers and producers of organic food, as well as a simple tool allowing the content to be filtered by location or by product. Organic Way is free to use and offers the following functions:

- A search tool informing users where they can purchase or consume organic products.
- Contact information allowing users to plan their visits to organic food producers in North Macedonia, as well as restaurants, shops, accommodation and tourism facilities offering organic food.

ACTORS AND STAKEHOLDERS

- Consumers' Organization of Macedonia
- Association for Development Initiatives – Zenit
- Association of Agro-Journalists Media Plus
- European Union
- Organization for the Respect and Care of Animals
- Ministry of Agriculture of North Macedonia
- Biokult
- Agency for Food and Veterinary Medicine
- farmers
- pracitioners



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- Information on the benefits of organic food for the environment and for health, and how to identify organic products.
- A Frequently Asked Questions section.

VALIDATION

After the app was launched, user feedback helped the creators improve the app to make it more useful and user-friendly. One year after the initial launch of the app, COM carried out a survey to obtain feedback from the project stakeholders. Among the responses were comments from producers of organic foods who stated that the app had increased their visibility in the market, as well as requests from consumers for the ability to purchase products directly through the platform.

IMPACT

The successful implementation of the app has facilitated the establishment of sustainable networks among stakeholders, fostering increased collaboration and cooperation within the agricultural sector. Notably, the app has played a pivotal role in promoting transparency and accountability throughout the supply chain, thereby enhancing consumer trust in producers and their goods. As a result, more consumers have shown a willingness to directly purchase products from producers, generating positive economic impacts for both producers and the local economy. The app has also contributed to the growth of the agro-tourism sector in the region by promoting local agro-tourism facilities and providing visitors with comprehensive information about local producers and their products. The app has thus helped grow the client base within North Macedonia and beyond, further bolstering the development of the agro-tourism sector.

"We want to build a holistic platform; a place where different stakeholders can find detailed verified profiles of potential partners and enter into transactions with interested parties, all within the platform", COM stated.

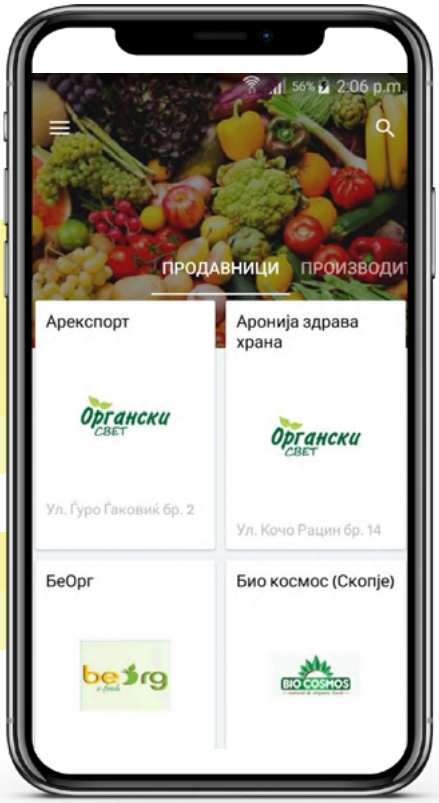
In response to a question of what could be expected in the longer term, COM stated:

"Our activities have led civil society to become more aware of the benefits of organic production – as a form of sustainable agriculture – for both consumers and the environment. Through our project activities we have shown that consumer interests must be taken into account when formulating and implementing agricultural policies. The project has served to identify consumers as the biggest economic group, including women, older adults, children, the disabled and all minority groups."

The mobile application has been promoted during public events, as well as at meetings organized by our organization, our partners and the Ministry, reaching out to all relevant stakeholders. Participant feedback at these events has consistently highlighted the app's usefulness, and the website has been well-received in its promotion of the benefits of organic food. It is important to note, however, that the comprehensive tracking of indicators beyond visitor numbers and app downloads has not been consistently maintained.

SUCCESS FACTORS

- The project's use of modern networking and advertising tools has successfully increased public outreach, enabling core messages to reach larger online audiences and generate greater visibility.
- The project's public outreach efforts have led to the creation of a positive environment for policy advocacy efforts targeting the relevant authorities, farmers' organizations and supermarket chains, facilitating greater engagement and cooperation.
- By raising public awareness and mobilizing support through online promotion and media appearances, the project has successfully generated additional pressure in support of the adoption of sustainable agriculture policies, including a policy framework on organic production.
- The project partners and stakeholders have successfully encouraged supermarket chains to establish partnerships with participating farmers and expand the ranges of organic goods in their stores, encouraging greater sustainability in the agricultural sector.



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SUSTAINABILITY

Organic Way is currently free to use, but if the ambitions of the creators are to be met as regards the creation of a platform supporting the organic food ecosystem, sources of funding will be required. COM plans to upgrade the app into a functional platform, creating a more holistic environment that supports every niche in the organic food system. The plan is to create a network of validated members who will be officially registered as such for an annual membership fee, with different levels of membership envisaged covering the entire range of services offered by the Consumers' Organization of Macedonia to interested parties.

REPLICABILITY AND UPSCALING

- The success of the Organic Way mobile application showcases the effectiveness of providing users with a convenient tool for accessing information about organic food sources. The use of an online platform and mobile application is steadily increasing in North Macedonia, which serves as a flexible technological infrastructure that can be adapted to various regions and markets.
- Establishing feedback mechanisms with users ensures ongoing enhancements and adaptability to changing needs and technological advancements.
- Building a network of producers, retailers, and consumers is a crucial aspect that can be replicated. Initiatives that facilitate collaboration within the agricultural sector can be established elsewhere, fostering sustainable networks and promoting a sense of community.

CONSTRAINTS

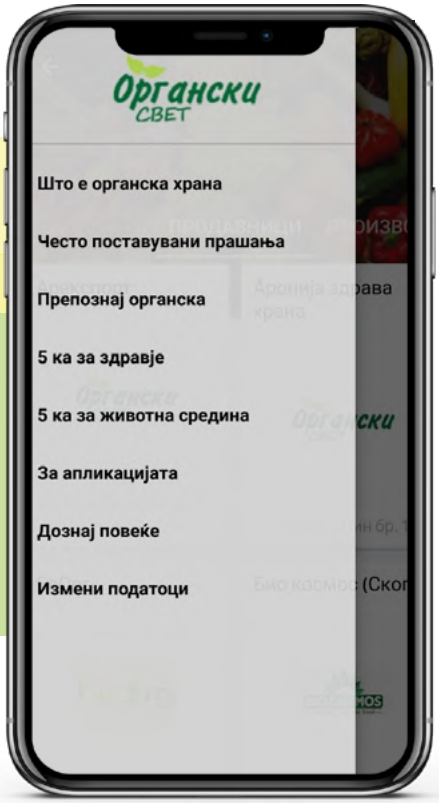
Despite the significant progress made in promoting the project, COM has faced considerable challenges, for example, in establishing trust among the target groups, particularly the producers. "During the survey, some of the respondents asked: «Who are you? What are your interests in this project?» They thought we just wanted to do a series of surveys and do nothing concrete, to justify the money we obtained for the project implementation," COM noted. COM also encountered notable apathy among the organic food producers when presented with this new initiative, who voiced doubt whether the project would bring about any substantial change. Another significant challenge related to the limited visibility of organic food producers. To address this issue, the project organizers carried out extensive searches of the databases of the Ministry of Agriculture and other relevant agencies and organizations to ensure accurate contact information and to establish direct communication channels with the producers.

The project organizers addressed the issues of distrust and apathy by organizing discussions and debates to explain the aim of the project and the vision for its further implementation, thus building a closer relationship and atmosphere of trust with the interested parties, especially the producers.

LESSONS LEARNED

Most key lessons learned were:

- As the first app of its kind in the country, the initiative coordinator has a unique opportunity to create a strong network of stakeholders operating in various fields.
- The initiative coordinator must identify and approach potential users, offer them a compelling reason to join the larger ecosystem and manage their integration process.
- A strong blueprint for the creation of a network of different stakeholders is crucial to the success of the initiative.



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- Such a pioneering endeavour in a new market comes with considerable responsibility in ensuring that the app is user-friendly, meets the needs of its users and leaves a positive impression on visitors.
- Building trust with stakeholders and users is vital to the success of the app and the broader initiative.
- The sustainability of the project will rely on additional resources and the establishment of links with such potential donors. The Office of Project Management should prioritize programs in the region that support the use of digital tools for the provision of consumer information, and the experience acquired to date should be leveraged to facilitate the integration of organic producers with other consumer organizations.
- At a national level, implementing a membership fee for organic food producers that advertise on the mobile application would contribute to the financial sustainability of the program, along with effective marketing plans targeting consumers.

CONCLUSION

The development of the "Organic Way" mobile app has given strength to the local stakeholders who are cooperating in the promotion of organic production and consumption. Through the project, the partners have established effective lines of communication with organic food farmers in North Macedonia and launched joint advocacy actions. The app's launch, and the resulting increased visibility of organic food, have encouraged supermarket chains, restaurants and tourism operators alike to include more organic options in their product ranges. Furthermore, the project's success is clear evidence of the benefits of modern tools and networking for public access, policy advocacy and the creation of sustainable networks of stakeholders. The project will continue in the future with joint advocacy activities, and the constant maintenance and development of the "Organic Way" web-based mobile app in the years to come with the support of the Ministry and the organic-friendly community.

MORE INFORMATION

This case study was elaborated by the Central European University (CEU) and the Food and Agriculture Organization (FAO).

It was developed through interviews with representatives of the Consumers Organization of Macedonia in 2022.

For further information about this case study, please reach out to FAO at REU-Digital-Agriculture@fao.org

KANATBEK'S TELEGRAM-BASED ADVISORY AND MARKETPLACE

Osh region, Kyrgyzstan

SUSTAINABLE DEVELOPMENT GOALS

INTRODUCTION

The use of instant messaging apps is experiencing a notable surge, with an increasing number of individuals, groups, and businesses leveraging them for both personal and professional purposes, facilitating the exchange of various types of information. In the context of Central Asia, particularly in Kyrgyzstan and Uzbekistan, Telegram messaging groups have gained widespread popularity in recent years.

One noteworthy example is the "Farmers" group (original name: "Фермерлер"), established in 2018 by Kanatbek Kaparov, a Kyrgyz farmer, which now counts over 2 700 members. This group serves as a hub for small-scale livestock and crop producers to buy or sell their products and seek advice from peers on diverse agricultural matters.

A key advantage of this group lies in its ability to address the obstacles posed by large distances and mountainous terrain faced by Kyrgyz farmers by providing farmers with the opportunity to connect with fellow farmers and potential consumers online at minimal cost, the group, empowering farmers to establish a more favorable position in the local and regional agri-food markets.

OBJECTIVE

To highlight the transformative impact of instant messaging apps in empowering smallholders by offering cost-effective avenues for product marketing and facilitating thematic knowledge exchange among peers. Specifically, the story of Kanatbek Kaparov, the founder of the "Farmers" Telegram group, exemplifies the intentional use of technology to create a platform that enables Kyrgyz farmers, regardless of their remote locations, to effectively showcase their products and seek valuable advice. Through this lens, the case study sheds light on the broader implications of instant messaging in enhancing knowledge-sharing and market access for agricultural communities.

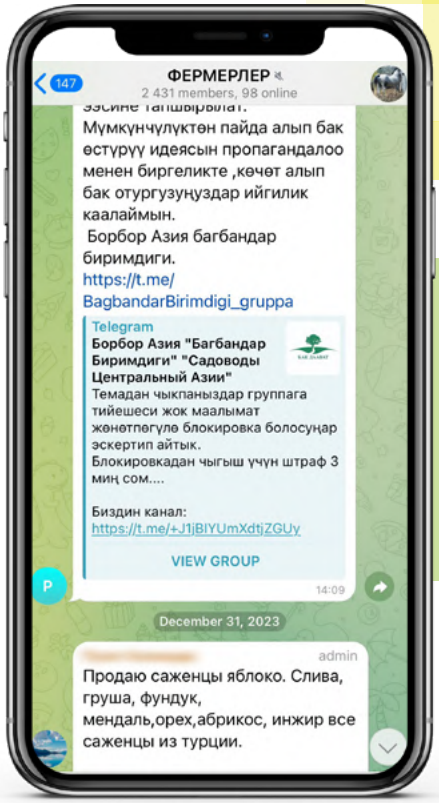
ACTORS AND STAKEHOLDERS

- Kanatbek Kaparov, initiator and facilitator of the group;
- small-scale farmers, interested in buying or selling agricultural products and participating in thematic discussions; and
- entities involved in agricultural businesses that use the platform to promote their products and share special offers.

GEOGRAPHICAL COVERAGE

The founder of the Telegram group is from Osh, a city situated in the Southern part of Kyrgyzstan.

Source: United Nations Geospatial. 2011. *Kyrgyzstan*. Cited 27 December 2023. https://www.un.org/geospatial/file/2036/download?token=ACIAKvzw



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METHODOLOGICAL APPROACH

There are nearly 6 million Telegram users in Kyrgyzstan, making this instant messaging app among the most popular ones in the country. The "Farmers" Telegram group signifies a switch from similar, but less active groups that previously emerged on WhatsApp. Telegram, surpassing other messengers in overcoming technical limitations, has emerged as an optimal platform for gathering a substantial number of individuals who share common professional interests and challenges. It seamlessly facilitates the online buying and selling of produce, providing a user-friendly interface.

The decision to establish a Telegram group stemmed from Kanatbek's observations that farmers in neighboring Uzbekistan were already successfully utilizing this app for both commerce and communication. Leveraging positive experiences from the Uzbek context, the group has become a singificant space for Kyrgyz farmers to connect, trade, and address shared challenges.

Within the group, farmers seeking to sell their products can provide product details, including the type and quantity of produce, pricing information, and their contact number. These posts often include visual aids such as pictures or videos, particularly for livestock offerings. Prospective buyers can initiate direct communication with the sellers through private messages, streamlining the transaction process. Beyond being a marketplace, the group functions as a virtual hub for peer support, enabling farmers to exchange advice and share experiences related to various aspects of agriculture.

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Conversations span topics from crop management techniques to livestock care, fostering a dynamic community where members leverage the collective knowledge and expertise of their peers. Additionally, agribusinesses utilize the channel to promote their products and share special offers. In the group, Kanatbek assumes the role of content producer, facilitator, and the overall channel moderator, ensuring a harmonious and productive environment.

In addition to the Telegram group, Kanatbek has expanded his online presence with a YouTube channel called “Bak Dawat”, showcasing videos of his agricultural activities. To broaden his outreach, Kanatbek manages profiles on Facebook and Instagram, sharing valuable agricultural advice. This diversified approach ensures accessibility for users with varying social media preferences. Kanatbek has accumulated several thousand followers across his various online platforms, including the Telegram group “Farmers”, which has 3 703 members and is consist-ently growing. This highlights the success of his comprehensive digital strategy.

VALIDATION

The Kyrgyz "Farmers" group on Telegram is experiencing continuous growth, attracting nearly three thousand members who share a common interest in agriculture. This trend echoes the success of similar online communities in other countries, such as the "Chorvador" Telegram group in Uzbekistan, which boasts over six thousand users. Like "Farmers", "Chorvador" serves as a platform for smallholders and agrodealers to engage in buying and selling, as well as exchanging valuable information and advice. However, a notable distinction lies in the monetization strategy: while the "Chorvador" group charges for advertisements, "Farmers" offers its services for free, enabling small-scale producers to promote their products without incurring fees. Another noteworthy example is the "Issikhona-agro-greenhouse" Uzbek Telegram channel, with a membership exceeding 18 000 greenhouse growers seeking advice or marketing their produce, including international users from Tajikistan and Kyrgyzstan.

The reputation of the "Farmers" group in Kyrgyzstan has reached noteworthy heights, with Kanatbek conducting seminars across 40 regions in the country. As trust in his professionalism and advice grows, the efficacy of his social media groups correspondingly increases. This success is underscored by long-term users like Alash Kudaibergenov, a farmer in the Chui Valley, who has actively utilized the platform for three years, resulting in numerous successful business deals. The sustained activity of the group over almost four years underscores its significance to Kyrgyz farmers.

SUCCESS FACTORS

There are several factors contributing to the success of "Farmers" Telegram group:

- Kanatbek as leading figure: the founder’s active engagement in online discussions, provision of advice, and content sharing across multiple platforms, including Telegram, YouTube, Facebook, and Instagram, enhances the user experience. Serving as a content producer, facilitator, and overall channel moderator, Kanatbek ensures a harmonious and productive environment within the group.
- Choice of platform: The selection of Telegram aligns with local preferences, considering its popularity in Kyrgyzstan, particularly for professional purposes. This choice eliminates the need for farmers to learn a new app, contributing to user-friendly access. Choosing Telegram over other instant messaging applications has proven effective in overcoming technical limitations, facilitating the gathering of a substantial number of users sharing common professional interests.
- Business model: The establishment of thematic Telegram groups, including "Farmers" is free of charge, with minimal maintenance costs. The decision to offer services for free distinguishes "Farmers" from similar groups, contributing to its widespread popularity.
- Virtual hub for peer support:
  The group functions not only as a marketplace but as a dynamic virtual hub for peer support. Discussions cover a range of agricultural topics, fostering a community where members leverage collective knowledge.
- Diversified online presence:
  Kanatbek’s strategy of expanding to YouTube, Facebook, and Instagram, alongside Telegram, ensures accessibility for users with varying social media preferences.

IMPACT

For many individuals in Kyrgyzstan, particularly those residing in remote and mountainous regions, an instant messaging group like "Farmers" serves as a crucial substitute for physical marketplaces. While traditional bazaars remain integral to Central Asian culture, the COVID-19 pandemic has ushered in significant changes, promoting the widespread adoption of online tools for goods exchange. Take, for example, Almaz Imanaliev, a member of the "Farmers" group, who shared that he has been using online platforms to purchase seeds and fertilizers for the past decade. These online marketplaces are increasingly recognized as vital alternatives, especially for farmers unable to visit physical bazaars during the agricultural season.

Given the time-consuming nature of travel for farmers in remote or mountainous areas, Telegram-based marketplaces offer a convenient solution, reducing costs and allowing farmers to position themselves more favorably without sacrificing valuable time or resources, particularly during the demanding periods of the agricultural seasons.

Moreover, Telegram-based agrimarketplaces present a user-friendly advantage for small-scale farmers compared to conventional e-commerce platforms. E-commerce often demands high-quality pictures, detailed product descriptions, an email address, creating barriers for those with limited digital literacy. In contrast, Telegram-based platforms provide a more immediate and simplified communication channel. This immediacy allows farmers to swiftly share product information, negotiate deals, and seek advice within the familiar and accessible environment of a messaging app. The simplicity of this process makes Telegram-based agrimarketplaces particularly well-suited for small-scale farmers, enabling them to participate in online commerce without advanced digital skills.

SUSTAINABILITY

The sustainability of the "Farmers" Telegram messaging group for Kyrgyzstan's farmers is rooted in various key elements. Economically, the platform provides a sustainable online marketplace, fostering economic inclusion for small-scale producers by facilitating the buying and selling of agricultural products. The platform's role as a virtual hub for peer support contributes to community resilience, creating a space for farmers to share experiences and knowledge. Culturally, the choice of Telegram aligns with local preferences, ensuring the practice's sustainability within the context of Kyrgyzstan. The gradual building of trust and reputation over time further enhances the sustainability of the platform, as users recognize it as a reliable source for agricultural advice and commerce.

CONSTRAINTS

The efficacy of the Kyrgyz messaging app, "Farmers" for online marketing and knowledge-sharing is not without its inherent constraints:

- Content overload and potential lack of focus in large groups: As the "Farmers" Telegram group continues to grow, there is a risk of losing focus, with a potential influx of unrelated content and advertisements. Without strict adherence to group rules, the platform may deviate from its primary functions as an online marketplace and a space for trusted advice. If the platform becomes cluttered with irrelevant content and advertisements, there is a risk of member disengagement. Users may leave the platform if it no longer serves its intended purposes, impacting the overall effectiveness of the "Farmers" group.
- Access challenges: limited internet connectivity, digital literacy gaps often stemming from generational or gender disparities, and device acessibility issues, such as use of feature phones over smartphones, hamper the ability to achieving equitable access. These barriers underscore the ongoing challenges in ensuring inclusive participation across diverse demographics and geographies.

LESSONS LEARNED

Since its establishment in 2018, the "Farmers" Telegram messaging group for Kyrgyzstan's farmers has yielded valuable lessons:

- Platform alignment: the success of the "Farmers" Telegram group highlights the importance of aligning the choice of the online platform with local preferences. Choosing Telegram, a popular messaging app in Kyrgyzstan, has proven effective in facilitating widespread accessibility.

REPLICABILITY AND UPSCALING

The replicability and upscaling potential of the "Farmer" group are notable for several reasons. Firstly, it transcends geographical limitations, presenting a replicable model that can be effortlessly implemented in diverse countries and contexts. The only prerequisites for potential users are access to a Telegram-enabled phone or computer and internet connection. Examining examples from other countries, notably Uzbekistan, attests to the ease with which this practice can be transferred and modified to cater to the specific needs of communities at national or local levels. In addition, the platform's use of Telegram, a widely popular messaging app in the region, making it easily replicable in other communities with similar preferences. The thematic focus on agriculture, coupled with the virtual peer support aspect, can be adapted to various geographical contexts, fostering knowledge exchange among farmers. The economic sustainability model, facilitating online buying and selling without additional fee, positions this practice as a replicable and scalable solution for reaching larger agricultural communities.

CONCLUSION

In conclusion, the "Farmer" Telegram messaging group emerges as a transformative force in Kyrgyzstan's agricultural landscape, providing a dynamic online community for small-scale producers. The multifaceted benefits extend from costless, fast, and easy access to local and regional markets. Furthermore, its impact goes beyond commerce, serving as a capacity development and knowledge hub. The "Farmer" group, with its adaptability, inclusivity, and economic sustainability, stands as a beacon for the positive transformation achievable through digital solutions in agriculture.

- Diversified online presence: Kanatbek Kaparov's strategy of expanding to multiple online platforms, including YouTube, Facebook, and Instagram, alongside Telegram, showcases the value of a diversified online presence. This approach ensures accessibility for users with varying social media preferences, contributing to a broader reach.
- Community building beyond commerce: the success of the group extends beyond being a marketplace, emphasizing the importance of community building. Providing a virtual hub for peer support fosters a dynamic environment where members can exchange knowledge, enhancing the overall user experience.
- Monetization strategy: the decision to offer services for free distinguishes "Farmers" from other groups and plays a role in its widespread popularity, as seen in contrasting groups like "Chorvador".
- Thematic focus: Maintaining the thematic focus of the group is of critical importance. The sustained value and success of the "Farmers" Telegram group hinge on aligning with the expectations of its members.
- Trust building: Building trust and reputation are gradual processes that require time and consistent effort. The presence of a dedicated enthusiast, who serves as the initiator and leading figure in the Telegram group, plays a pivotal role in this process.

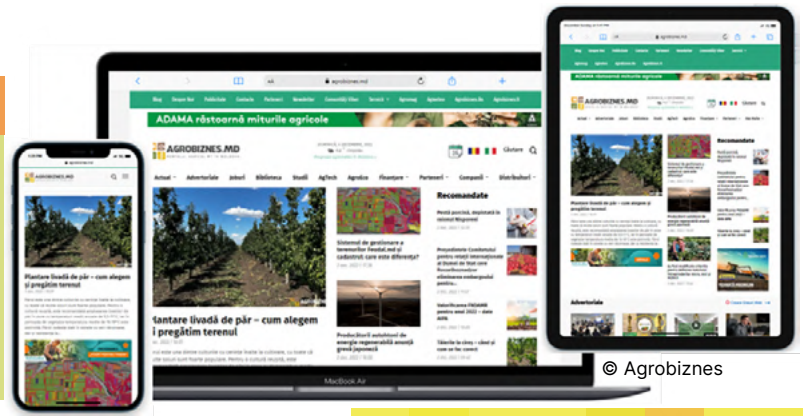
MORE INFORMATION

This case study was elaborated by the American University of Central Asia (AUCA), and the Food and Agriculture Organization (FAO).

It was developed through interviews with Kanatbek Kaparov, founder of the Telegram group in 2022.

For further information about this case study, please reach out to FAO at REU-Digital-Agriculture@fao.org.

SERGIU'S AGROBIZNES ONLINE PORTAL: AGRICULTURAL KNOWLEDGE AND INFORMATION FOR FARMERS



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Republic of Moldova, Chișinău

SUSTAINABLE DEVELOPMENT GOALS

OBJECTIVE

The objective of this good practice case study is to showcase the key elements, success factors and impact of Agrobiznes, the largest agricultural knowledge and information portal Republic of Moldova, as well as a range of connected initiatives. The document presents the digital services freely available to stakeholders, addressing their development, use case, and impact. The case study describes enabling factors, as well as constraints, which have shaped the experience, and perspectives for building on its success.

INTRODUCTION

In 2011, Sergiu Jaman was a young professional living in Chișinău, with experience as a TV reporter and producer. With the aim of combining insights gained from his work with his personal interest in agriculture and information and communication technology (ICT), he created a small media company which in the following year launched the Agrobiznes website (agrobiznes.md). Envisioned primarily as a source of agricultural news, the website also served as a point of reference for digital services offered to agricultural companies. Initially working on his own, Sergiu compiled and published agricultural information online, perfecting the look and functionality of the web portal. Over the next few years, the project registered a significant expansion in scope, with the creation of an editorial team and a growing number of collaborations with sectoral experts, as well as local and international organizations. As a result, Agrobiznes became an important source of agricultural news, data, and expertise, accessible free of charge. In addition, the media project began establishing itself as an enabler for digital communities interested in agriculture and digital transformation. A growing interest in the services provided on the platform generated a steady increase in the number of users. As a result, Agrobiznes has become the most visited web portal focusing on agricultural information in Republic of Moldova, and one of the most successful media initiatives of its kind in Eastern Europe.

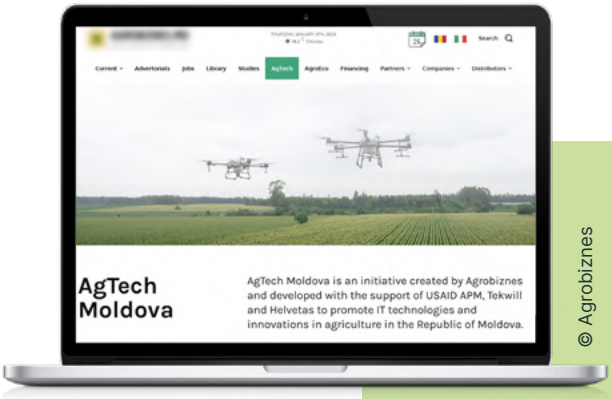
GEOGRAPHICAL COVERAGE

Republic of Moldova, Chișinău

Source: United Nations Geospatial. 2013. *Republic of Moldova*. Cited 27 December 2023. https://www.un.org/geospatial/file/2096/download?token=Lt_9K319

ACTORS AND STAKEHOLDERS

- farmers
- practitioners
- national and international organizations
- agripreneurs



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METHODOLOGICAL APPROACH

The Agrobiznes portal serves as the central hub for a range of information, advisory, and communication services. These are organized by topic, and include substantial content related to the agricultural sector, primarily focusing on (but not restricted to) realities in Republic of Moldova. All the resources published on Agrobiznes are available free of charge. The services provided can be grouped according to their scope, functionality and use case:

News and current affairs. This includes: news (typically several per day) from the agricultural sector; full articles, often focusing on practical aspects and advice; an agricultural event calendar, with additional details for scheduled events; an analytical section with market insights; a business section with business ideas and success stories, covering both startups and larger farms. News and articles address a wide range of issues directly or indirectly connected to agriculture, from technological developments in agricultural production to market conditions, financing, and legislative updates. News relevant to women farmers, including training programs and access to financial aid, are published regularly. It is worth noting that in the Agrobiznes editorial team, women are the majority, facilitating the development of gender sensitive content. Another significant output is the agricultural podcast, AgroPodcast (agrobiznes.md/podcast), produced since 2021 with support from FAO, and covering specialized topics, mostly related to domains of agricultural production.

Each podcast, hosted on the Soundcloud platform, is reachable from a dedicated page, with supplementary information and references, where appropriate. Finally, a newsletter is broadcast twice a week to those interested, delivered either by email or through the WhatsApp application.

The Agrobiznes digital library (biblioteca.agrobiznes.md), launched in 2021 and developed in partnership with United States Agency for International Development (USAID) and Tekwill (tekwill.md), is a searchable repository of over 100 freely downloadable guidebooks, grouped by topic (e.g., irrigation, organic farming, beekeeping, financial planning, viticulture, pesticides, fruit production, vegetable production). Some materials are also available in minority languages (Russian). The guidebooks are published by national and international partner organizations involved in the development of the agricultural sector in Republic of Moldova. Downloading materials requires free registration on the portal; uploading them is limited to organizations registered and authorized for this purpose, in order to safeguard the standards of the digital library.

The AgMeteo platform (agmeteo.md) , developed in partnership with iMetos (metos.at) and Moldova Agroindbank is a weather forecast service that provides real-time access to data from over 100 weather stations distributed across the country. AgMeteo introduces substantial benefits for smallholders and medium-sized farms, as they can obtain real-time information from nearby weather stations at no cost. In addition, AgMeteo integrates the iMetos disease modeling interface, which helps farmers plan for pest and disease prevention.

Community building and digital transformation. Support for information sharing and digital communities is embedded in most services hosted on Agrobiznes. Two initiatives, however, stand out in this category. First, the Agrobiznes Viber communities, launched in 2018, with over 15 000 members and covering 15 themes, ranging from ecological agriculture to technology and trade; second, the annual AgTech conference, which hosted its third edition in 2022, and which brings together local and international stakeholders interested in promoting technological development and digital transformation in agriculture.

Educational resources. In addition to the expertise shared in the digital library, Agrobiznes maintains a dedicated page with links to accredited institutions teaching agricultural studies in Moldova. Details on each institution and their activity profile are provided, together with additional presentation materials (e.g. videos), where available. Also in this section, users have access to collected news articles related to agricultural education. Agrobiznes, in partnership with USAID and Tekwill, hosted two editions (2020 and 2021) of the AgTech Academy, a specialized training session for young graduates, in which the latter learned from experts in the field and interacted with agricultural companies, resulting in several internships.

Job portal. Several tools to support the agricultural job market and share employment opportunities are available on the platform: job announcements; a dedicated Telegram channel with over 1 000 members; a request form for internships with established agricultural companies.

The AgroMag digital marketplace (agromag.md) is a business-to-business platform aimed at facilitating trade. Over 50 companies are present, with over 1500 products being presented or marketed. Agrobiznes also provides a catalogue with information and links to agricultural businesses, distributors, input suppliers, and connected service providers (e.g., financial institutions).

SUCCESS FACTORS

Both internal and external factors contributed to the success of the Agrobiznes project. It all starts with the drive and persistence of its founder, colleagues, and partners, to bring a fresh, inclusive and comprehensive approach towards sharing information and expertise and connecting with a wide range of existing and potential stakeholders. This has proven to be particularly effective, in tandem with a positive external factor: the overall importance and development trend of the agricultural sector in Republic of Moldova and the region, with a large community of farmers becoming ever more interested in digital news, data, and competent guidance. This enabling regional context is also emphasized by the popularity of the portal outside of Republic of Moldova (e.g., more than half of visitors access the site from Romania). Finally, support and financing made available by partnering organizations, both local and international, has been essential for the success of specific projects.

CONSTRAINTS

One common obstacle to digital transformation, particularly for smallholders and poorer communities, is the level of digital skills required to access and benefit from digital services. In this regard, the level of digital skills needed to use the Agrobiznes platform is relatively low, as the website serves as a hub for all connected functionalities. To further lower the entry barrier for potential stakeholders, attention was given to supporting a range of communication channels that are well-known and used by farmers in Moldova (e.g., Viber, Telegram, WhatsApp, Facebook).

VALIDATION

Considering its primary focus on sharing information and expertise, direct validation of the Agrobiznes portal is provided by the size of its audience and the level of outreach achieved. With over 2 million unique visitors per year and continuously growing interest into the services and initiatives it hosts or links to, the Agrobiznes website is a well-established and popular agricultural information source in Republic of Moldova and beyond. Further validation is granted through the interest and support of local and international organizations as partners on specific projects.

IMPACT

The information services made available through the Agrobiznes portal provide a range of tangible benefits for its stakeholders. First and foremost, the portal facilitates easier and faster access to agricultural information, by publishing a large volume of sectoral news, data (e.g., the AgMeteo platform), insights (e.g., AgroPodcast), and training materials (e.g., the Agrobiznes library) through a feature-rich, accessible and responsive user interface. In addition, stakeholders gain access to higher-quality, trustworthy information, through the review standards implemented by the editorial team and the reliable expertise provided by partnering organizations. The portal also increases active participation and collaboration between stakeholders by introducing them to specialized events (e.g., the AgTech conference, the AgTech Academy), as well as dedicated digital platforms (e.g., the AgroMag marketplace) and communication channels (e.g., Jobs channel, Viber communities). Together, these benefits act as a catalyst for change, on the path toward digital transformation.

SUSTAINABILITY

The economic sustainability of the media project depends on reliable financing and a viable business model. For Agrobiznes, this hinges on the continued success of its hybrid approach, where advertising and media services geared primarily towards medium-to-large businesses generate the bulk of the revenue, which then enables, with additional support from external partners, the provision of cost-free information, advisory, and educational aids available to all farmers.

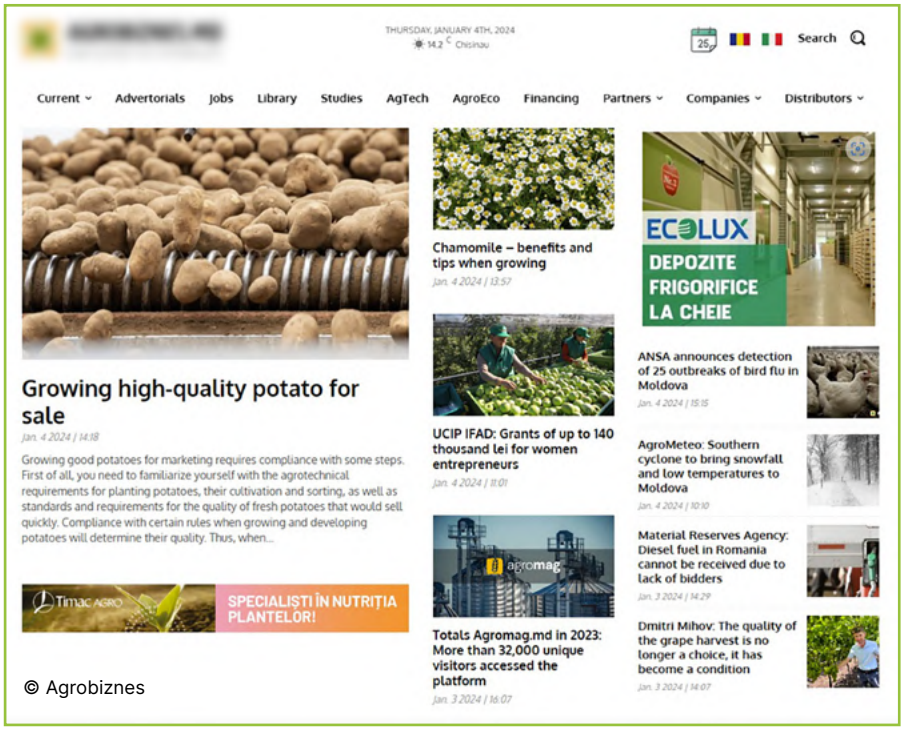
Agrobiznes project operates in a typical business environment defined by opportunities and risks. Sergiu has a positive take on this issue, stressing that the team is focused on its mission, rather than potentially negative local factors, such as competition, or other external constraints which are beyond its control (personal communication, November 21, 2022).

LESSONS LEARNED

A few important lessons can be highlighted from capitalizing on the experience of Agrobiznes, particularly with regard to the free information services offered and their outreach:

- Commitment to innovation is key, together with the willingness to learn, adapt, analyse feedback, and experiment with new approaches, even at the risk of failing. As Sergiu puts it, "in a sense, we [the Agrobiznes team], also grew up, as professionals, together with the platform".
- Working and collaborating with sectoral experts, through flexible arrangements, when necessary (e.g., regular employment or ad-hoc basis, in-house or remotely), ensures the quality and impact of the output. Equally important is an active mindset toward partnering up with local and international organizations with significant topical knowledge and development experience.
- Establishing and nurturing communication channels to foster participation and support a large and diverse community of agricultural stakeholders is essential, if the aim is to generate lasting change.

As a media entity dealing primarily with digital information and tools, the environmental footprint of the Agrobiznes project is moderate to low. Social sustainability has a strong outlook for the near future, given the growing number of stakeholders; in the medium-to-long term, it depends on continuing to provide free and affordable access to relevant resources and expertise while building and maintaining inclusive digital communities.



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REPLICABILITY AND UPSCALING

In 2021, the Romanian website of Agrobiznes was launched (agrobiznes.ro), followed in 2022 by the introduction of the Italian website (agrobiznes.it). The two developments are a testament of the potential for replicability and show that the approach implemented in Republic of Moldova can be adopted in other countries, despite differences in socio-economic contexts. Inevitably, adaptation is required to better respond to the local needs. Initial results are promising, with both platforms registering significant growth in the number of visitors since their inauguration.

CONCLUSION

The Agrobiznes media project and web portal are proof that, when it comes to digital transformation, an entrepreneurial spirit can bring significant benefits to a large number of stakeholders. The Agrobiznes portal provides many benefits to its stakeholders. It offers easy and fast access to agricultural information through a user-friendly interface that features a large amount of news, data, insights, and training materials. Stakeholders also benefit from the editorial team's review standards and partnering organizations' reliable expertise, ensuring the information's quality and trustworthiness. The portal promotes collaboration between stakeholders by hosting specialized events, digital platforms, and communication channels. Moreover, integrating an inclusive and collaborative approach can transform such an initiative into a highly effective agent of change.

- The financial stability of a media project is crucial and can be achieved through a viable business model and reliable financing. A hybrid approach, where revenue is generated primarily from advertising and media services geared towards medium-to-large businesses, can fund the provision of cost-free information, advisory, and educational aids to all farmers with additional support from external partners.
- Production of gender-sensitive content is a critical success factor to ensure reach to rural women. This can be reflected in various ways, such as publishing news that is relevant to women farmers, including training programs and access to financial aid. Additionally, having a gender-balanced editorial team, with women in the majority, can facilitate the development of gender-sensitive content.
- Digital skills can be an obstacle to digital transformation, particularly for smallholders and poorer communities. However, this barrier can be addressed by making digital services more accessible. For example, the Agrobiznes platform requires relatively low levels of digital skills, Likewise, by making digital services accessible through familiar communication channels, the entry barrier for potential stakeholders can be lowered.

MORE INFORMATION

This case study was elaborated by the Central European University (CEU) and the Food and Agriculture Organization (FAO).

It was developed through interviews with Sergiu Jaman, founder of a media company that launched Agrobiznes website in 2022.

For further information about this case study, please reach out to FAO at: REU-Digital-Agriculture@fao.org

ALIYA'S PROMOTION OF FELT RUGS ON SOCIAL MEDIA

Chui, Issyk-Kul, Naryn regions, Kyrgyzstan

SUSTAINABLE DEVELOPMENT GOALS

INTRODUCTION

Roughly two-thirds of Kyrgyzstan's impoverished population resides in rural regions. High unemployment rates, particularly among women, constitute a major social challenge. Facilitating the integration of women into the labour market, particularly in agriculturally oriented regions, can lead to enhanced living standards and generation of new income streams.

In 2013, Aliya Rakhman decided to establish Nakta World, a company aimed at supporting rural women residing in remote areas of Kyrgyzstan to earn their living by producing traditional eco-friendly, premium felt rugs, which are handmade of compressed and matted sheep wool. Nakta World employs between 40 and 100 artisans from the villages of Naryn, Chui, and the Issyk-Kul regions who meticulously craft the felt rugs, referred to as shyrdak tailored to meet the demands of domestic and international clients. Through this endeavour, the company not only contributes to the preservation of traditional craft but also ensures a dependable and decent source of income for the artisans.

OBJECTIVE

This case study describes the experience of a female entrepreneur from Kyrgyzstan who leveraged the potential of social media platforms to market traditional Kyrgyz eco-friendly premium felt rugs globally. Her company, Nakta World, revived the traditional technique of rug making by incorporating contemporary designs which gained international interest in the unique products of rural artisans. Aliya's business idea not only rekindled the appreciation for artisanal Kyrgyz rug making, but also played a pivotal role in empowering rural women artisans by providing them with opportunities to participate in rug production and generate a decent income.

Nakta World heavily relies on the local knowledge of women artisans for both felt rug production and design. In an effort to preserve the traditional knowledge, Aliya Rakhman, the owner of the company, organized training sesions aimed at equipping rural women with the skills necessary for engaging in rug making with the support of USAID in 2019. The collaborative effort yielded substantial results, with more than 1 000 women trained in the art of felt rug making.

In response to the increasing global recognition of traditional Kyrgyzstani felt rugs, Nakta World is actively adapting by showcasing their products online through an English-language website as well as across social media. Customers of Nakta World have become aware that Kyrgyz felt rugs are made using an ancient nomadic technique of felting and quilting wool. The United Nations has recognised the artisanal rug-making skill, and shyrdak rugs were added to UNESCO's list of Intangible Cultural Heritage in Need of Urgent Safekeeping in 2012.

GEOGRAPHICAL COVERAGE

The majority of women artisans working for Nakta World live and work in villages across Naryn, Chui, and Issyk-Kul regions, while the main workshop is located in Bishkek city.

Source: United Nations Geospatial. 2011. *Kyrgyzstan*. Cited 27 December 2023. https://www.un.org/geospatial/file/2036/download?token=ACIAKvzw

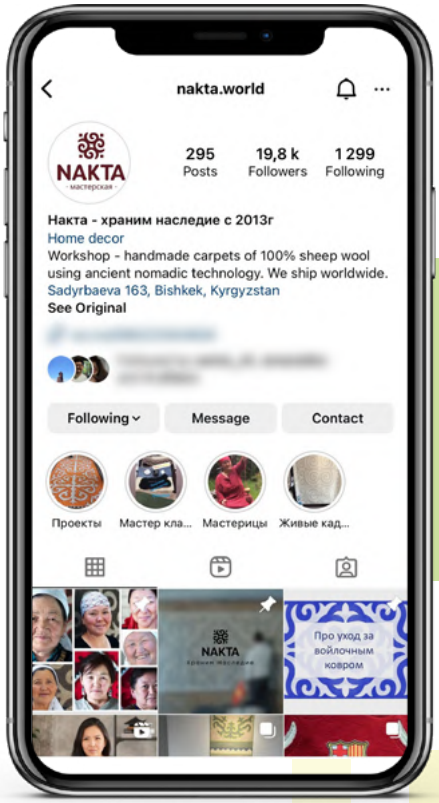
METHODOLOGICAL APPROACH

Eco-friendly, premium felt rugs of Nakta World are well-known within and outside Kyrgyzstan, whereby 90 percent of their products are exported to France, Japan, Kazakhstan, Norway, Russian Federation, Ukraine, United States of America, etc. Nakta World's market positioning and robust emphasis on international consumers are bolstered by their social media presence and the company's English-language website.

Nakta World relies on brand marketing through Instagram. With over 20 000 followers, Nakta World's Instagram page is regularly updated with engaging stories, highlights, reels and photos that immerse followers in the journey of felt rug production, showcasing the artisan women, as well as unveiling the team's latest projects.

ACTORS AND STAKEHOLDERS

- women artisans
- raw material suppliers
- distributors (local and foreign)
- buyers



© Nakta

Nakta World's Instagram posts and highlights showcase images, videos, and stories of the women who create the felt rugs, providing customers with an opportunity to connect with the individuals behind the craftsmanship. One of Nakta's posts states:

Our Nakta workshop has dozens of faces. These are the faces of women: mothers, sisters, grandmothers, wives and daughters. These are the faces of the keepers of the heritage of our ancestors. Creative power permeated with hundreds of hours of manual labour. Each stitch on the carpet absorbed the warmth and care of women's hands and hearts, with wishes to bring harmony, goodness and protection to the home...

Additionally, customers share photos of purchased felt rugs along with their reviews, which are then reposted or shared on company's Instagram page. This helps in building trust in the brand. The photos shared by customers serve as practical examples of how the felt rugs can be integrated into various interior spaces.

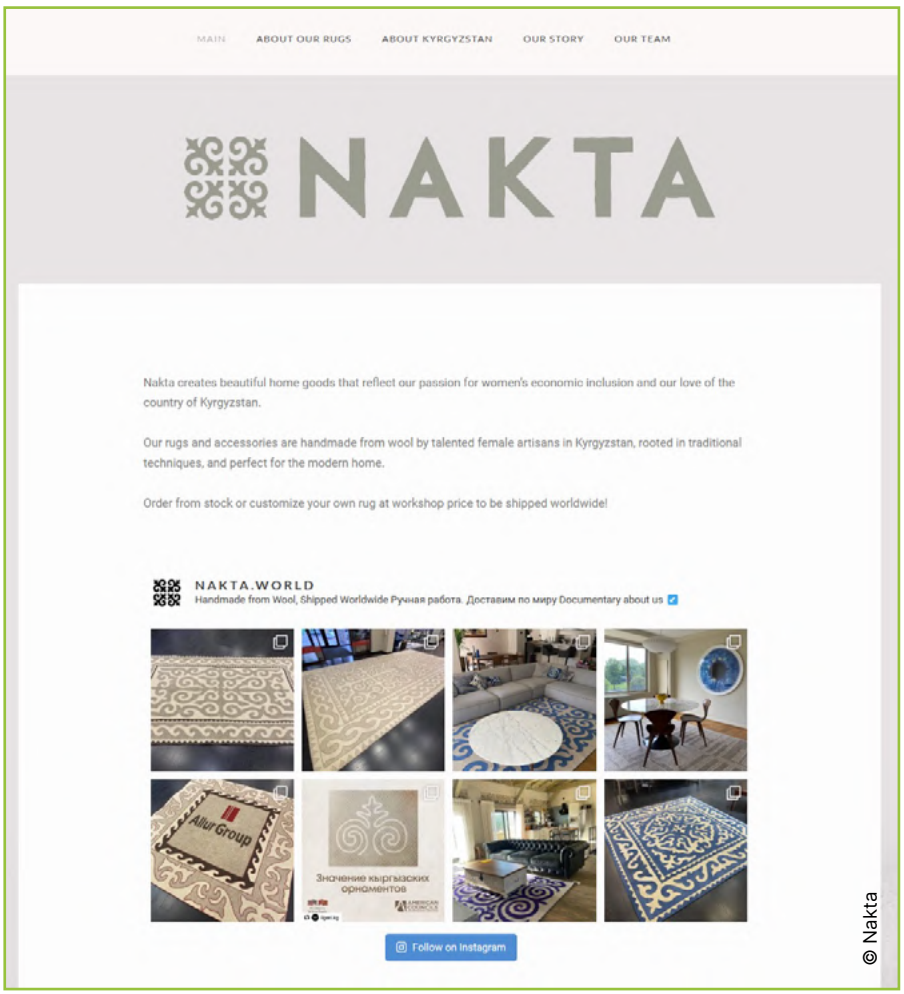
Nakta World uses a WhatsApp business account to showcase a catalogue of available felt rugs, view prices, share information about the company, and respond to inquiries. Users can place an order directly through Nakta World's WhatsApp account, which is supported by a chatbot.

VALIDATION

- Supported by marketing and sales through social media, and its English-language website, Nakta World has grown its customer base and expanded their market penetration which indicates the success of their business model.
- Nakta World's endeavour to revive the traditional art of crafting felt rugs by enriching them with contemporary designs, and empowering rural women artisans who handmake the rugs to earn dependable and decent income has garnered the attention of national and international journalists, who have produced articles and documentaries showcasing Nakta World's impactful activities.

SUCCESS FACTORS

- Nakta World employs an English-language website to attract international customers, thereby expanding its customer base globally.
- Nakta World actively and consistently uses Instagram and WhatsApp to showcase its product catalogue, communicate with customers, and manage orders.
- The Instagram and WhatsApp accounts of Nakta World present a cohesive brand message by posting curated content. They actively engage their customers by encouraging them to share photos of purchased rugs and their reviews. This not only builds brand trust and loyalty but also offers insights into how the felt rugs can be creatively integrated into diverse interior settings to potential customers.
- Nakta World leverages storytelling on Instagram, sharing photos, videos, and stories that feature the artisan women crafting the felt rugs. This humanizes the brand, enabling customers to know the artisans behind the artwork and connect with their stories.
- The marketing strategy of Nakta World is supported by an international team that has been involved since the establishment of the company.
- Establishing a partnership with USAID during the first years of the company's operations, facilitated the training of artisans, equipping them with rug-making skills. This also created a potential workforce pool for the company.



IMPACT

Positive impact on the livelihoods of rural women of remote regions in Kyrgyzstan is Nakta Design's main strength. By employing between 40 and 100 mainly older women artisans across the country, the company not only provides them with additional income but also serves as a catalyst for women's empowerment. By working remotely, these women are in a position to generate decent income while still ensuring they have sufficient time to spend with their families. This enables women to expand their family's livestock, elevate their living standards, and afford their children's education. Furthermore, by building a strong social media presence for Nakta World, over the course of several years, Aliya has successfully cultivated increased popularity of felt rugs as a unique and beautiful interior design item that has a rich history and tradition.

CONSTRAINTS

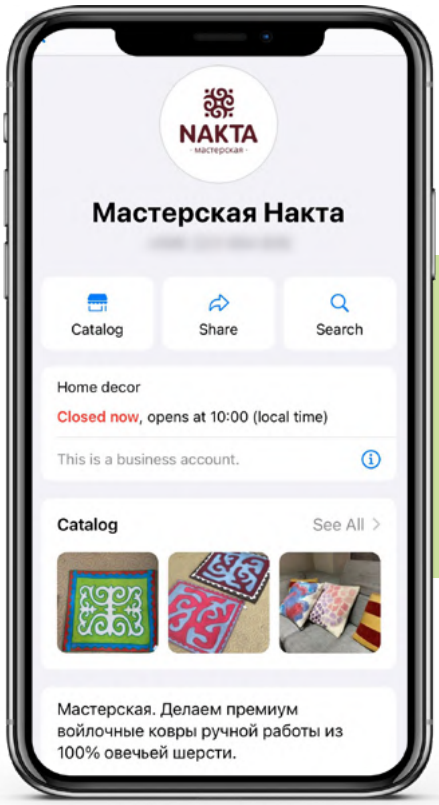
The adopted online marketing strategy must be built on comprehensive market research and advertisement in order to solidify the company's market position. This requires continuous maintenance and investments as online marketing strategies should be constantly adjusted to evolving trends.

LESSONS LEARNED

- Consistently sharing carefully crafted and engaging content aligned with current trends on company's Instagram account and the website can effectively enhance the brand visibility and awareness.
- Harmonizing the company's website with the social media platforms to cater to needs of diverse customer groups – local, regional and international – can enhance the outreach and potentially increase revenue. Sharing photos, videos and stories of rural women artisans who craft the felt rugs, humanizes the brand by allowing customers to get to know the individuals behind the artwork and personally connect with their stories. Encouraging customers who have made purchases to share photos and reviews of the products can contribute to fostering greater trust and loyalty within the customer base.

SUSTAINABILITY

With the widespread use of social media platforms worldwide, online promotion remains one of the key elements to reach customers in both local and international markets, especially for products that can easily be shipped abroad. Additionally, the popularity and widespread usage of social media are likely to continue in the future. Consistent social media marketing and the English-language website enhances the visibility and company awareness which is imperative, as aliya reports the produced felt rugs are predominantly demanded in foreign markets and gaining popularity on local market. As a result, the utilization of social media platforms and a dedicated website has played a pivotal role in enhancing the sustainability of Naka World.



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REPLICABILITY AND UPSCALING

Marketing and sales through social media and websites are becoming standard practices for businesses, driven by the growing availability of these tools. Establishing a website or creating a presence on social media platforms has become more convenient, often involving minimal costs and relative simplicity. As customers are becoming more digitally literate and getting more accustomed to purchasing goods online, this practice is replicable. According to Aliya, others have followed their example, replicating the practice of selling shyrdaks online.

CONCLUSION

Nakta World's felt rugs produced by rural women artisans are in high demand in the international market. The customer base is constantly growing due to its robust social media presence and its English-language website. Regular and compelling content posted on social media ensures customer engagement. Through these efforts, the company actively contributes to the preservation of the traditional art of felt rug making while simultaneously promoting the widespread use of these rugs. It serves as a catalyst for increasing awareness about the intricate traditions and historical significance associated with these rugs. Additionally, the company plays a crucial role in empowering rural artisan women by providing them with valuable income-generating opportunities. Aliya's innovativeness and communication ensured her company's growth and an expansion of the client base.

MORE INFORMATION

This case study was elaborated by the American University of Central Asia (AUCA), and the Food and Agriculture Organization (FAO).

It was developed through interviews with entrepreneur Aliya Rakhman in 2022.

For further information about this case study, please reach out to FAO at REU-Digital-Agriculture@fao.org.

DIGITAL BREEDING

AUTOMATED HERD MANAGEMENT SYSTEM: ERKEBULAN'S TRANSFORMED DAIRY FARM

© Yeldala/Sergey Buyanov

Mamlyut district, Minkeser and Bekseit villages, North Kazakhstan region, Kazakhstan

SUSTAINABLE DEVELOPMENT GOALS

INTRODUCTION

Erkebulan Mambetov has been growing crops for a long time. He has been getting high yields of grain and other crops. Several years ago, Erkebulan decided to diversify his business and master cattle breeding. In 2012, he started breeding Black Angus for slaughter, and in 2019 he opened a dairy farm.

With many years of experience in the agricultural business, Erkebulan understood that the path to production efficiency was through data collection. Given the volatile market situation, it was extremely important for him to adequately assess the current capabilities of his farm and plan his activities as carefully as possible.

Like many owners of agricultural enterprises in Kazakhstan, Erkebulan constantly faces personnel shortages. There are very few experienced specialists; young people, leaving to study in the city, hardly ever return to the villages. Erkebulan realized that he would not be able to hire many workers to work on a dairy farm, so he decided to use an automated herd management system.

By introducing this technology, Erkebulan pursued two goals:

- Automate the accounting of cattle and the volume of milk produced, while monitoring the health status and treatment of cows.
- Reduce the need for labour.

Automation allowed Erkebulan to take into account the reproduction rate of the livestock, the amount of feed consumed, and the state of health of the animals

OBJECTIVE

This case study focuses on the experience of a farmer from Northern Kazakhstan, who previously was only engaged in crop production, but over the past two years has successfully diversified his business by building a dairy farm. It also explores how the automation of herd management has helped him succeed in his business, and how other cattle breeders can apply this practice.

when managing the farm. All this helped him to effectively plan his farm's activities. Two years after he started, the farm reached its production targets: 12 tonnes of milk per day.

The farm currently houses 1 300 head of cattle, of which the 600 are dairy. Only 40 people work on the farm, including specialists and unskilled workers. With traditional herd management, it would take a lot more to manage a herd of this size.

GEOGRAPHICAL COVERAGE

Mamlyut district, Minkeser and Bekseit villages, North Kazakhstan region, Kazakhstan

Source: United Nations Geospatial. 2020. *Kazakhstan*. Cited 27 December 2023. https://www.un.org/geospatial/file/2015/download?token=wETZTp56

ACTORS AND STAKEHOLDERS

- dairy farmer in Northern Kazakhstan;
- farm workers;
- farms planning to work or already working in dairy production;
- automated herd management software providers;
- milk processors; and
- state and private financial institutions interested in lending to farmers.

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METHODOLOGICAL APPROACH

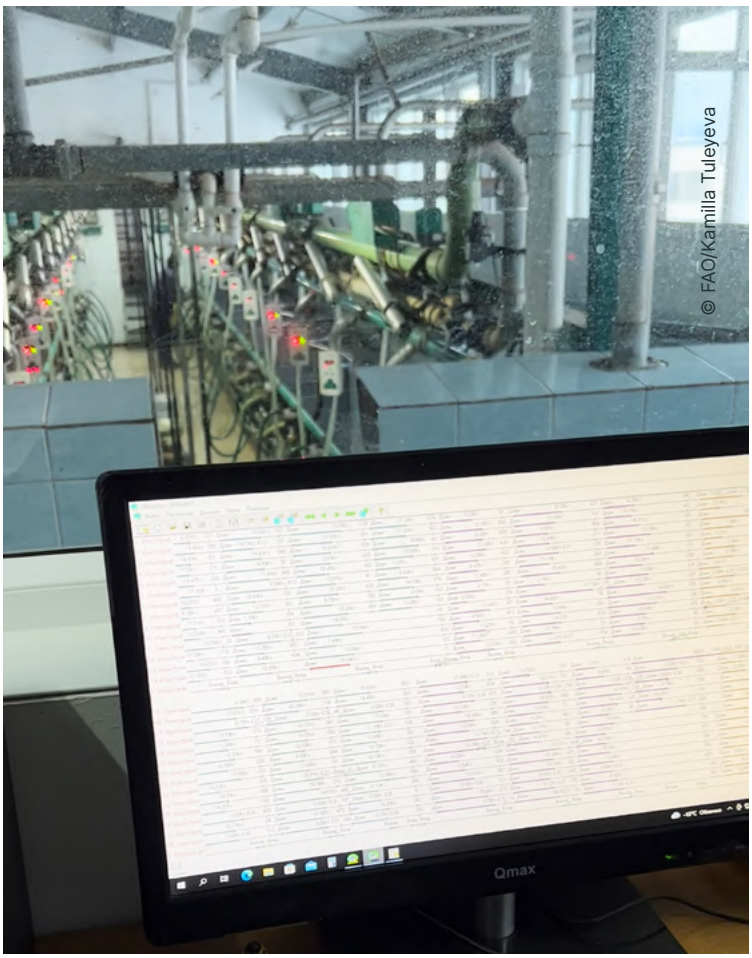
Before embarking on a dairy project, Erkebulan carefully studied the technology of livestock management and the possibility of automating the herd management process. He visited several livestock farms using this technology in Germany and Ukraine.

After reviewing various herd management technologies, he purchased the software and the milking equipment. Later, he bought other programs: sensors for tracking the weight of feed, as well as sensors for tracking cows.

The program provides visual KPIs (key performance indicators) on the highest priority topics: fertility management, health, and production. The dashboard provides visual prompts that highlight the current status of key aspects of farm management (milking, tasks, and problems). All data is stored in the cloud. To ensure the smooth operation of the technology, Erkebulan ensured there is a good internet connection on his farm.

VALIDATION

Erkebulan reports a reduction in the use of labour on the farm and the convenient way to record and store animal health data.



IMPACT

The introduction of this technology has reduced the use of labour. For example, on a farm with a livestock of 1 300 cattle, there are only two reproduction technolo-gists. Without a herd management program, three more people would be required to service such a sizable herd. In addition, digitalization eliminated the routine work of collecting data on animal productivity, because the software records the volume of milk produced by each cow on a daily basis.

According to Erkebulan, the use of digital technologies attracted young specialists to the farm, who are now in short supply in rural areas. Since the beginning of the practice, the farm has hired five young professionals.

Women play an important role in the implementation of this practice. Currently, in addition to the herd management program, several more systems have been installed at the Erkebulan dairy farm. The performance of all these programs is monitored, and data is collected and analysed by two specially trained women livestock specialists.

SUCCESS FACTORS

- The farmer had many years of experience in the agricultural business. In addition, before embarking on a dairy project, he carefully studied the experience of other farmers as well as the existing software and equipment for automating the management of a dairy farm.
- The project started with clear goals and the level of automation to be achieved.
- The project was financed with a combination of his own funds (15 percent) and concessional lending from the state and subsidies for livestock breeders (the remaining 85 percent).

CONSTRAINTS

- When Erkebulan started to implement this technology, he faced a lack of qualified personnel to manage new equipment and software. He had to engage an engineer from the city, who was well acquainted with the automation of dairy farm processes.
- Another constraint in implementing the technology was the lack of a good internet connection needed to collect and store all collected data on livestock.

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SUSTAINABILITY

This technology requires a lot of investment. The entire project, including construction, equipment, and software expenses, cost KZT 2.3 billion (USD 5.4 million). Erkebulan financed 15 percent of the investment from his own funds and the rest by taking out a subsidized loan from the state-owned Agrarian Credit Corporation.

Replicability and upscaling: Considering the high cost of such software, the practice is viable for medium and large dairy farms with at least 400 head of cattle.

CONCLUSION

This practice has several beneficiaries. The owner of the farm reached his planned milk production targets in just two years. The software regularly collects data on milk yield, lactation schedules, and cow health. The farm manager can then use this data to plan his activities.

Exploring the potential benefits of the technology and the experience of farmers who have already applied it played an important role in the success of the practice.

LESSONS LEARNED

- The availability of operational data on production indicators and the ability to closely monitor the animals' condition are invaluable in managing a dairy farm. For farmers who want to open a dairy farm and quickly reach production targets, process automation is not a whim, but a necessity.
- Even though process automation saves labour, there still are problems with hiring qualified specialists capable of servicing this innovative technology.

MORE INFORMATION

This case study was elaborated by the Kazakhstan Growers' Union (KGU) and the Food and Agriculture Organization (FAO).

It was developed through interviews with Erkebulan Mambetov, director of the research and production centre on the cattle breeding farm in 2021.

For further information about this case study, please reach out to FAO at REU-Digital-Agriculture@fao.org.

HEALTHY CATTLE, HEALTHY PROFITS: HEAT DETECTION AND HEALTH MONITORING LEG SENSORS FOR COWS IMPLEMENTED BY ERKEBULAN

© Yeldala/Sergey Buyanov

Mamlyut district, Minkeser and Bekseit villages, North Kazakhstan region, Kazakhstan

SUSTAINABLE DEVELOPMENT GOALS

INTRODUCTION

In 2019, Erkebulan Mambetov opened a dairy farm with 800 cows. The dairy business was a completely new direction for him, but he already had some experience with pure breeding. Erkebulan decided to combine these lines of business and achieve maximum efficiency at his new enterprise.

During the first two years of the dairy farm's operation, technologists and inseminators worked with cows in a traditional way, i.e. they determined when a cow was in heat by sight. Insemination of the animals was done on a schedule convenient for the workers. However, calf production under this work scheme was unstable and poorly predictable.

Erkebulan has been involved in growing crops for many years. He had been using automation, such as fuel control sensors, on his other farm for a long time. He decided to try to apply automation in the field of breeding cows, purchasing leg sensors to track the onset of sexual heat and monitor the reproductive health of his animals.

By introducing this innovative technology, Erkebulan pursued two goals:

- Accurately monitor the onset of sexual heat in cows and inseminate animals in the most fertile period.
- Monitor the health of the cows and promptly resolve all emerging problems.

OBJECTIVE

This case study relays the experience of a farmer in Northern Kazakhstan who has started using foot sensors on his dairy farm to track the sexual heat of cows. It traces the steps he has taken from learning from farmers in other countries to implementing the technology, and how this has helped him in his business. It also examines the expected impact of this practice on farm production and income.

The sensor is attached to the animal's hoof and allows not only the state of the animal's sexual activity to be monitored around the clock, but it also gives a signal about possible health problems. The device acts as a kind of pedometer, tracking each cow's activity throughout the day. If any of the animals is more active than usual, it means that they have come into sexual heat, and it is time to inseminate them.

The sensor also monitors the beginning of calving and sends an alarm to the computer if any difficulties arise during calving. Moving towards automation in this area has helped the farm to better care for cows while also reducing calf mortality during childbirth. Now, the farm's livestock specialists estimate the monthly liveability rate of calves at 97 percent.

In addition, the leg sensors also monitor circumstances that are detrimental to the cows' health, for example, overcrowding in stalls or excessive group activity that can interfere with the animals' comfort.

ACTORS AND STAKEHOLDERS

- dairy farmer in Northern Kazakhstan;
- farm workers;
- farms planning to work or already working in dairy production;
- providers of devices tracking the sexual heat and reproduction health of cows;
- cattle farms interested in buying purebred animals for fattening; and
- state and private financial institutions interested in lending to farmers.

GEOGRAPHICAL COVERAGE

Source: United Nations Geospatial. 2020. *Kazakhstan*. Cited 27 December 2023. https://www.un.org/geospatial/file/2015/download?token=wETZTp56

METHODOLOGICAL APPROACH

Before starting his dairy farm, Erkebulan studied the experience of other farmers working in this direction. Considering that very few such farms in Kazakhstan use digital technologies, he decided to meet with a number of Russian and Ukrainian farmers, from whom he learned about the existence of sensors for tracking sexual heat in cows.

Considering that in 2019 Erkebulan had already invested in the construction of a dairy farm and the purchase of equipment and software for the milking parlour, he had to wait till 2021 to purchase the leg sensors. Implementation began at the same time.

Technologists, inseminators, and livestock specialists working at the enterprise participated in the implementation of the new technology. Two specially trained women livestock specialists are involved in processing the collected data and monitoring the leg sensor software.

VALIDATION

Erkebulan confirms the effectiveness of the practice, noting a significant increase in the level of insemination of cows and a decrease in calf mortality. His economic assessment also confirmed the profitability of the practice and a relatively short payback period of the investment.

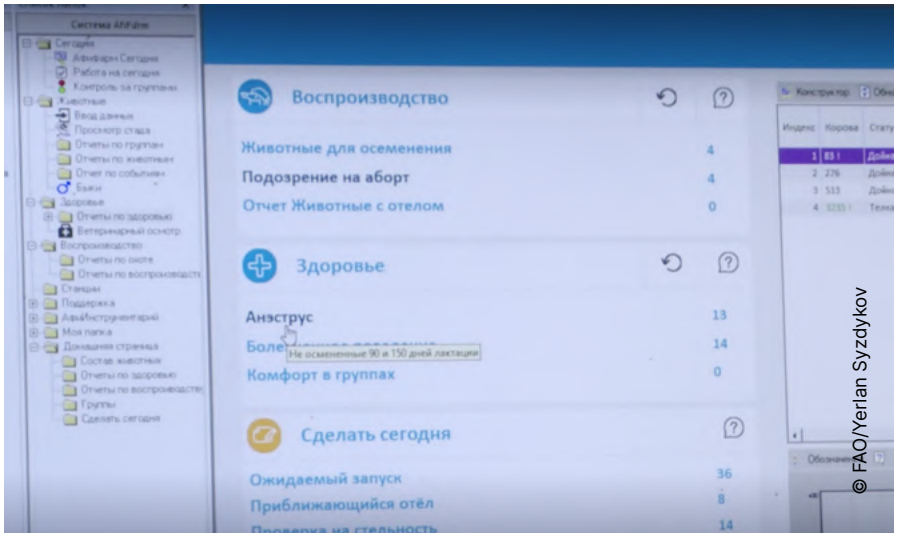
IMPACT

To track the effectiveness of the practice, Erkebulan monitors two indicators – the cow's insemination rate from the first try and the service period. The first indicator, a midpoint measurement, has already improved. Before the introduction of the practice (June 2021), the percentage of insemination was 40–42 percent. As of December 2021, i.e. six months after implementation of the practice, this indicator increased to 53–54 percent. Erkebulan plans to increase the insemination rate to 70 percent.

The service period is the period from a cow's calving to its subsequent fertilization; it serves as an indicator of the animal's fertility and the organization of the herd's reproduction. Ideally, this figure should be 120 days. Before the introduction of the practice at the farm, it was 213 days. It will be possible to track changes in the indicator only nine months after the start of the use of the technology. Erkebulan hopes to reduce this figure to 130–140 days by then.

SUCCESS FACTORS

- **The introduction of the new technology was paid from the farmer's own funds thanks to the profit from his field farming activities.**
- **The government's ongoing project to provide the rural areas of the North Kazakhstan region with the necessary infrastructure (water and electricity) enabled the farmer to save on building infrastructure for his new farm and invest in digital technology instead.**
- **Another important institutional factor was the availability of government subsidies for livestock production. In 2021, the farm received about KZT 200 million (USD 44.56 million) in subsidies, saving on operating costs and allowing available funds to be used for the purchase of foot sensors for cows.**



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CONSTRAINTS

The main problem Erkebulan faced was the lack of specialists who could service the cows' leg sensors. He planned to invite such specialists from Israel. However, due to quarantine restrictions, they could not fly out. The installation and commissioning of the equipment had to be carried out through online consultations with Israeli experts.

SUSTAINABILITY

Erkebulan invested about KZT 37.2 million (USD 87 400) in the implementation of the practice. The practice will be quite profitable: With an internal rate of return of 36 percent, the investment will pay off in just over three years.

LESSONS LEARNED

Digital technologies, such as leg sensors for detecting sexual heat in cows, have a huge impact on the economic performance and working conditions of staff. Therefore, it is in the farmer's interests to introduce such innovative technologies as early as possible.

REPLICABILITY AND UPSCALING

The practice is applicable to any livestock farm able to afford the necessary investment. The leg sensors are reusable. The cost of the technology is quite high. However, just six months after implementation the practice demonstrated its first results in the form of an increase in the cows' insemination rate.

CONCLUSION

Sensors for tracking the activity and sexual heat of cows allow Erkebulan's farm to plan its activities more efficiently, since this technology allows the farm to collect and analyse information on the herd's reproduction rate. The practice gave Erkebulan the opportunity to further diversify his business. In addition to dairy, he plans to develop meat production. Erkebulan is currently reselling young bull calves to buyers, but in the future he plans to raise and feed bull calves on his own. Now he is building an additional farm to put his plans into action.

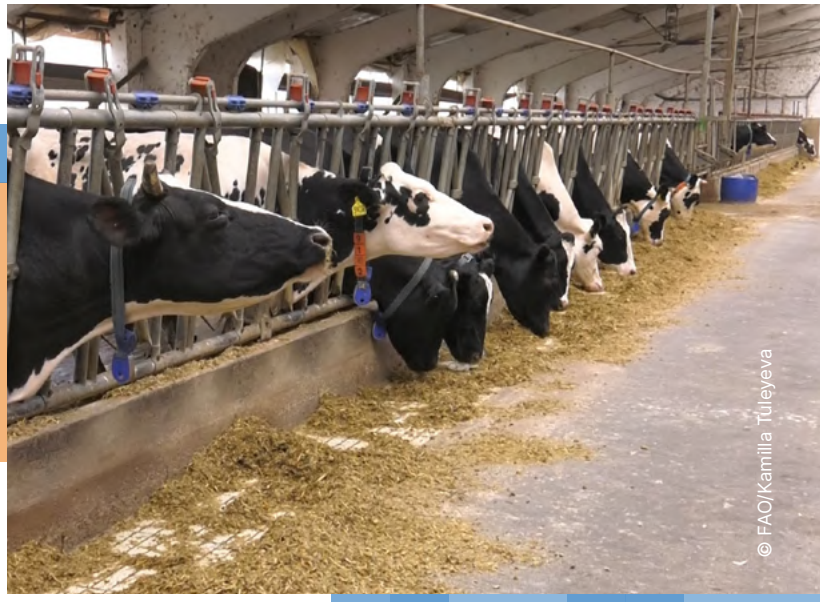
MORE INFORMATION

This case study was elaborated by the Kazakhstan Growers' Union (KGU) and the Food and Agriculture Organization (FAO).

It was developed through interviews with Erkebulan Mambetov, director of the research and production centre on the cattle breeding farm in 2021.

For further information about this case study, please reach out to FAO at REU-Digital-Agriculture@fao.org.

ENHANCED DAIRY COW MANAGEMENT AND HEALTH: THE AUTOMATED HERD MANAGEMENT ROBOTICS EMPLOYED BY DAUREN



Kazakhstan, Almaty region, Talgar district, Arqabay village

SUSTAINABLE DEVELOPMENT GOALS

INTRODUCTION

The agroholding began breeding beef and dairy cattle back in 2002. Until 2013, Dauren Bekenov, director of the research and production centre on the cattle breeding farm, did not use digital technology in herd management. Feeding, milking. and the care of cows was done manually, which resulted in high wage costs and overconsumption of feed. As a consequence, inaccurate feed rationing for dairy cows resulted in low milk yields.

In 2015, Holstein-Friesian dairy cows were brought to the agroholding holding from Canada. For the agroholding to work efficiently with expensive and pedigreed cattle, Dauren decided to introduce robotic herd management technology. After carefully studying the experience of other farmers and existing offers on the market, he settled on Swiss technology. He purchased several robotic milking machines, which were also equipped with scrapers to remove manure from the cowsheds, rubbers for cows, and agroholding management software.

In introducing this innovative technology, Dauren had the following goals:

- Reduce manual labour through the use of robotic units.
- Focus on monitoring animal health thus reducing treatment costs and making production more profitable.

Robotic herd management has helped the agroholding to save time and money. It has optimized processes such as automated milking, artificial insemination, veterinary care, feeding, manure removal, and high milk yield production.

OBJECTIVE

This case study recounts the experience of a farmer in South Kazakhstan who used robotics to manage dairy cows in cowsheds. It traces the farmer's journey from his efforts to find the right technology to its practical implementation on the farm. It also explores how this innovative technology helped him lower production costs, while improving working conditions for employees and reducing the incidence of mastitis among cows.

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Now the agroholding can afford to hire fewer employees. Previously one milker was needed for every 30 cows, but now one robotic milking machine serves 60 head at least thrice per day. One operator now controls the milking of the entire herd. In addition, with the help of a computer, one veterinarian can monitor more cows than if they were to do the work manually.

Dirty, time-consuming work, such as manure removal, is now done by machines instead of humans. The use of such digital technologies increases the prestige of working at the agricultural holding company in the eyes of young people, which in turn helps to attract more highly qualified employees.

GEOGRAPHICAL COVERAGE

Kazakhstan, Almaty region, Talgar district, Arqabay village

Source: United Nations Geospatial. 2020. *Kazakhstan*. Cited 27 December 2023. https://www.un.org/geospatial/file/2015/download?token=wETZTp56

ACTORS AND STAKEHOLDERS

- director of the training scientific and production centre at a cattle breeding agroholding in South Kazakhstan;
- students studying at the farm's research and production training centre;
- suppliers of robotic milking technology;
- consumers of milk and dairy products; and
- state and private financial institutions interested in providing loans to farmers.

METHODOLOGICAL APPROACH

After visiting several family farms in the United States of America and Europe, Dauren noticed that many small farms used robotic milking machines and software to monitor and manage the herd. It occurred to him how convenient it would be to have remote access and be able to monitor the production process through a smartphone.

Having studied the solutions available on the market, Dauren chose a Swiss herd management system. After signing a contract with the supplier and installing the software, the agricultural holding's employees entered data about each cow into the system. Currently, the program monitors 1 520 cows on the farm.

Darina Sultanbay manages the dairy complex. She is responsible for milk yields, cow care, and the smooth operation of all dairy production. Sultanbay is one of the few women at the agroholding who holds a responsible position in production. She has done several internships abroad. The dairy complex has 670 cows, but no stifling smell of ammonia or manure, which is often a tell-tale sign of a dairy farm. There are currently two cowsheds with a capacity of 200 cows each. One milking parlour has been built where everything is computerized: six robots work 24 hours a day on the principle of voluntary milking. That is, the cow determines when she needs to be milked. Feeling that the moment has come (a feeling of discomfort), she goes into the parlour. The robot automatically cleans the cow's udder, and the automated system feeds and collects milk while the cow is eating, adjusting to the physiology of the animal. To enable automated milking, each cow has been fitted with a smart collar that collects information on the location of the animal, including milk production, veterinary care, and lactation events. The average daily milk yield with this approach is 32 litres.

SUCCESS FACTORS

- The agroholding has its own research and production training centre, which includes two veterinary pathological laboratories, laboratories for zootechnical analysis of feed, as well as agricultural chemistry. Thus, before starting the implementation of the practice, the possible effect and consequences of the practice on production were carefully examined.
- Before choosing a technology and investing, the experience of dairy farms from the United States of America and Europe was studied, as well as solutions available on the market.
- Thirty percent of investments in innovative technology were financed through a concessional loan from the Agrarian Credit Corporation; both personal and borrowed funds were used to implement the project.
- Government subsidies for animal husbandry allow the agroholding to maintain production margins, given the rise in costs due to a hike in the prices of imported feed and animal protection products.

VALIDATION

Robotic installations not only milk cows in compliance with all the golden rules of milking, but they also analyse the quality of the product, which allows to quickly detect health problems and prevent poor-quality milk from reaching the dairy processing plant.

This allows for early detection of the most common disease in dairy cows – mastitis. Before the introduction of the practice, the prevalence of mastitis among cows was 15-20 percent; now it has decreased to 1 percent.

With the implementation of robotic herd management, Dauren has been able to reduce personnel costs. The entire milking process is controlled by a single operator who controls the operation of the robotic milking machines that make it possible to get the maximum milk yield from each cow. In addition, with the advent of the herd management system, the agroholding was able to reduce the number of inseminators from three to one. The remaining employees have time not only to inseminate cows, but also to update their records.

In addition, the veterinarians' workload has decreased. Now they do not need to visually inspect animals several times a day, as the computer monitors the condition of the entire herd throughout the day. If during the day there is a deviation in the usual behaviour of any animal, data that is read from the smart-collar, the program sends an alarm signal to the veterinarian, and they can examine the animal. With remote monitoring capability, one veterinarian can monitor up to 500 cows. In addition, each cow's treatment history is available in the system, so they don't have to waste time checking records.

IMPACT

The practice is socially sustainable; it has minimized manual labour on the agroholding and generally simplified the specialists' work. For example, the veterinarian knows exactly which cow has given milk on which day thanks to the automatic notification system at the robotic milking machine. Thus, they make sure the animal's life cycle is normal, for example, whether the lactation period begins on time. In case of any deviations from the norm, the veterinarian can immediately start working with the animal to prevent any complications or health problems.

All three women working on the farm are actively using technology in their work. A livestock technician keeps a record of the herd in the herd management program. A feeder uses the same software to compose balanced rations for cows. A calf attendant manages calf feeds using an improved milk taxi with milk dispenser and milk pasteurization functions.

Collecting and analysing production data has allowed Dauren to improve the efficiency of the farm, including reducing the prime cost of milk produced by 20 percent, which has made the enterprise more profitable.

CONSTRAINTS

- The biggest problem faced is the shortage of qualified specialists. This issue is particularly acute now, since over the past few years dairy farms have started importing more foreign breeds of cattle. Foreign breeds require special care; traditional norms of feeding and care are not suitable. Qualified specialists are also needed to provide the required care for foreign breeds and to use the robotic herd management system. Thanks to cooperation with universities, the agroholding provides internships for students, where they can get practical skills in using innovative technologies on the dairy farm and later get a job.
- Another challenge is the limited connectivity to high-speed internet in rural areas. Thus, not all farms can afford online consultations with foreign experts.

In addition, automation has saved employees from such routine and dirty work as cleaning cowsheds. All manure is now automatically removed by a robot scraper. The agroholding is also equipped with automatic back rubbers. When an animal approaches such a device, it automatically turns on and rubs the animal's skin. This helps to keep the animal's body clean; remove parasites, lichen, and ticks; and improve blood circulation. The use of back rubbers also calms the cows and improves their well-being, as a result of which they produce more milk. Thanks to these devices, veterinarians are free from mechanical work and can focus on other, more important tasks.

SUSTAINABILITY

- Also, accurately formulating dairy cow rations helps to get more milk yield.
- Dauren plans to invest the saved funds in the purchase of several more robotic milking machines.

REPLICABILITY AND UPSCALING

The herd management system is widely used on dairy farms, including small ones. In Europe, this technology is used by many family farms with no more than 50 cows. In Kazakhstan, this technology can be applied on farms with at least 60 dairy cows, given that one milking machine is designed to serve 60 cows.

CONCLUSION

There are several beneficiaries of this practice. Thanks to the automation of milking, insemination, veterinary control, and other processes, Dauren has optimized costs and improved the working conditions of his employees, who no longer have to do many kinds of manual labour.

Prompt analysis of the milk's quality allows the farm to detect and prevent mastitis in cows at an early stage, which has ultimately contributed to the improvement of the final product.

Having a clear vision and carefully researching the technology and experience of farmers already using it before investing in a business proved to be critical for the successful results of this practice, along with a balanced mix of existing funds (70 percent) and a concessional loan from the government (30 percent).

LESSONS LEARNED

Robotic herd management and remote monitoring reduce the cost of material and non-material resources, as well as facilitating human labour and making production more profitable. As regards economic sustainability, the rationed use of feed allows the agroholding to purchase and consume exactly what is necessary for milk production.

MORE INFORMATION

This case study was elaborated by the Kazakhstan Growers' Union (KGU) and the Food and Agriculture Organization (FAO).

It was developed through interviews with Dauren Bekenov, director of the research and production centre on the cattle breeding farm in 2021.

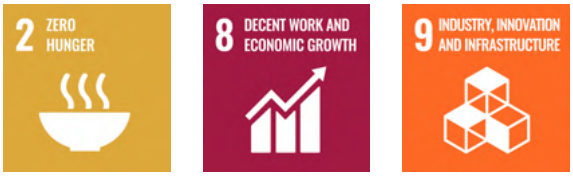
For further information about this case study, please reach out to FAO at REU-Digital-Agriculture@fao.org.

BEYBIT'S PATH TO ENHANCED LIVESTOCK FARM CARE: FEEDING AND HEALTH MANAGEMENT SOFTWARE

© FAO/Kamilla Tuleyeva

Kazakhstan, Aqmola region, Enbekshilder district, Mamay village

SUSTAINABLE DEVELOPMENT GOALS



OBJECTIVE

This case study describes the implementation of cattle feeding and health management software at the feedlot of a Kazakhstani producer of premium marbled beef. It explores why the company needed to implement such technology and how it raised the standards of all processes at the feedlot, including veterinary safety. It also defines the conditions necessary for the successful implementation of the practice on other livestock farms.

INTRODUCTION

There are many breeds of cattle used to produce delicious, marbled meat, but the most popular at the moment is considered to be an Aberdeen Angus breed: the Black Angus. About 80 percent of all marbled beef produced in the world comes from bulls of this breed, which are black and reach an average of 400–500 kg. Angus meat is described as marbled because of the thin veins of fat in the meat. Experts call Aberdeen Angus the "black pearl" of beef cattle breeding, which emphasizes its importance and value.

Considering the potential of the industry, Yerubaev Beybit founded Kazakhstan's first cattle breeding company in 2010. He began breeding 3 600 Black Angus bulls, brought into the Aqmola region from the United States of America. At the initial stage, it was assumed that the enterprise would start selling pedigree youngsters to farmers. However, it soon became clear that there was no demand; the local farmers did not trust the new exotic breed of cattle. As a result, Beybit had to build his own feedlot to fatten up the young cattle that were not in demand as breeding stock. He then completed the cycle by building his own meat processing plant.

Today, the vertically integrated holding consists of four stages of production: feed production, a pedigree breeding unit, a 15 000-head feedlot, and a meat process-ing unit. Currently, the holding has more than 8 500 cattle, which are already in great demand among farmers. The finished product is sent to retail chains and restaurants in Kazakhstan, as well as the Russian Federation, the United Arab Emirates, and Uzbekistan.

The most important component in obtaining quality marble meat, according to Beybit, is a healthy and proper diet for steers. It is simply impossible to hide the consequences of improper nutrition: the marbling of the meat directly depends on the animal's diet. For the products to meet the requirements of foreign and domestic customers, the enterprise implements international standards in production. Beybit therefore decided to use a software for feeding and health management of cattle at the feedlot. For the system to work smoothly, he provided internet communication on his farm and trained his employees.

By introducing this innovative technology, Beybit pursued the following goals:

- Optimize feeding processes to produce quality marbled meat.
- Gain access to world-class veterinary services and individual animal management.
- Facilitate the export of products through collaboration with foreign experts.

The technology began to be introduced in 2020. Just a year later, it had already yielded its first results: In December 2021, the company signed a KZT 447.73 million (USD 1 million) contract for the supply of marbled beef to the United Arab Emirates. For the Kazakhstani beef producer, this deal could be the key to the other Persian Gulf markets.

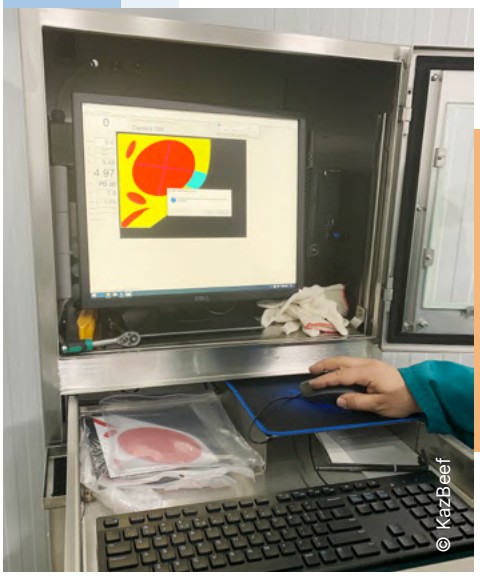
GEOGRAPHICAL COVERAGE

Kazakhstan, Aqmola region, Enbekshilder district, Mamay village

Source: United Nations Geospatial. 2020. *Kazakhstan*. Cited 27 December 2023. https://www.un.org/geospatial/file/2015/download?token=wETZTp56

ACTORS AND STAKEHOLDERS

- head of an agro-industrial holding in Northern Kazakhstan;
- feedlot employees;
- farmers who bring their livestock to the feedlot;
- customers and partners;
- cattle feeding and health management system providers; and
- other cattle breeders interested in meeting international standards and exporting their produce abroad.



METHODOLOGICAL APPROACH

Beybit learned about the technology back in 2012, as the provider was well known and had an excellent reputation in the livestock industry. At that time, however, there was no way to bring the technology to Kazakhstan. Once Beybit was able to establish contact with the provider, he decided to invest in the technology.

The cattle feeding and health management software is an electronic model based on an automatically generated source code in an appropriate programming language. The main function of the software is to keep individual records of each animal in the feedlot for optimal feeding rationing and health management of cattle, thereby improving production and food safety. Effectively organizing individual animals also facilitates the improved marketing of finished cattle, thereby boosting the profitability of feedlots. Beybit employs about 30 experienced feeding, veterinary, and individual animal management specialists to help optimize all on-farm processes.

The software is regularly updated by the developers and all data collected about the animals is automatically saved to the system ensuring smooth bi-directional data transfer between the feeding complex and the software database if there is an internet connection.

When an animal first enters the feedlot, it is tagged with a radio-frequency identification tag (a RFID tag), which uses electromagnetic fields to automatically identify, and track tags attached to the animal. The animal is then automatically registered in the information system, where the following data is entered: the date of arrival at the feedlot, the weight of the animal from the scale head, the national ID input from RFID tags, the temperature input from digital thermometers, and the data input from other measuring devices. All data entered is stored in the system's cloud and is available to Beybit at any time. The data from the RFID tags can be used to record the movement of animals from one feedlot to another as well as their shipment for sale or slaughter. If the tags are lost, the system accommodates the retagging of animals without losing their history.

With the introduction of RFID tags, it is possible to sort animals at the feedlot by age, weight, and other traits in real time. The information system automatically assigns each group a colour and number to visually distinguish the feedlot. This helps manage feeding, i.e. to compose specific ingredients for feeding according to the assigned group characteristic.

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SUCCESS FACTORS

- The farmer had a clear vision of his goals: to automate the process of managing the feedlot and to export his products to new markets.
- Management was willing to innovate and transform operations to improve results.
- The farmer foresaw the possibility of introducing this technology and prepared the necessary technical infrastructure in advance.
- A partner funded the costly technology.
- The uptake of this innovative technology was facilitated by the availability of qualified English-speaking staff.

The health status of each animal is also recorded in the information system, which is linked to the identification number. Built-in protocols on the animal's arrival for different livestock categories include suggested vaccines, preventive treatments, parasite control, and performance-enhancing products. These are based on age, weight, medical history, a ready marketing plan, and a feeding program for a specific group of cattle.

The software is equipped with an electronic pharmaceutical database that includes a full pharmaceutical inventory system, including electronic uploading of additional drug types, pricing, and product mapping. The system also allows for records of medical products and administration routes and quantities, along with procedures such as dentition scoring, recording of hide colour, or assessing hip height. The system also creates a medication injection schedule for each animal.

When an animal becomes ill, the software produces built-in animal treatment protocols that generate instructions for treating the animal based on individual medical history, weight, temperature, and diagnosis. The veterinarian enters relevant data and symptoms into the system and receives ready-made recommendations for treating the animal. If they have difficulty deciding how to treat the animal, the system allows consultations with foreign veterinarians and specialists with years of experience working with pedigree cattle in real time.

The next major function of this software is to compose feed rations for cattle on the farm. Grain fattening is a key factor in the technology of premium marbled beef production; it creates marbling and gives a better flavour to the meat. The farm staff input all the necessary parameters for the animals on the feedlot into the software, which is a major factor in feeding formulation.

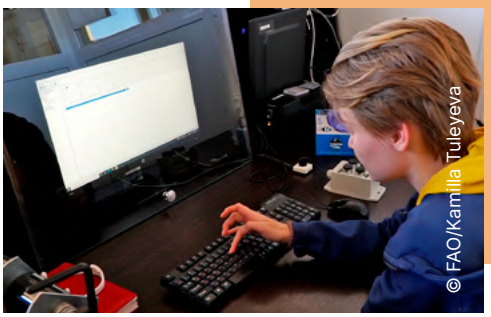
A nutritionist from United States of America developed the rations at Beybit's farm to include all necessary vitamins and minerals for the animals' health, which affects the quality of the meat. The nutritionist regularly oversees the feeding process, monitors weight gain, and can make adjustments to the feed if necessary.

This technology traces the full history of the animal and creates reports for analysis and more effective management decisions, such as the treatment history of animals, an inventory of pens, and a summary of the health status of the group. Full transparency of all processes allows international certification of the finished products.

VALIDATION

The introduction of this technology made it possible to facilitate the export of the produce, since working with the cattle feeding and health management system creates the conditions for birification ("validity check"). Canadian specialists working with the Kazakhstani holding as part of this practice have confirmed that everything at the farm is being done correctly, competent livestock feeding rations have been compiled, growth hormones are not used, and all other conditions for raising livestock are observed.

Potential buyers take note of this and understand that the holding's products can be trusted.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CONSTRAINTS

There were no constraints during the introduction of the technology itself because Beybit had provided for the automation of processes ahead of time. Even at the construction stage, he had consulted with foreign experts about what kind of infrastructure should be provided at the farm. However, after introducing the practice, Beybit faced lacklustre institutional support. According to him, the lack of a clearly defined state policy in the field of veterinary medicine and weak veterinary control significantly complicates the work of livestock breeders.

IMPACT

With the introduction of the practice due to the automation of processes, the employee productivity increased. The company began to optimally distribute feed and obtain the best quality meat, which led to the company's recognition both domestically and internationally. This allows Beybit to maintain relatively high wages for farm workers. The introduction of modern technologies has also allowed him to attract young people and qualified specialists to the livestock sector.

Automation of the feedlot management makes the specialists' work easier. If veterinarians have doubts about a particular treatment method, they can review ready-made and tested treatment protocols, seek the advice of an overseas consultant, and discuss possible options. This makes their work more efficient and at the same time promotes the sharing of experience internationally. The farmer can supervise the entire process from the comfort of his office.

SUSTAINABILITY

Beybit spent KZT 348.7 million (USD 819 000) to implement the practice. It is worth noting that the practice gave a positive result one year after the application. The livestock health and nutrition management system, thanks to individually formulated diets, helped increase the average weight gain from 0.68 to 0.76 kg per day. Thus, Beybit managed to reduce the period of feeding the livestock before slaughter (from 565 to 490 days).

REPLICABILITY AND UPSCALING

The implementation of the technology is economically feasible for feedlots with more than 5 000 cattle. Also, given the high cost of technology, not all farms will be able to afford such investments. The lack of internet and the lack of English language skills among the staff may be a limitation for implementation on other farms since the software is only available in English.

CONCLUSION

This practice has several beneficiaries. Beybit received international confirmation of the quality of his products, established sales to a new export market, and improved the working conditions of his employees. It is important to note that the technology makes it possible to significantly scale production in the face of a shortage of qualified personnel in Kazakhstan. Having a clear vision of his goals and careful planning for the implementation of the practice played an important role in achieving success. Institutional and financial support, as well as training for specialists, may be needed to expand this practice to other livestock farms in Kazakhstan.

LESSONS LEARNED

- The implementation of livestock feeding, and health management software does not, by itself, lead to significant changes on the farm.
- The information obtained through this system helps to manage the farm more precisely, allowing necessary changes and improvements to be made in accordance with the recommendations of experienced foreign specialists.

MORE INFORMATION

This case study was elaborated by the Kazakhstan Growers' Union (KGU) and the Food and Agriculture Organization (FAO).

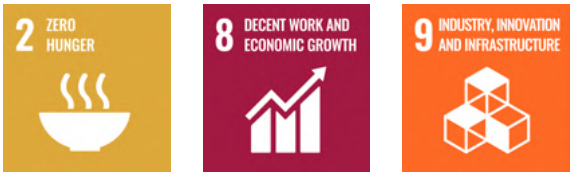
It was developed through interviews with Dauren Bekenov, director of the research and production centre on the cattle breeding farm in 2021.

For further information about this case study, please reach out to FAO at REU-Digital-Agriculture@fao.org.

AERIAL INSIGHTS FOR LIVESTOCK MANAGEMENT: BEYBIT'S AUTOMATED LIVESTOCK COUNTING DRONES

Kazakhstan, Aqmola region, Enbekshilder district, Mamay village

SUSTAINABLE DEVELOPMENT GOALS



OBJECTIVE

This case study focuses on the introduction of automated cattle counting by drone at a livestock farm in Kazakhstan. It explores how the farm manager came to use this technology and what benefits it gave him. It also explains which livestock farms can implement such a practice, and what conditions are necessary for its successful implementation.

INTRODUCTION

In 2010, Beybit Yerubaev founded Kazakhstan's first livestock enterprise to breed pedigree bulls. Today, it is a vertically integrated holding, where different divisions support one another. The central part of the holding is a feedlot located in the Malik Gabdullin village. Farmers from Aqmola and neighbouring regions bring their livestock here for fattening. The holding also has its own breed multiplication farm where farmers can rent or buy pedigree bulls to improve the performance of their herd.

The holding's crop production division provides feed for both the feedlot and the multiplication farm. Fattened cattle are sent for slaughter and butchering to the holding's own meat processing plant. From there, finished products are distributed to retail chains and restaurants in Kazakhstan, Russian Federation, the United Arab Emirates, and Uzbekistan.

As the herd grew, it became increasingly difficult to manage it using traditional methods. This also applied to such a seemingly simple procedure as counting livestock. Several workers had to spend a whole day counting livestock. Sometimes their counting results would not match, so they would have to start over. As it took a lot of workers' time and energy, Beybit decided to start counting cattle using a drone in 2020.

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By introducing this innovative technology, Beybit pursued two goals:

- Make livestock counting more accurate by eliminating the possibility of human error in counting.
- Free up employees' time for other tasks.

The move to automation resulted in increased accuracy in livestock counting, as well as a significant reduction in the time it took workers to do this, allowing them to switch to other production processes on the farm.

In addition, the practice helped to structure the livestock count data. The program exports all data to a computer, where it distributes it into different folders depending on the year and month. This significantly simplifies data analysis.

GEOGRAPHICAL COVERAGE

Kazakhstan, Aqmola region, Enbekshilder district, Mamay village

Source: United Nations Geospatial. 2020. *Kazakhstan*. Cited 27 December 2023. https://www.un.org/geospatial/file/2015/download?token=wETZTp56

ACTORS AND STAKEHOLDERS

- manager of an agro-industrial holding in Northern Kazakhstan;
- feedlot employees;
- farmers who bring their cattle to the holding's feedlot;
- customers and partners; and
- cattle-counting technology suppliers.

METHODOLOGICAL APPROACH

Beybit learned about this technology for automated livestock counting using drones from international partners. Livestock inventory management and feedlot reconciliation play an important role on any farm. Whether it is an accountant requiring an audit of the feedlot, a lender requiring a livestock audit, a change of barn manager, or a change of ownership of the feedlot, livestock accounting is critical.

This technology is based on the principle of computer imaging: detecting objects, determining their location in images, and classifying them. The drone installation includes a GPS navigation system, sensors, and a camera. Before launching the drone, a farm specialist enters flight parameters into the program, after which the drone flies over each cell in the feedlot at an altitude of 8–25 m at a vertical angle, taking pictures along the assigned trajectory of the flight. Then the resulting raw images with a resolution of 4096×2160 pixels in 600–700 pieces are downloaded to a computer with software installed for post image processing using machine learning. This software with its algorithms allows image segmentation by analysing individual pixels in unmanned aerial vehicle (UAV) images with a certain spectral threshold. This processing can take from 12 to 24 hours and requires an internet connection.

For machine learning, segmentation parameters, i.e. the characteristics of the cattle and feedlot - the object of analysis and the background – are initially entered. This technology works best in a situation where the animal's colour has a sharp contrast with the background, which is the case at Beybit's farm, where cattle are dark in colour, which contrasts with the colour of the feedlot.

The program allows high-resolution processed images where the result of automatic cattle counting are clearly seen with the accuracy of 98 percent. Each image includes the number of animals therein. It is possible to check the report generated by the automatic cattle counting on the feedlot with the current number of animals to eliminate errors.

An important factor in the use of technology is the availability of personnel with specialized skills in the use of drones and data processing software.

VALIDATION

The practice of using drones for automated livestock counting in Beybit Yerubaev's agro-industrial holding in Northern Kazakhstan addressed several key needs for the various actors and stakeholders involved.

The introduction of drone technology improved accuracy by eliminating the possibility of human error. The automated counting system, based on computer imaging and machine learning, achieved a high accuracy rate of 98 percent. Automation significantly reduced the time required for livestock counting. This freed up employees' time for other tasks, enhancing overall operational efficiency on the farm. Additionally, the program used for drone-based counting exported all data to a computer, organizing it into different folders based on the year and month. This structured approach simplified data analysis, making it easier for farm management to track trends and make informed decisions.

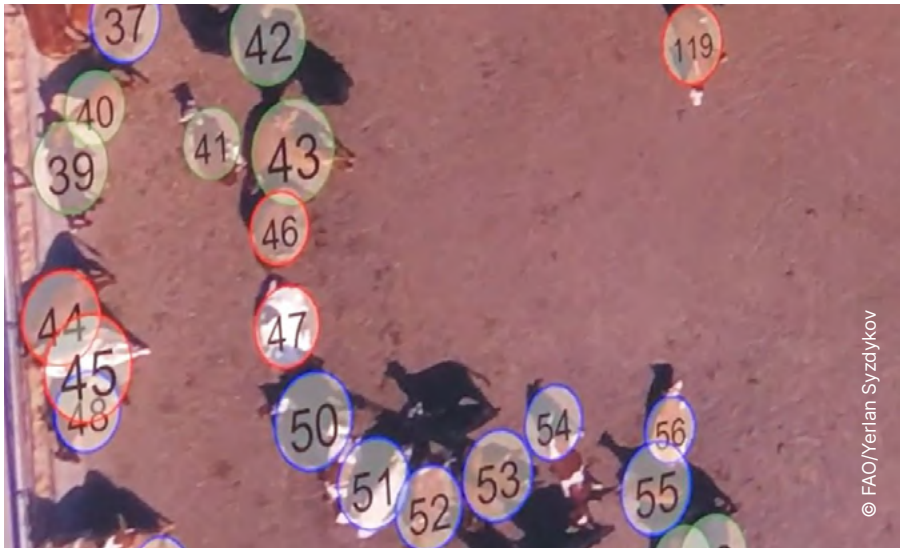
SUCCESS FACTORS

- Thanks to interaction with international partners, the farm is up to date with the latest innovative technologies used in animal husbandry.
- The farmer was well aware of his goal: to automate livestock counting to free up his workers' time for more important tasks.

IMPACT

The impact of Beybit Yerubaev's decision to introduce drone technology for automated livestock counting in his agro-industrial holding in Northern Kazakhstan is significant and multi-faceted.

- The introduction of drone technology has eliminated the possibility of human error in counting livestock. The technology, based on computer imaging and machine learning algorithms, achieves an accuracy rate of 98 percent in automatically counting cattle.
- Traditional livestock counting methods required several workers to spend an entire day manually counting livestock. The automation has led to a significant reduction in the time required for livestock counting, allowing employees to allocate their time and energy to other essential tasks on the farm.
- While the initial investment in drone technology and associated software may be significant, the long-term impact includes potential cost savings due to increased efficiency and reduced manual labour requirements.



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SUSTAINABILITY

Beybit spent KZT 348.7 million (USD 819 000) to implement the practice. It is worth noting that the practice gave a positive result one year after the application. The livestock health and nutrition management system, thanks to individually formulated diets, helped increase the average weight gain from 0.68 to 0.76 kg per day. Thus, Beybit managed to reduce the period of feeding the livestock before slaughter (from 565 to 490 days).

CONSTRAINTS

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LESSONS LEARNED

- The implementation of livestock feeding, and health management software does not, by itself, lead to significant changes on the farm.
- The information obtained through this system helps to manage the farm more precisely, allowing necessary changes and improvements to be made in accordance with the recommendations of experienced foreign specialists.

REPLICABILITY AND UPSCALING

The implementation of the technology is economically feasible for feedlots with more than 5 000 cattle. Also, given the high cost of technology, not all farms will be able to afford such investments. The lack of internet and the lack of English language skills among the staff may be a limitation for implementation on other farms since the software is only available in English.

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This practice has several beneficiaries. Beybit received international confirmation of the quality of his products, established sales to a new export market, and improved the working conditions of his employees. It is important to note that the technology makes it possible to significantly scale production in the face of a shortage of qualified personnel in Kazakhstan. Having a clear vision of his goals and careful planning for the implementation of the practice played an important role in achieving success. Institutional and financial support, as well as training for specialists, may be needed to expand this practice to other livestock farms in Kazakhstan.

MORE INFORMATION

This case study was elaborated by the Kazakhstan Growers' Union (KGU) and the Food and Agriculture Organization (FAO).

It was developed through interviews with Yerubaev Beybit, farmer, in 2021.

For further information about this case study, please reach out to FAO at REU-Digital-Agriculture@fao.org.

DIGITAL CROP PRODUCTION

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ZURAB'S APPROACH FOR OPTIMIZED RESOURCES AND INCREASED PRODUCT QUALITY: DIGITAL TECHNOLOGIES FOR APPLE PRODUCTION

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Georgia, Shida Kartli, Gori municipality, Kvarkhiti village

SUSTAINABLE DEVELOPMENT GOALS

OBJECTIVE

This case study describes the path of a company that gradually introduced modern precision agriculture and automation technologies in apple production. The document demonstrates the impacts and contributions that these technologies brought to the prosperity of agricultural businesses, a better environment, and better working conditions.

INTRODUCTION

The Shida Kartli region is well known for its apple production and Tiriphoni Gardens is a distinguished agricultural company in this business. Located in village Kvarkhiti, Gori municipality, Tiriphoni Gardens applies multiple digital technologies and tools in production, sorting, and storage activities. From the very beginning, Zurab Gojiashvili and the other founders of the company aimed at having a modern apple orchard. They researched and experimented with various technologies and attended multiple pieces of training to arrive at the business model they had envisioned from the start.

Tiriphoni Gardens started its operations in 2014 and it is now considered one of the largest apple producers in Georgia. In 2017, it received the European Union quality certification. The company's co-founder and director, Davit Gachechiladze, prouds himself to represent one of the first Georgian producer companies that obtained the GLOBALG.A.P. Certification. The company was the first to have this certification for apple production in Georgia.

The GLOBALG.A.P. Certification is a trademark and set of standards for good agricultural practices available for three scopes of production: crops, livestock, and aquaculture. Farms participating in the GLOBALG.A.P. programme must ensure a certain quality of goods coming from the farm. Most buyers in Europe, and worldwide, demand evidence of the GLOBALG.A.P. Certificate. Obtaining the certification costs around EUR 50 000 with an additional EUR 5 000 to be planned for the yearly checks.

The company operates on 31 ha of land, out of which 28 ha is occupied by an apple orchard. Tiriphoni Gardens owns several water wells, and it has installed hail nets. The orchard is equipped with precision agriculture tools, including an automated irrigation and fertigation system, a meteorological station, and sensors for temperature, humidity, precipitation, pest and disease control, etc. This allows the company to limit its inputs of water and chemicals, which has also a positive environmental and economic impact.

GEOGRAPHICAL COVERAGE

Georgia, Shida Kartli, Gori municipality, Kvarkhiti village

Source: United Nations Geospatial. 2015. *Georgia*. Cited 27 December 2023. https://www.un.org/geospatial/file/1922/download?token=euWtsSCU

The Preferential Agrocredit Programme has been initiated by the Ministry of Environment Protection and Agriculture of Georgia and has been implemented by the Rural Development Agency since 27 March 2013. The purpose of the project is to improve the processes of primary agricultural production, processing, storage, and sales by providing the legal and natural entities with cheap, affordable long-term and preferential funds. Within the frame of the project, the enterprises engaged in the processes of primary agricultural production, processing, and storage could receive preferential agrocredit or agroleasing from the financial institutions for fixed and current assets.

ACTORS AND STAKEHOLDERS

- Tiriphoni Gardens
- international donor organizations
- local state programs
- local supermarket chains
- export partners

METHODOLOGICAL APPROACH

From the beginning, the quality of the products was the priority for the producer. To achieve high-quality products together with sizable quantity outputs, the company representatives continuously research available technologies and attend different training programs. The company regularly takes part in different forums and exhibitions around the world to collect information and practices, and to have access to the global markets and modern technologies of production. Such activities provide opportunities for an improved international presence by raising awareness about their operations on an international scale.

The company gradually introduced different technologies into the production process and arrived at the precision agriculture model currently in use. Before applying these innovative approaches to the whole orchard, the company used parts of its land to pilot the technologies. After seeing the positive results, it decided to scale up to the entire area of operations.

The orchard uses a wide range of precision agriculture technologies. With an automated fertigation system, only high-quality, certified fertilizers and pesticides are automatically applied to the orchard. The meteorological station, together with the sensors installed in the orchard, provide data about temperature, humidity, soil moisture, mineral content, rainfall, solar radiation, wind speed, as well as risks of pests and diseases. The data collected by the station are processed by a decision support system that uses algorithms and models to provide recommendations for crop management and pest control based on the collected data. An agronomist analyzes collected information and plans the interventions necessary for the orchard to flourish and thrive.

As the harvest gradually increased, the necessity for proper sorting equipment emerged. The company representatives invested time in researching relevant equipment. They decided to purchase a second-hand sorting and grading line that met their needs. During the harvest period, the farm representatives set parameters for grading and sorting apples by size, colour, and shape. Through various technologies such as weight and laser sensors, machine vision and X-ray scanners, the line singles out the ones that do not meet the pre-set criteria. Apples move through autonomous conveyor belts and in the water to avoid damage due to friction and collision during the sorting process. Pneumatic ejectors are used to remove the apples from the conveyor belt based on the criteria set in the system. All activities are controlled by a computing control system, which monitors and controls the various processes, as well as collect and analyse data. The sorting line has the capacity to sort and grade up to five tonnes of apples per hour.

After sorting, the apples are moved to the storage unit. The company owns a cold storage facility certified by International Organization for Standardization where up to 1000 tonnes of apples can be stored. The storage unit is also equipped with sensors that allow operators to set and maintain the humidity and temperature levels required for storing the products, achieving energy efficiencies.

The management of Tiriphoni Gardens is currently researching methods to improve the production process. They are consider introducing aerial imagery, a technology that uses drones to take images and provide precise and up-to-date information about the current phenophase of the plants, fertigation conditions, and probable problems in different areas of the land.

SUCCESS FACTORS

- **The company operates with a clear strategy, which enables it to be more productive and profitable.**
- **Researching and testing technologies before applying them to the production process leads to better-informed decision-making. A gradual introduction of new tools and technologies in the company allows for cost savings.**
- **Seeking financial support by applying for grants and co-financing programs helps improve access to finance.**

© Tiriponi Gardens

VALIDATION

Tiriphoni Gardens successfully sells its products to local supermarket chains and exports its goods to foreign markets as well. The use of innovative approaches and modern technologies allows Tiriphoni Gardens to maintain high-quality increased yield and provide a stable supply of quality apples, making Tiriphoni Gardens a reliable partner for local and international companies.

IMPACT

The technologies in use help Tiriphoni Gardens to optimize the use of resources, increase the quality of its products, quickly respond to challenges in the production process, and remotely manage different parts of the production.

The adoption of a weather station and sensors allow efficient resource utilization. They can make timely interventions and apply water, together with fertilizers and pesticides when needed. The environmental footprint is reduced as Tiriphoni Gardens does not overconsume resources, but uses exactly the needed amounts of fertilizers, pesticides, and water in the production process. This also means that employees are less exposed to chemicals and adverse effects on their health are reduced.

The automated grading and sorting line helps to achieve efficiency and reduce labour costs through automation. It also increased marketability by ensuring consistent quality standards, which can lead to higher prices and better profitability for the producer. It can also reduce food loss by separating apples that are not marketable for sale, but that could be consumed in other ways.

The cold storage room equipped with sensors allows for precise temperature and humidity control, ensuring that the stored products are kept at optimal temperatures for maximum quality of shelf life and reducing energy consumption, thereby lowering operating costs. It also enables remote monitoring and control, reducing the need for manual labour, as well as data logging and analysis. Ultimately, precise temperature control can help preserve the quality and safety of the stored products, reduce the risk of contamination as well as spoilage and waste.

CONSTRAINTS

One of the challenges that Tiriphoni Gardens faces is a lack of specialized laboratories in Georgia for quality control testing. Thus, the company must send products to laboratories abroad and pay associated higher costs.
The COVID-19 pandemic had a negative impact on the company, especially in terms of logistics and the ability to procure technologies from abroad. For example, the delays in importing equipment affected the construction of the cold storage facility.

SUSTAINABILITY

From an economic perspective, the technologies in use help the company to obtain high-quality products that can easily find a place on supermarket shelves and be exported to different markets.

Additionally, precision agriculture technologies help to achieve environmental sustainability. They can significantly optimise the use of resources and production inputs as these tools allow the producer to apply exactly the necessary amount of water, pesticides, and herbicides.

Finally, as a result of the automation of the process and the lack of chemical exposure, labour costs are reduced and the working conditions for employees are significantly improved.

REPLICABILITY AND UPSCALING

The company first piloted its technologies on a smaller portion of its land to observe the real benefits and constraints of using the given technology. Only after reviewing the results of the pilot, it decided to implement the system for the whole orchard. This is a verification means for scalability.

The use of precision agriculture technologies contributed to business success. Therefore, the company plans to expand its production on additional land plots and introduce new varieties of apples.

In addition, company representatives think that it will be beneficial to start producing sweet cherries in order to better utilize the capacity of the cold storage facility. Apples and sweet cherries have different harvest periods and when apple harvest starts, stocks of cherries will already be sold. These lessons, as well as the methodology and business model of the company can be replicated by other farms.

CONCLUSION

Tiriphoni Gardens gradually implemented various precision agriculture and agriculture automation technologies in its apple production and it is planning to grow its business to start a sweet cherry production. Its innovative approaches contributed to higher-quality products, help achieve and maintain international certifications and facilitated marketability and international market access. Moreover, the benefits of adopting innovative approaches extend beyond the advantages of the reduction of production and labour costs. They also help to reduce the environmental footprint, improve working conditions, and to cement the company's presence in local and international markets.

LESSONS LEARNED

- Digitaltechnologies can lead to high-quality homogeneous products with improved marketability, labour efficiency and reduced environmental footprint. High-quality and certified products have better chances to reach international markets.
- Carefully researching and testing new production technologies and gradually introducing digital innovations leads to less resistance to change in personnel, smoother adoption, and reduced risks of failure.
- Collecting and analysing data improves the decision-making and planning process.

MORE INFORMATION

This case study was elaborated by the Georgian Farmer's Association (GFA)and the Food and Agriculture Organization (FAO).

It was developed through interviews with Zurab Gojiashvili, co-founder of Tiriponi Gardens, in 2022.

For further information about this case study, please reach out to FAO at REU-Digital-Agriculture@fao.org.

FARMING AT NEW HEIGHTS: SERGEI'S AGRO-DRONES

Kyrgyzstan

SUSTAINABLE DEVELOPMENT GOALS

INTRODUCTION

Among the majority of Kyrgyz farmers who still uphold traditional and indigenous practices, a small but growing number of pioneers are introducing digital solutions to agriculture. One of these innovators is Sergei Baimov, among the first Kyrgyz entrepreneurs to employ unmanned aerial vehicles (drones) in farming.

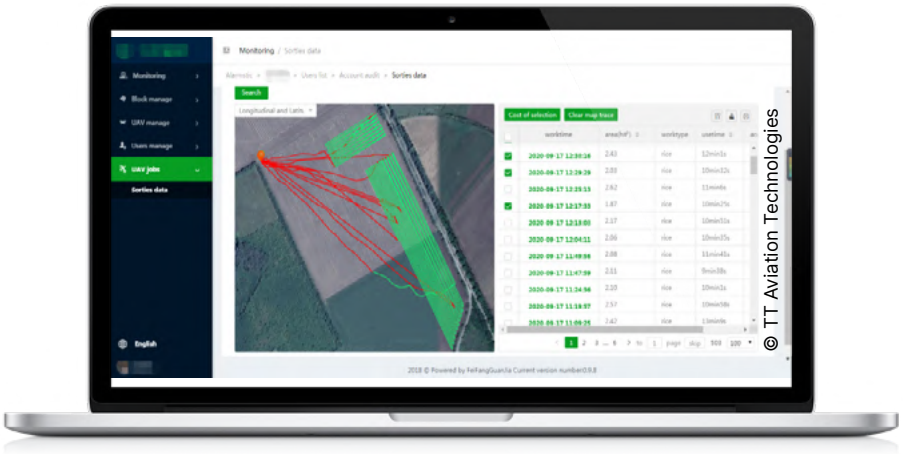
Sergei has been working with drones since 2011 and was the first to bring drones to Kyrgyzstan. At that time, Sergei's team used to work with radio-controlled models and was assembling the drones manually. Today, his enterprise boasts a diverse range of ten drone types, encompassing quadrocopters, rotary drones, planes, and more.

As of early 2022, Sergei's focus has shifted to delivering specialized drone services tailored explicitly for the agricultural sector. His ten "agro-drones" are equipped with specialized software packages for monitoring fields, forests, and livestock, as well as for precision aerial spraying of fertilizers, pesticides, and herbicides.

Sergei's services have generated considerable interest, prompting farmers and other stakeholders to embrace these emerging technologies. The majority of his customers are small-scale farmers who request spraying services for 5–15 hectares of land. Agroholdings and the public sector have just recently started partnering with Sergei's company.

OBJECTIVE

This case study demonstrates the main advantages and various applications of using drones in agriculture, as demonstrated by Kyrgyz entrepreneur Sergei Baimov. It shows the potential of drones to improve agricultural production and farmers' decision-making by improving precision in farming, reducing risks to workers, diminishing environmental impacts and raising the efficiency in the collection of field information. More importantly, it shows how sophisticated and high-end technological solutions can be applied in different geographies and socio-economic contexts and even serve the needs of farmers who are not in the position to afford these expensive technologies themselves.



Leveraging his extensive experience, Sergei and his team of experts now offer several services, including maintenance and drone setup for clients. In addition to repairing agricultural drones, Sergei's company also provides training for drone pilots, a distinctive offering within Kyrgyzstan.

GEOGRAPHICAL COVERAGE

The entrepreneur provides services all over Kyrgyzstan.

Source: United Nations Geospatial. 2011. *Kyrgyzstan*. Cited 27 December 2023. https://www.un.org/geospatial/file/2036/download?token=ACIAKvzw

ACTORS AND STAKEHOLDERS

- farmers
- solution providers
- national organizations

METHODOLOGICAL APPROACH

Drones were not utilized in the Kyrgyz Republic prior to the 2010s, and Sergei was among the pioneers to commence demonstrating the advantages of employing drones for agricultural purposes in the country.

Sergey's agricultural drones are equipped with advanced technologies. Navigation relies on Global Positioning System (GPS) and Global Navigation Satellite System, enabling operators to remotely configure flight routes through the ground control system, with options for manual or automatic route generation. The drones feature multispectral and hyperspectral cameras, thermal cameras, Light Detection and Ranging, obstacle avoidance radars, a first-person view camera, and a terrain-following radar that allows the drone to follow the height change of the terrain and keep the distance from the ground fixed at all times, ensuring efficient and safe operations. A real-time kinematic positioning system allows precise tracking of flight routes and sprayed areas.

For data analysis, Sergey's company relies on a software provided by the drone manufacturers, accessible through both desktop and mobile applications. This software enables operators to create and manage flight paths, recording essential data such as sprayed area information, location, flow rate, drone speed, and altitude – all stored securely in the cloud. The software supports various data upload methods, including 4G connectivity, Bluetooth, and temporary storage in the remote controller's offline data storage. Notably, operators have real-time control over chemical flow rates through the software interface, enhancing precision and responsiveness in the field.

RGB maps and NDVI (Normalized Difference Vegetation Index) provide essential insights into crop health, aiding precision aerial spraying. RGB maps use the three primary colours – red, green, and blue – to capture high-resolution visual information of the crops and the surrounding environment. NDVI is derived from the multispectral images captured by sensors, which detect reflected light in various bands, and provides information about the level of chlorophyll and overall vegetation health.

RGB maps and NDVI assist in visualizing crop patterns and identifying potential issues, such as pest infestations, diseases, malnourishment, drought, or uneven growth. This capability facilitates precision aerial spraying, allowing for the targeted application of fertilizers or pesticides to specific areas that demand attention. This approach optimizes resource utilization and minimizes environmental impact.

Sergei's drones have a 10-liter tank capacity and are powered by lithium batteries, with an average flight duration of 10 to 12 minutes. Recharging occurs in the field using generators.

This comprehensive technological integration ensures efficient, data-driven, and sustainable agricultural drone operations for Sergey's company.

VALIDATION

Sergei's business idea and innovative approach to doing agriculture in Kyrgyzstan has demonstrated its success by attracting large numbers of interested farmers, general public, and also national-level bodies. The concrete solutions provided by Sergei have not only piqued interest but have also acted as a catalyst, motivating individual Kyrgyz farmers to invest in drones to enhance their agricultural activities.

SUCCESS FACTORS

Sergei's substantial financial investment in agricultural drones during a time when this technology remained relatively unfamiliar in Kyrgyzstan underscored his success. This achievement was bolstered by several additional key success factors:

- Sergei offers a range of drone services in agriculture that cater to diverse user needs, including the ones of small and medium-scale farmers. This approach widens the spectrum of potential users.
- embracing a calculated level of risk, Sergei positioned himself advantageously as a pioneer within the field. His willingness to venture into uncharted territory set the stage for his company's success.
- Sergei's company invested in awareness-raising campaigns to facilitate engagement with both private and public sector stakeholders. These campaigns played an important role in familiarizing a diverse audience with the transformative potential of drone technology in agriculture, fostering interest and participation.

IMPACT

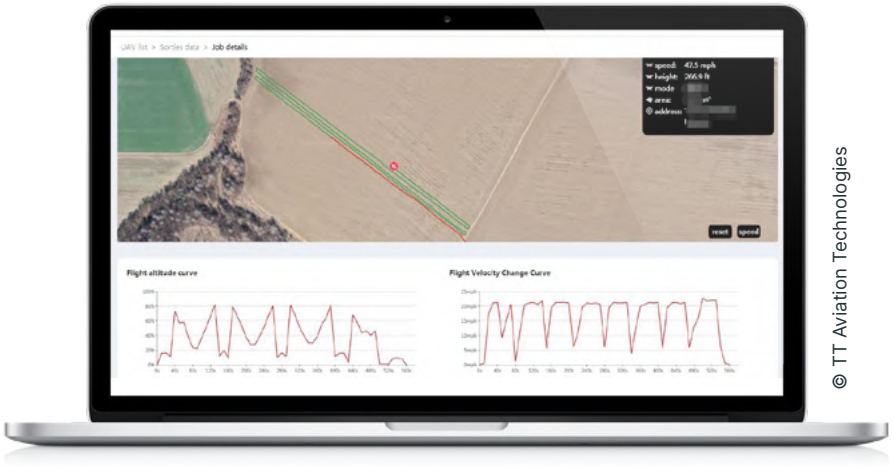
Sergei's company has effectively showcased the manifold advantages and potential applications of drones within agriculture and beyond.

Compared to traditional methods of monitoring fields, the utilization of drones offers undeniable benefits that translate into reduced manual labor, more efficient use of resources, more accurate monitoring of fields, and enhanced safety for both agricultural workers and the environment, particularly in terms of fertilizer usage.

Drones can also play a crucial role in early pest and disease management, as well as treatment. In 2022, Sergei's services helped address pests affecting sugar beet production in Kyrgyzstan, demonstrating the effectiveness of drones in pest management.

Sergei's company extends its services to financially constrained farmers, granting them the opportunity to harness the advantages of drone technologies through an «as-a-service» model for areas as modest as a few hectares. By tailoring services to the specific needs of individual farmers, the company offers a cost-effective solution, alleviating the burden of investing in expensive equipment for these agricultural practices and optimizing the use of pesticides and fertilizers.

Moreover, Sergei's drone pilot training services created new employment opportunities for individuals across various sectors.



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Currently, in accordance with the Air Code of the Kyrgyz Republic, the use of drones is allowed only with the permission of the Civil Aviation Agency, which requires obtaining a certificate. Additionally, the drones must be registered with the Civil Aviation Agency before they can be flown legally. To import drones into Kyrgyzstan, individuals or entities must obtain permissions from both the State Committee for National Security of Kyrgyzstan and the Service for Regulation and Supervision in the Communications Industry.

- As a physical asset, drones must be often transported to remote agricultural areas. This can be logistically challenging, especially without appropriate vehicles or infrastructure.
- Scaling up a drone-based agricultural monitoring service requires more than just additional investment. It involves considerations like hiring and training staff, developing efficient workflows and expanding service coverage.

CONSTRAINTS

Sergei has encountered several constraints that could serve as general guidelines for those interested in following his path:

- The initial investment required to purchase drones, especially if intended for multiple functions or equipped with advanced sensors, can be substantial. This initial cost can be a barrier for individuals or small businesses looking to adopt drone technology for agricultural purposes.
- The field of drone technology is rapidly evolving, leading to constant upgrades and innovations. This can make it challenging for individuals and businesses to keep up with the latest advancements and ensure their drone equipment remains competitive.
- Drone regulations vary from country to country, and even within different regions of the same country. These regulations can impose limitations on drone usage and other operational aspects. Sergey states that recently the regulations on importing and operating drones have become stricter.

SUSTAINABILITY

Sergei's endeavour exhibits strong potential for sustainability. The reduction in manual labour, efficient resource utilization, and precise monitoring offered by drones contribute to long-term sustainability by optimizing production processes and minimizing environmental impact.

Furthermore, Sergei's commitment to democratizing drone access through cost-effective solutions ensures that smaller-scale farmers can benefit of precision spraying services without the burden of significant upfront investments.

Sergei's expanding client base and growing team further enhance the sustainability of his endeavour. As of 2022, the businessman plans to open office exclusively for agricultural drones.

As word spreads about the positive impact of his services on harvest quality and field security, more farmers are likely to adopt similar technological approaches. This diffusion of innovation creates a self-sustaining cycle, where the benefits realized by initial adopters inspire broader adoption among the farming community.

REPLICABILITY AND UPSCALING

The case of Sergei demonstrates significant potential for replicability and upscaling. While drones are already proving transformative in agriculture globally, Sergei's multifaceted services cater to diverse user requirements, offering a blueprint for other regions and contexts. His emphasis on tailored solutions and versatile applications increases the likelihood of widespread adoption across various agricultural landscapes.

Ultimately, the keen interest displayed by national authorities in leveraging drone technology across various sectors adds another layer of replicability to Sergei's business. As the use of drones gains recognition and support at the governmental level, it catalyzes the proliferation of drones in Kyrgyzstan, contributing to the long-term viability of the drone-enabled agricultural revolution.

CONCLUSION

As drones continue to reshape agriculture, Sergei's case underscores the potential for transformative change within sectors that have historically remained rooted in conventional methods.

His example has already demonstrated advantages of agricultural drones for all sorts of farmers. Drones are expensive to buy for personal use, but people can use his services. By using drones in agriculture, the farmers can increase their yields, ensure food quality standards, and better protect the environment.

Similar drone services to Sergei's can also offer job opportunities for the younger generation in the rural areas.

LESSONS LEARNED

The lessons learned from Sergei's pioneering use of drones in Kyrgyz agriculture underscore the importance of strategic risk-taking, education, and adaptable service offerings.

- **Introducing innovative technologies in traditionally rooted sectors can yield substantial benefits.**
- **The spread of drones in agriculture and other sectors accelerate the process of development of said technology, therefore it remains important to keep up to date with the most recent changes and emerging solutions that drones can offer.**
- **Through his adaptable service offerings, Sergei effectively caters to a diverse clientele, accommodating the needs of both agroholdings and smaller-scale farmers.**
- **The legislation of drones is not well-established in all countries yet, while the usage of drones is considered dangerous, and proper pilot trainings for drones are inevitable. Sergei, to address this in his home country, started providing trainings for pilots.**

MORE INFORMATION

This case study was elaborated by the American University of Central Asia (AUCA), and the Food and Agriculture Organization (FAO).

It was developed through interviews with entrepreneur Sergei Bainov in 2022.

For further information about this case study, please reach out to FAO at: REU-Digital-Agriculture@fao.org.

SAVING WATER, MAXIMIZING YIELD: MOISTURE SENSORS FOR IRRIGATION. PAVEL'S STORY

© FAO/Kamilla Tuleyeva

Kazakhstan, Qaraghandy region

SUSTAINABLE DEVELOPMENT GOALS

INTRODUCTION

Pavel Lushchak established his farm in 2 000. Since then, the farmland has grown a hundredfold from 200 ha to 20 000 ha. Pavel employs 143 people and produces a wide range of crops on his farm, from grains and legumes to oilseeds and potatoes. Because of Qaraganda's dry summers, he has to pay close attention to irrigation.

In 2014, Pavel launched a potato irrigation project, purchasing new sprinkler instal-lations. The potato crop was good, but he noticed that during the harvest the potatoes were sometimes dirty, which required additional workers to dry and sort them. This made him think that he might be overwatering his crop. He installed moisture sensors in the potato fields to determine how much moisture the crop was consuming at different soil depths.

By introducing this innovative technology on his farm, Pavel pursued the following goals:

- Increase the efficiency of the irrigation process for moisture-loving crops and, as a result, improve the quality of yield.
- Use material resources and labour more efficiently.

Moisture sensors have helped eliminate human error in decision-making on the farm. For example, if earlier farmers had to manually check the soil moisture level in each field, now the moisture sensors provide the necessary information remotely in 15 minutes. Instead of going to the field and visually inspecting the moisture levels, a farmer can access the sensor readings from their computer to see how much moisture the crop requires at that moment.

OBJECTIVE

This case study focuses on the experience of a Kazakhstani farmer who has successfully started growing wet crops, such as potatoes and alfalfa, in a low-rainfall region. This became possible after he began to use moisture sensors. It describes how he experimented with various moisture sensors before deciding on the technology that best suited him, and how this practice helped him improve both the quality and volume of his potato and alfalfa harvest.

Taking into account the operational weather data, they can decide on the amount of irrigation necessary for each crop.

The technology saves time both for farmers, who no longer have to manually determine soil moisture, and workers, who once had to dry and sort potatoes.

In addition, with the implementation of the technology, the farm does not waste water and electricity. Each cubic metre of irrigation water is now carefully calibrated and taken into account by moisture sensors.

ACTORS AND STAKEHOLDERS

- farm owners in Central Kazakhstan;
- agronomists and other farmers and crop and vegetable growers who are interested in the introduction of innovative technologies in irrigation;
- technology providers; and
- researchers, professors, and students from agrarian and engineering universities.

GEOGRAPHICAL COVERAGE

Kazakhstan, Qaraghandy province, Osakarov district, Nikolayevka village

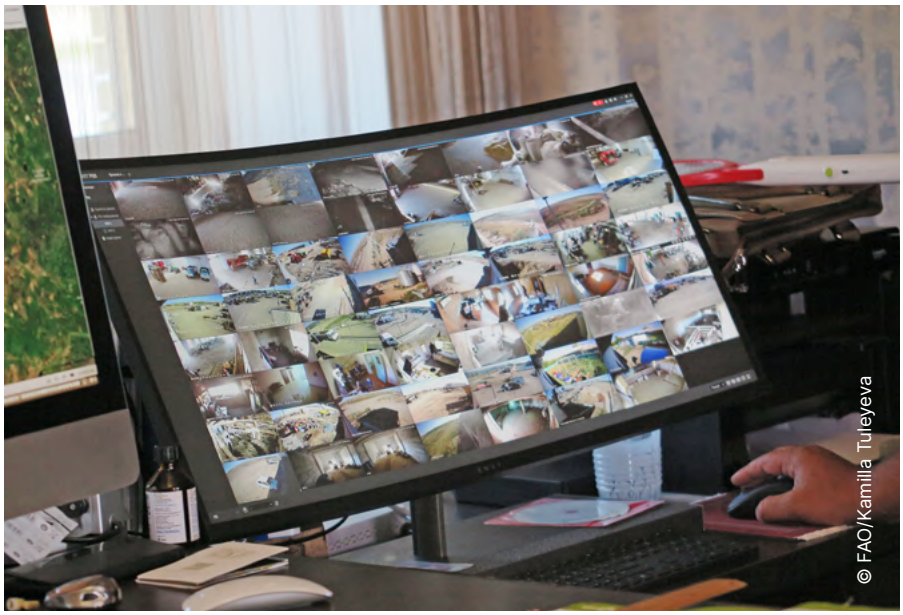
Source: United Nations Geospatial. 2020. *Kazakhstan*. Cited 27 December 2023. https://www.un.org/geospatial/file/2015/download?token=wETZTp56

METHODOLOGICAL APPROACH

In 2019, Pavel decided to test his potato overwatering theory. He purchased moisture sensors and a weather station. The sensors consist of a steel rod, an aluminium shell with a display, and scales to protect against clay and sand. They offer moisture accuracy of ± 3 percent (after soil-specific calibration) and the built-in temperature sensor achieves ± 0.5°C.

The weather station serves as a brain for the sensors that measure the moisture amounts for every 10 cm of soil up to the depth of 1 m. This helps the farmer understand how much moisture the crop consumes at different levels of soil depth. The data from the sensors is automatically transmitted through the weather station to the farmer's computer.

Pavel learned about the technology from colleagues on the internet. When necessary, he personally met with technology suppliers, and attended presentations and thematic exhibitions. He introduced the new technologies gradually. Before making a final decision on the use of any technology, Pavel tested it for its adaptability. If the technology did not fit his needs, he searched for alternatives, never settling on one option.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VALIDATION

The use of moisture sensors in irrigation has significantly improved the quality of the crops and saved workers' time. In addition, Pavel can collect and analyse historical irrigation data, allowing him to experiment with irrigating different crops.

The weather station costs about KZT 1.5 million (USD 3 500) while one humidity sensor costs about KZT 735 000 (USD 1 600). Thus, a system consisting of a weather station and a moisture sensor costs about KZT 2.2 million (USD 5 000) on average.

Pavel spent a total of about KZT 10 million (USD 23 500) on this technology. According to his economic analysis, the annual cost saving is KZT 12 million (USD 28 200). Thus, Pavel recovered the equipment's costs in less than a year.

SUCCESS FACTORS

- The farmer clearly understood that the old irrigation methods no longer worked, and he was willing to invest in new technologies to develop his business.
- Institutional support was not required as the farmer invested his own money from his business and used his own land.
- Available technology on the market was thoroughly researched.
- New equipment was introduced gradually, and each technology tested in advance for adaptability and compatibility with other solutions.

IMPACT

The implementation of this practice has helped Pavel improve the quality and yield of potatoes being produced on his farm. Later, he used moisture sensors to irrigate alfalfa, thereby improving the quality and volume of the crop by 20–30 percent. In addition, moisture sensors have increased the efficiency of water and electricity use.

The potato irrigation project created additional jobs for women, as the farm needed additional workers at the potato storage facility because of the increased yield. While only 5 percent of the farm's workers were women before the project started, women now make up 30 percent of the team.

The introduction of digital solutions has allowed workers to better manage their time. With proper irrigation, potatoes no longer need to be washed and dried after harvesting, making working conditions easier for workers who harvest potatoes.

CONSTRAINTS

The use of humidity sensors and weather stations requires a high-speed internet connection, which is unaffordable for most farmers.

SUSTAINABILITY

Soil moisture monitoring allows farmers to use water more efficiently by not over-watering some crops and sufficiently irrigating others. In addition, the farm saves energy on pumping. In a broader sense, excessive irrigation causes great harm not only to crops but also to the soil, given that moisture, like oxygen, must be consumed in precisely measured quantities. Rationed irrigation helps to protect the soil from salinization.

LESSONS LEARNED

- Carefully select technologies for implementation.
- Train specialists who can work with new technology.

REPLICABILITY AND UPSCALING

It is not recommended to apply this technology on farms that do not have an analytical information system and experienced management personnel. Thus, the use of such technologies for small farms is impractical.

CONCLUSION

This practice has several beneficiaries. The farm owner increased the efficiency of irrigation, improved the quality and volume of crops, and therefore earned more income from his work. In addition, the farm is using water and electricity required for irrigation more efficiently.

Through the introduction of the practice, the farm workers stopped manually determining soil moisture and crop irrigation rates and were able to focus on other tasks.

The practice has also improved working conditions for the women working at the potato storage facility. Thanks to a precisely calibrated watering rate, they no longer have to wash and dry dirty potatoes.

MORE INFORMATION

This case study was elaborated by the Kazakhstan Growers' Union (KGU) and the Food and Agriculture Organization (FAO).

It was developed through interviews with Lushchak Pavel, farmer, in 2021.

For further information about this case study, please reach out to FAO at: REU-Digital-Agriculture@fao.org.

EFFICIENT AND PRECISE FIELD WORK: PAVEL'S GPS MONITORING OF AGRICULTURAL MACHINERY

© FAO/Kamilla Tuleyeva

Kazakhstan, Qaraghandy province

SUSTAINABLE DEVELOPMENT GOALS

INTRODUCTION

Founded in 2 000, Lushchak Pavel's crop farm has grown a hundredfold in 20 years, from 200 ha to 20 000 ha. As the farm grew, Pavel needed to optimize costs and make the production process more efficient.

Previously, his agricultural machinery was not equipped with GPS navigation. Workers operated tractors and combine harvesters by eye, often resulting in some parts of the field being missed during harvesting or sowing. In such cases, it was necessary to start the machinery again to process the missed areas wasting time and fuel.

In 2016, Pavel bought new tractors and combine harvesters equipped with several additional functions to determine soil moisture levels and record data on the work done. In 2018, he also equipped the machines with GPS trackers. This allowed him to monitor the machines' work remotely using special software.

By introducing these innovative technologies on his farm, Pavel pursued the following goals:

- Improve the efficiency of production processes by better distributing the labour of machine operators.
- Use fuel more efficiently and make up for the shortage of workers.

Regular tracking of machinery using GPS trackers allowed dispatchers to make routes more efficient and eliminate the possibility of using machinery for personal use. This resulted in fuel savings during the harvesting and sowing seasons.

OBJECTIVE

This case study focuses on the experience of a farmer from Central Kazakhstan, who started to use GPS monitoring of agricultural machinery for cultivating his fields. It describes how this practice helped the farmer significantly save fuel and more efficiently distribute the work of the farm's equipment operators amid a shortage of workers. It also explores how other crop farmers can apply this practice on their farms.

In addition, the transition to GPS navigation reduced the load on machine operators. If previously they had to manually control the trajectory of the machine, now all they have to do is enter the field coordinates and the machine will automatically move along the specified trajectory.

The introduction of the new technology also created two additional jobs for women who now work as dispatchers. They, as well as other employees working with GPS trackers, were trained to use the technology. The dispatchers control the recording of data as agricultural machinery enters the farm. At the control point, the machines' licence plate numbers are read, and goods are weighed on electronic scales and recorded on electronic invoices. Data analysis takes place later, at the administrative level.

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ACTORS AND STAKEHOLDERS

- farm owners;
- farm employees;
- agronomists, other farmers, and crop and vegetable growers who are interested in implementing GPS monitoring; and
- GPS tracker suppliers.

GEOGRAPHICAL COVERAGE

Kazakhstan, Qaraghandy province, Osakarov district, Nikolayevka village

Source: United Nations Geospatial. 2020. *Kazakhstan*. Cited 27 December 2023. https://www.un.org/geospatial/file/2015/download?token=wETZTp56

METHODOLOGICAL APPROACH

Pavel asked his fellow farmers about the digital technologies they were using while also searching for relevant information on the web. He renewed his fleet of agricultural machinery gradually, replacing outdated models with more functional models with automatic data analysis.

For example, since 2018, Pavel has purchased one new combine harvester per year. Now his farm's fleet of agricultural equipment is 90 percent renewed and equipped with GPS trackers.

Pavel helped his workers adapt to the new equipment by setting up training courses.

VALIDATION

The implementation of GPS monitoring of agricultural machinery allowed Pavel to increase the productivity of his machine operators and the efficiency of the farm as a whole.

In addition, the introduction of GPS navigation technology on the farm has led to savings of about 200 tonnes of fuel per year across the farm by reducing unproductive trips and the inefficient use of machinery.

IMPACT

Replacing outdated agricultural machines with ones that are more complex and equipped with sensors to read data and other additional features required workers to learn additional skills. As a result, machine operators who have learned to work on new, more complex equipment earn more.

The use of new technology has contributed to more precise fieldwork. Agricultural machines move along defined trajectories, which eliminates skipped sections and leads to more efficient use of fuel.

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SUCCESS FACTORS

- The farmer clearly understood that to increase the efficiency of the production process, he needed better, modern, more complex equipment. Institutional support was not required as he invested his own funds from his business and used his own land.
- Available technologies on the market were carefully studied and additional information gathered personally from technology suppliers when necessary.
- The farm's fleet of agricultural equipment was gradually renewed.
- Employees were given special training to learn how to use the new equipment.
- Well-established logistics allowed to the efficient use of machinery, in particular, to transport grain during the hottest season for farmers: harvesting.

SUSTAINABILITY

Switching to more advanced agricultural machines solves the problem of labour shortages. High-performance harvesters require fewer operators to maintain them. This reduces the investment in the processing of 1 ha of land and increases productivity.

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CONSTRAINTS

- One of the main difficulties Pavel encountered in applying good practices was a lack of IT specialists. He had to stop using some of the programs because they required up to four operators to maintain them.
- Another challenge was the implementation of GPS monitoring technology, which requires high-speed internet. In 2016, the farm used mobile data, but it was not enough. In 2018, Pavel invested in connecting the enterprise to high-speed broadband internet.

REPLICABILITY AND UPSCALING

According to Pavel's economic assessment, the payback period for GPS navigation technology on a farm with an area of 20 000 ha is less than a month. Due to the low cost of implementing the technology and the significant economic effect, the use of GPS navigation technology to prevent the unproductive use of machinery is recommended for all farms that use their own or hired machinery, regardless of the farm's size.

LESSONS LEARNED

The use of GPS monitoring of agricultural machinery increases the efficiency of the production process and results in better use of both human labour and material resources.

CONCLUSION

This practice has several beneficiaries. The farmer improved the efficiency of the production process and received valuable data for further planning of his work. As a result of the practice, he was also able to significantly save on fuel.

In addition, the farm has become more efficient in the use of machine operators. Some workers on the farm have gained new skills in operating more advanced machinery and thus increased their income.

The implementation of this practice also helped to create new jobs for women.

MORE INFORMATION

This case study was elaborated by the Kazakhstan Growers' Union (KGU) and the Food and Agriculture Organization (FAO).

It was developed through interviews with Lushchak Pavel, farmer, in 2021.

For further information about this case study, please reach out to FAO at: REU-Digital-Agriculture@fao.org.

PRECISION FARMING WITH PARALLEL AUTOMATIC DRIVING: NURLYBEK'S STORY

Kazakhstan, Aqmola region, Burabay district

SUSTAINABLE DEVELOPMENT GOALS

OBJECTIVE

This case study focuses on the experience of a farm manager from Kazakhstan, who introduced parallel driving technology on his farm. It explores how he decided to implement parallel driving, and what factors guided him in choosing the suppliers of this innovative technology. It also describes the early results of the practice, including specific economic benefits in the form of cost savings, and how other crop farms can begin to apply the technology in their operations.

INTRODUCTION

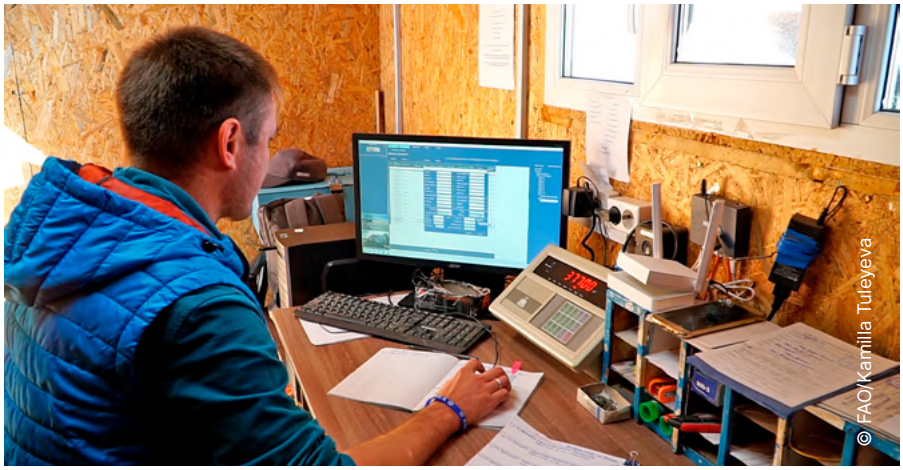
The farm, located in the Aqmola region, has been operating since 2014, growing crops on about 12 000 ha. At first, the farm used traditional methods of growing crops, but everything changed with the arrival of the new farm manager, Seyitzhaparov Nurlybek, in 2017. After analysing the farm's activities, Nurlybek discovered the fields were being cultivated ineffectively. Manual operation of agricultural machinery during the sowing and weeding of the fields led to regular reseeding of 15–20 ha annually. This in turn led to the overconsumption of seed, fertilizer, and fuel.

Nurlybek decided to create conditions for more economical and profitable farming on the farm. In 2019, he convinced the farm owner to equip all farm machinery with parallel driving systems to help machine operators avoid omissions and overlaps when cultivating the field.

By introducing this innovative technology, Nurlybek pursued two goals:

- Minimize the impact of human error in tillage thus eliminating field reseeding.
- Reduce seed and fertilizer costs by building better routes for agricultural machinery.

The introduction of parallel driving has led to significant cost savings. It has also increased productivity for machine operators as automated driving has greatly facilitated night-time work when temperatures are not so high.



GEOGRAPHICAL COVERAGE

Kazakhstan, Aqmola region, Burabay district

KAZAKHSTAN
RUSSIAN FEDERATION
Burabay
Nur-Sultan
Chelyabinsk
Kurgan
Petropavl
Omsk
Karasuk
Kokshetau
Pavlodar
Kurchatov
Semey
Oskemen
Oral
Furmanovo
Dzhambeyty
Aqtöbe
Khromtau
Qarabutau
Atyrau
Ganyushkino
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Aktumsyk
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Zhetybay
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Oyyl
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Yrghyz
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Saryshagan
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Taldyqorghan
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Qyzylorda
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ARAL SEA
Ustyurt Plateau
Qaraghandy
Arqalyq
Zhailma
Ridnyy
Qostanay
Lebyazhye
Georgiyevka
Bestamak
Ayaguz
Urdzhar
Zaysan
Beskol
Karaganda
Temirtau
Zhezkazgan
Balkonur Cosmodrome
Ostrova Vozrozhdeniya
Ostrova Tyuleniy
Poluostrov Buzachi
Fort Shevchenko
Kazakskiy Zaliv
Qattaqorghon Suv Omborii
Toqtakon Suv Omborii
Tarim
Takes
Yoshkon
Ural
Volga
Irtysh
Tobol
Ishim
Sarysu
Shu
Ili
Chu
Syrdariya
Amu Darya
Caspian Depression
Ural Mountains
Lake Balkhash
Issyk-Kol
Lake Zaysan
Lake Markakol
Lake Tengiz
Lake Alakol
Lake Sarykamys
Lake Qattaqorghan
Lake Aydarkol
Lake Koshkarkol
Lake Shalkar
Lake Zhaltyr
Lake Qyzylkak
Lake Qamqaly
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VALIDATION

Parallel driving has proven to be an easy enough technology to implement. When working, the machine operator needs to enter the width of the grip and record the coordinates of the start of the movement. After the first pass, they indicate the point of completion of the movement. Then, the device independently analyses the data, draws parallel lines, and displays a map with the course indicator on the monitor. The technique works with the help of satellite navigation systems, creating both straight and curved lines, minimizing overlaps and crossings.

IMPACT

This innovation has reduced costs through savings on seed, fertilizer, and crop protection products, allowing the farm to generate more income. The farm's net income, in turn, directly affects the employees' income since 10 percent of its net income is distributed to employees annually as bonuses. Pesticide pollution was reduced. More accurate seeding and reduced inaccuracy in seeding and fertilizer application reduced the amount of pesticides sprayed.

SUSTAINABILITY

- The equipment cost about KZT 1 million (USD 2 350). With a standard machinery load of 600 ha per season, the annual resource savings from using the tractor for two operations (tillage and seeding) would be KZT 420 000 (USD 990) without subsidy and KZT 273 000 (USD 640) with subsidy.
- With a standard machinery load of 2 500 ha per season, the annual resource savings would be KZT 1.47 million (USD 3 450), without subsidy. In the case of subsidizing the cost of seed, fertilizer, and fuel purchased (according to the subsidy standards as of 2020), the savings in resource costs when using the parallel driving system would be KZT 854 900 (USD 2 008).

SUCCESS FACTORS

- The benefits for the farm and the wishes of the workers who were going to use this technology guided the choice of supplier.
- The practice of parallel driving proved to be easy to implement. The involvement of the machine operators in the selection of suppliers ensured the rapid adaptation to the new technology.
- No government support was required as the farm invested its own funds in the practice so.

CONSTRAINTS

- The main barrier Nurlybek faced was the high cost of equipment, as a result of which he had to purchase some devices second-hand.
- In addition, there are sometimes problems with satellite communication in the Burabay region, which complicates the operation of parallel driving systems.

REPLICABILITY AND UPSCALING

The technology has very high economic efficiency indicators when using high-performance equipment (tractors, combine harvesters), for which the high annual production rate is more than 2 000 ha per machine. The technology can be used on any farms (regardless of size) where such high-performance machines are available and used. It is important to note that the equipment, if necessary, can be reinstalled on any vehicle.

If the parallel driving system is used on less-energy-intensive machines, for example, on tractors with an annual production rate of 600 ha (K-700 tractor), the economic efficiency will be 4.2 times worse, i.e. the payback period for investments in equipment for parallel driving will increase proportionally four to five times and will be about three years without the use of subsidies and five years with the use of subsidies for seed, fertilizer, and fuel.

The technology can be used in any farm, regardless of size, where high-performance machines with an annual load of more than 600 ha per year are available and rationally used (with 100 percent utilization).

LESSONS LEARNED

The work of machine operators was made easier and at the same time more productive. Previously the tractor operator had to look back regularly when sowing and manually ensure that there was no reseeding needed, but now the machinery does it for them. All that is required is for the operator to correctly enter the exact coordinates and turn the machine in a timely manner to enter a new lane.

CONCLUSION

This practice has several beneficiaries. The farm manager has reduced operating costs, thereby increasing the farm's efficiency. He has also improved the working conditions of his machine operators.

Having a clear vision and discussing the various technology providers with the operators before investing in the practice proved to be critical success factors.

Further implementation of parallel driving technology could require support in the form of subsidizing the cost of the equipment.

MORE INFORMATION

This case study was elaborated by the Kazakhstan Growers' Union (KGU) and the Food and Agriculture Organization (FAO).

It was developed through interviews with Seyitzhaparov Nurlybek, farmer, in 2021.

For further information about this case study, please reach out to FAO at: REU-Digital-Agriculture@fao.org.

MODERNIZED ALMOND PRODUCTION: AUTOMATION AND PRECISION AGRICULTURE TECHNOLOGIES DEPLOYED BY GIGI

Kvemo Kartli region, Georgia

SUSTAINABLE DEVELOPMENT GOALS

OBJECTIVE

The objective of this good practice case study is to share the experience of the Georgian company Mkisa, which introduced innovative precision agriculture digital solutions and practices in its super-intensive almond production. The document shows the benefits of using precision agriculture and explores its benefits, constraints, and lessons learned.

INTRODUCTION

Mkisa is a start-up company that began its operation in the summer of 2020. The company founders had owned land for several years but refrained from investing in agricultural business until the year 2020 when one local bank announced an agricultural investment program entitled Agro Loan with lower interest rates and prolonged grace periods for almond production – a real novelty for Georgia's agriculture.

The founders developed a business plan, analysed projected revenues and payback periods, and decided to invest, as the numbers seemed impressive. Subsequently, Mkisa purchased additional land in Bolnisi Municipality and started setting up a super-intensive almond orchard equipped with precision agriculture technologies.

From its inception, the company representatives wanted to understand and measure everything.

"We live in a technological era, so how could this not be possible", says Gigi Gachechiladze, Executive Director. They invested in collecting information and knowledge to understand already existing practices in almond production, both at local and international levels.

Agro Loan is a funding program offered by the Bank of Georgia to support the development of olive and almond production sector in Georgia. Beneficiaries are able to finance their business expenses for the first four years of operating the orchard, including equipment and facilities purchases, labour wages, and other capital and cultivation-associated costs. The bank also assists the program's participants in finding and negotiating contracts with local and international buyers. Further, the businesses that apply for such loans are eligible for state support programs such as "Plant the Future" and "Cheap Agro Credit". Read more at: https://bankofgeorgia.ge/en/business/funding/agroproject

After researching different production technologies and consulting agronomists, the company decided to deploy the super-intensive almond orchard model. Mkisa representatives conducted a comparative analysis of intensive almond production and super-intensive production. Although in terms of the initial investment, the chosen super-intensive method (1 700 trees per hectare) was more expensive, in terms of returns and payback period, Mkisa considered this method to be the most profitable in the longer term. Their analysis showed that in 25 years the super-intensive model would generate 20–30 percent more income than the intensive model.

ACTORS AND STAKEHOLDERS

- financial service providers
- providers of precision agriculture solutions
- state programs and international development actors

GEOGRAPHICAL COVERAGE

Kvemo Kartli region, Georgia

Source: United Nations Geospatial. 2015. *Georgia*. Cited 27 December 2023. https://www.un.org/geospatial/file/1922/download?token=euWtsSCU

METHODOLOGICAL APPROACH

Mkisa uses different precision agriculture technologies and tools to enhance its super-intensive almond production, including an automated fertigation and irrigation system and a meteorological station connected to multiple sensors and a web-based and mobile application.

Fertigation refers to the injection of fertilizers, used for soil amendments, water amendments, and other water-soluble products into an irrigation system. The automated fertigation–irrigation system checks water quality, acidity, and mineral content. Fertilizers and pesticides are diluted in the water and applied only when needed. Using this system, operators can pre-set relevant mineral content and needed amounts of pesticides, as well as water volume for irrigation. The system automatically delivers water and chemicals to the plants. Thanks to the automation of the irrigation and fertigation process, human involvement is halved, and labour cost is reduced.

Furthermore, Mkisa installed a meteorological station connected to multiple sensors throughout the orchard to make exact measurements in real-time. The weather station collects information about wind speed and direction, temperature, solar radiation, humidity levels, soil moisture content, evapotranspiration, and precipitation levels. The data is sent to a cloud system, where it is analysed so that forecasts, data, and agronomic advice are made available through a web-based and mobile application called Weatherlink. Mkisa receives regular reports via email as well as early alerts when any preliminarily set parameter is not met, allowing to act quickly. For example, if the soil moisture level goes below the required level, the system alerts the company representatives to intervene and improve the soil conditions.

SUCCESS FACTORS

- Researching different technologies thoroughly to make informed decisions on which digital solutions are the best fit.
- Developing a solid business plan with returnoninvestment calculations.
- Actively seeking and applying for investment programs and grants offered by a variety of actors (financial institutions, state, and international organizations).
- A forward-looking founding team with an open mindset, eager to introduce new technologies and innovations.

VALIDATION

As of August 2022, Mkisa has adopted precision agriculture technologies in its almond orchard for less than two years with promising results. The company has not had a harvest yet and there are aspects of technologies that are still being tested and adjusted.

Nonetheless, the company decided to expand the size of the plantation from 10 ha to 40 ha and further invest in technologies. For instance, Mkisa is considering to adopt additional digital tools to better control the irrigation and fertigation systems remotely and to improve energy consumption via solar panels.

ICT-based solutions such as automated fertigation–irrigation systems and weather stations are not new to the agricultural sector, and neither are they to almond production. Almonds require sun, a warm climate, and a large amount of water in order to thrive and produce nuts. Its yield, as the yield of any type of crop, correlates with the quality and type of the soil. Via automated irrigation–fertigation systems and sensors, a farmer can determine the quality of soil, for example, the available nitrogen, and the amount of water percentage to ensure efficient utilization of water and fertilizers. Additionally, almond production is particularly vulnerable to cold weather and to frost damage that could wipe out future nuts on the trees when almonds are in full bloom. Weather stations can provide accurate weather information to farmers to mitigate the effects of the seasonal weather effects and temperature shocks, and overall can ensure better monitoring of the abiotic conditions for the plants.

IMPACT

The use of precision agriculture technologies allows Mkisa producers to consume precisely the necessary amounts of water, pesticides, and fertilizers, and to sustainably use resources in production. This reduces input costs, as producers do not overuse resources, leading to more efficient farm management and potentially improved quality and the output of the product, making it better marketable. Ultimately, also labour costs are significantly reduced, as less human involvement is needed in the irrigation and fertigation process.

"Risk reduction and management are critical in agricultural production", says Mkisa's Executive Director. These technologies allow him to reduce risks and improve decision-making and operations by measuring specific conditions providing analytical data, and sending alarm messages when there is a need for intervention.

SUSTAINABILITY

It is expected that start-up investments made in automated fertigation and irrigation system and the meteorological station are utilized year-over-year with lower costs and higher yields.

Furthermore, in the long-run, the company plans to become financially sustainable and increase its environmental sustainability. The founders, who already own a well and water reservoir for irrigation, plan to install solar panels to produce the required energy for production.

CONSTRAINTS

Technological knowledge and expertise are not widespread in Georgia and it was hard to find skilled individuals who could provide support to Mkisa to maintain, repair, and improve the digital solutions adopted. There were multiple technical issues that the company had to solve without receiving any outside support, which required deep research and precious time from the founders. Furthermore, the local labour market does not offer qualified personnel to operate effectively the technologies implemented.

According to the company representatives, the super-intensive almond production model that Mkisa deploys in almond production is innovative for Georgia and relatively new worldwide. There is no available information on such practice locally and the information available from international sources for such production methods is limited as this type of practice is only around for 15 years.

REPLICABILITY AND UPSCALING

The company manages multiple land plots in Georgia, producing different agricultural products in addition to almonds, such as blueberry and maize. The founders keep studying and analyzing returns from the use of technologies and plan to introduce similar methods in their other plantations.

Furthermore, the company seeks to achieve economies of scale in its almond production by expanding the plantation size. They purchased an additional 30 ha of land bordering the orchard to expand their production, where the existing technologies can be applied with a relatively small investment. Since a weather station is already installed, Mkisa would only need to purchase additional nodes (sensors), whereas the already installed irrigation–fertigation system together with the water reservoir and water well have enough capacity to cover the whole orchard.

The Mkisa team maintains an active Facebook account where it displays its practices and promotes its produce (Mkisa • **მკისა** - https://www.facebook.com/MkisaAgronomist). This experience might inspire other farmers in the region to use digitally enabled precision agriculture tools.

CONCLUSION

In two years, Mkisa adopted, installed, and began to operate precision agriculture solutions in its super-intensive almond production and is planning to grow its business by expanding its land size and adopting new technologies to increase efficiency and environmental sustainability. The adopted precision agriculture solutions contribute to improved quality of products, increased efficiencies, and reduced costs on different inputs, including labour. Mkisa's business approach facilitated the introduction of new technologies while its team of professionals makes the adoption long-lasting. The founders' open mindset to innovations and technologies, together with their ongoing research work, set a clear vision and strategy for when and how to invest. Such investments are more likely to turn into prosperous agricultural businesses.

LESSONS LEARNED

- Developing business and investment plans, substantiated by solid research on agronomic practices and possible technologies to be applied can lead to more informed decisions on what and how to produce.
- Investments in precision agriculture solutions help to mitigate risks associated with the production process, making farming more precise and minimizing the use of inputs and resources. This saves costs and contributes to achieving higher quality and increased yield.

"You may be paying more once, but in the long run, it saves costs of labour and other inputs" – says Gigi Gachechiladze, the Executive Director of Mkisa.

MORE INFORMATION

This case study was elaborated by the Georgian Farmer's Association (GFA) and the Food and Agriculture Organization (FAO).

It was developed through interviews with Gigi Gachechiladze, the Executive Director of Mkisa, in 2022.

For further information about this case study, please reach out to FAO at REU-Digital-Agriculture@fao.org.

MAXIMIZED YIELD WITH MINIMAL RESOURCES: THE DIGITAL RESOURCE-SAVING SYSTEM OF THE AGRARIAN UNIVERSITY OF KAZAKHSTAN

Kazakhstan, Almaty region, Talgar district, Baibulak village

SUSTAINABLE DEVELOPMENT GOALS

OBJECTIVE

This case study recounts the experience of an agricultural university from southern Kazakhstan, which has set up an experimental garden for testing various fruit and berry crops in the climatic conditions of this country. It presents the organization's path, from the idea of creating a garden to the project's first results. It also examines how technology-enabled fruit production helps to save on material and intangible resources, and which conditions are required for adapting high-quality Dutch fruit and berry varieties to Kazakhstan.

INTRODUCTION

Fruit production is one of the priorities for Kazakh farmers, given that the country imports about 70 percent of all fruit consumed there. The Kazakh National Agrarian University decided to contribute to solving this problem by opening an experimental garden to try different varieties of fruit and berries.

In the experimental garden, created with the participation of Dutch companies, there are about 40 varieties of apples, pears, plums, cherries, strawberries, redcurrants, as well as cultures that are new for Kazakhstan – blueberries and asparagus – from globally known Dutch plant growers, which are managed by a digital resource-saving system.

Fruit and berries are grown using adapted foreign plant care systems to protect them from pests and diseases.

Introducing these innovative technologies, the university and its partners pursued the following goals:

- Demonstrate modern innovations in the field of sustainable fruit growing, with the use of new varieties, effective production systems, and new technologies.
- Discover whether first-class Dutch varieties of fruit and berries can adapt to the climatic conditions of Kazakhstan.

In 2021, the garden brought its first harvest of apple and pear trees. The total weight of the crop was 513 kg from an area of 0.1 ha. This is considered a good harvest one year after planting the trees, taking into account the unfavourable weather and climatic conditions in the spring (frosts down to -50 °C during the flowering of trees).

As university students join professional researchers at the demonstration site, the practice also contributes to the training of young specialists.

Kazakhstan's climatic conditions were also taken into account during the implementation of the practice. A support system of the trapezoidal type was installed, ensuring the fertility of the garden for many years regardless of high winds.

ACTORS AND STAKEHOLDERS

- kazakhstani agrarian university
- Dutch companies
- farmers interested in growing high-quality fruit and berry crops
- technology suppliers
- university students

GEOGRAPHICAL COVERAGE

Kazakhstan, Almaty region, Talgar district, Baibulak village

Source: United Nations Geospatial. 2020. *Kazakhstan*. Cited 27 December 2023. https://www.un.org/geospatial/file/2015/download?token=wETZTp56

METHODOLOGICAL APPROACH

The university came up with the idea of creating an experimental garden back in 2019. The management of the educational institution met with several companies in the Kingdom of the Netherlands to discuss the possibility of working together in this direction. In 2020, the university signed a memorandum of cooperation with a group of Dutch companies, under which a 1.5-ha demonstration plot of fruit and berry crops was built.

To ensure favourable conditions for growing fruit and berries, as well as saving natural resources, a complex digital management system was implemented in the orchard, including automatic drip irrigation with combined fertilizer application, moisture level sensors, sun and photosynthesis process sensors, and a weather station, which sends data directly to the connected mobile app, without going out into the field.

At the moment of irrigation, users can see on their computer or mobile app screens which trees or berries are receiving moisture and in what quantity. It is important to give plants time to absorb the water so the sensors monitor soil moisture levels, and weather station data helps predict how much moisture will be needed the next few days. This prevents plants from being flooded with water and saves moisture and energy consumption. The system also calculates fertilizer consumption per plant.

Both parties sponsor the project in equal shares. The university has taken on all the costs associated with the preparation and implementation of engineering networks, while the Dutch partners provided innovative technologies and planting materials.

SUCCESS FACTORS

- The university had a clear vision of its goal – to find out which new varieties of fruits and berries would take to Kazakh soil, while applying innovative technology throughout the process.
- When implementing this project, the educational institution enlisted the support of private partners, who provided the university not only with first-class planting materials, but also with the expertise of leading Dutch technology suppliers.
- Dutch companies provided some of the project's funding helping to save on state funds.
- The application of digital technologies helped to ensure favourable conditions for growing each plant in the garden.

VALIDATION

The implementation of the practice is still ongoing. However, the participants of the project were able to harvest the garden's first produce this year. The garden's first harvest was presented to farmers and fruit growers in September 2021.

RESULTS

The practice allows researchers to test how well Dutch fruit and berry varieties can thrive in Kazakhstan using digital technology. By visiting the experimental garden, farmers can see the results of foreign varieties in Kazakhstani conditions and decide whether they should invest in breeding these crops; they can also see the exact amount of water and fertilizer consumed by each plant.

IMPACT

University staff working in the experimental garden regularly hold meetings and training seminars for Kazakh farmers, teaching them how to start, manage, and take care of gardens using Dutch technology. They can also use the app to study water and fertilizer consumption per plant. Researchers are now helping to organize the transfer and adaptation in Kazakhstan of about 40 promising varieties of fruit and berry crops, each of which requires special growing conditions that can only be provided by implementing an integrated horticulture management system. The project also contributes to solving the problem of increasing food security by ensuring the phytosanitary well-being of fruit and berry crop plantations and obtaining environmentally friendly products.

Regarding the social aspects, as the project progresses, the researchers contribute to curricula and practical exercises for students, as well as develop general training programmes that meet the current market needs. Through such training programmes, students can gain important and innovative knowledge in the application of digital technology in intensive horticulture.

CONSTRAINTS

In 2020, the experimental garden had restrictions on the supply of some materials due to the COVID-19 lockdown. Likewise, Dutch scientists were supposed to visit the site, but this never happened. Nevertheless, the specialists managed to consult the university online to instruct the experimental garden personnel on the use of digital technologies for the cultivation of the fruit and berries.

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LESSONS LEARNED

When implementing a project on growing new plant varieties in Kazakhstan using innovative technologies, it is important to enlist the support of an experienced partner to allocate funding, manage associated risks, and share their knowledge and experience for the successful implementation of intensive horticulture.

SUSTAINABILITY

- Half of the funds for the project were provided by the university and half by private partners. Given that the practice involves high-tech production of fruit and berries, it can be assumed that it will require significant investment. In addition, given the high cost of planting materials and the cost of the technology itself, such investments will be accompanied by high risks.
- The practice helps to save water and fertilizer consumption on the experimental plot by developing individual irrigation and fertilizer rates for each crop. Thanks to the drip irrigation system and automated fertilizer application, the correct amount of nutrition is used for each plant.

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REPLICABILITY AND UPSCALING

This practice is recommended for large farms because it involves very high costs. Given the high cost of Dutch equipment and planting materials, the project carries high risks. The larger the scale of production, the easier it will be for farmers to recoup their investment.

CONCLUSION

The experimental garden does not require many workers to maintain, which means that growing fruit with innovative technology requires just a few people to manage all the watering, fertilizing, and plant protection. For example, pesticide spraying is done by one large machine operated by just one person.

In general, the practice saves on material resources, such as water and fertilizers, as well as resources, such as people's time.

The university has now implemented 95 percent of the practice. To complete the process, the institution plans to install special light cameras in the orchard that can recognize signs of disease by the colour of the leaves. Such cameras can also determine the degree of maturity of the fruit.

MORE INFORMATION

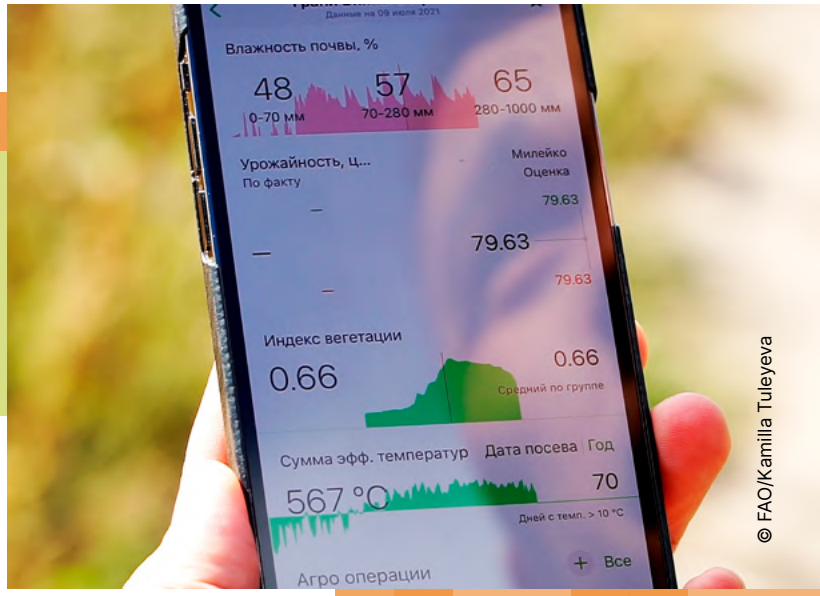
This case study was elaborated by the Kazakhstan Growers' Union (KGU) and the Food and Agriculture Organization (FAO).

It was developed through interviews with representatives of the Kazakh National Agrarian University in 2021.

For further information about this case study, please reach out to FAO at: REU-Digital-Agriculture@fao.org.

DIGITAL FARM MANAGEMENT

DIGITAL FIELD MANAGEMENT SYSTEM: TALGAT'S WAY FOR IMPROVED MANAGEMENT AND SAVED RESOURCES



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Kazakhstan, East Kazakhstan region, Glubokoye district

SUSTAINABLE DEVELOPMENT GOALS

OBJECTIVE

This case study recounts the experience of an agricultural university from southern Kazakhstan, which has set up an experimental garden for testing various fruit and berry crops in the climatic conditions of this country. It presents the organization's path, from the idea of creating a garden to the project's first results. It also examines how technology-enabled fruit production helps to save on material and intangible resources, and which conditions are required for adapting high-quality Dutch fruit and berry varieties to Kazakhstan.

INTRODUCTION

Aldazharov Talgat is the director of a poultry-feed-growing company, which is part of a large poultry holding. The company, along with the holding's other crop-growing enterprises, supplies feed for two poultry farms in eastern and northern Kazakhstan.

The main components of poultry feed are winter and spring wheat and sunflowers. The farm must maintain a stable yield annually to provide the poultry farms with sufficient feed. Therefore, it was extremely important for Talgat to record historical data quickly and efficiently on the size of cultivated areas, yields, and the effect of various fertilizers on certain crops. He realized that the digitalization of management processes would make his work much easier. Over the years, Talgat has implemented several digital solutions in the area of fuel-level monitoring, satellite field monitoring and material resource management.

In early 2021, Talgat began using software to integrate the management of all production processes on the farm. Agronomists and farm managers uploaded satellite images of all fields into the software program and began to record the fertilizers applied and the yield of each crop on a regular basis. All these efforts led to the generation of a database of all fields and crops being grown in the system.

In addition, the program monitors the work processes in real time. Farmers can check the current location and fuel level of the machinery as well as other indicators. Dispatchers remotely set tasks for each machine every day, for example, to make hay or bale. The software tracks how much work the specific tractor has done to date. The data is then sent to the accounting system, where the wages and the amount of the remaining fuel are automatically calculated.

By introducing these innovative technologies, Talgat pursued the following goals:

- Improve the quality and timeliness of management decisions.
- Better predict crop yields.

After Talgat tied all the digital technologies into one system, he was able to view and compare data from previously installed digital solutions. Paper records about the yield of a particular field were no longer needed. The farm no longer depended on the human factor in this regard. Even if the current agronomists move to other farms, all the data they have collected will be safely stored in the system.

ACTORS AND STAKEHOLDERS

- manager of a plant-growing farm in East Kazakhstan;
- farm workers;
- agronomists and other farmers interested in improving the quality of management decisions; and
- farm management technology suppliers.

GEOGRAPHICAL COVERAGE

Kazakhstan, East Kazakhstan region, Glubokoye district

Source: United Nations Geospatial. 2020. *Kazakhstan*. Cited 27 December 2023. https://www.un.org/geospatial/file/2015/download?token=wETZTp56

METHODOLOGICAL APPROACH

Before selecting a technology, Talgat carefully studies information about it on the internet and attends exhibitions and seminars hosted by technology suppliers. He also keeps in touch with the service providers he already uses in case they are ready to offer him new technology or software.

The first technology he introduced to his farm in 2012 was GPS monitoring and fuel-level sensors for agricultural machinery. The next step was satellite field monitoring, followed by an enterprise resource planning system, which combined finance, supply chain, trade operations, reporting, production, and personnel management in one program.

All these technologies dealt with different processes on the farm. Talgat needed to link different digital solutions into one global system to make them all easier to manage.

An automated remote management system for field farming using satellite monitoring was ideal for this purpose. In addition to managing production processes and storing data, the software independently estimates the yield of each field based on satellite images. Talgat can now compare actual yields with forecasts, as well as with the average yield for the region. This data makes it very convenient for the farmer to make plans for harvesting and storing grain.

VALIDATION

Thanks to this innovative technology, Talgat is able to better plan the farm's production process. It has already allowed the farm to save seed, fertilizer, and harvesting time. The efficiency of the farm due to digitalization has already shown double-digit growth rates.

SUCCESS FACTORS

- The farm director had a clear understanding of his goal: to speed up management decisions and increase crop yields.
- No institutional support was required as the farm used its own and borrowed funds and used its own land to implement this practice.
- The farm director is very competent in choosing technologies. He actively searched for new products on the market, communicated with suppliers, compared similar products, attended trade shows, and researched suppliers before choosing a particular technology and investing.
- As part of a large poultry-farming holding, farm is more economically sustainable.
- Technology was introduced gradually and changes evaluated.

IMPACT

The introduction of the farm management system allowed Talgat to use farm labour more efficiently. Previously, agronomists spent a lot of time compiling operational reports. Now these reports are generated automatically, and the experts can fully concentrate on their work of increasing crop yields.

The introduction of the practice especially affected the work of dispatchers who control the movement of machinery in the fields. Thanks to the new software, they can now manage the entire process in one window, where they see the vehicles' routes and the work being performed, and issue trip tickets. At the same time, the system calculates the output for each machine and writes off inventory items. The dispatcher simply double-checks the numbers.

Similarly, the practice has facilitated the work of warehouse managers, accountants, economists, and HR managers. These positions are mostly performed by women. The digitalization of production processes has freed them from many routine chores, allowing them to focus on more complex and interesting tasks.

CONSTRAINTS

- According to Talgat, the most difficult thing was to adapt the specialists' way of thinking – dispatchers, agronomists, machine operators – to get them to use digital solutions.
- Another limiting factor was poor internet coverage. The mountainous terrain of eastern Kazakhstan further exacerbated this problem. It took him considerable time and expense to provide internet access on all of the fields.

SUSTAINABILITY

Talgat believes that this practice could be useful for small farmers as well. A subscription to the software costs about KZT 670 (USD 1.5) per ha, which he says is small compared to the benefits the software provides.

The effectiveness of this practice directly depends on the efforts being made to enter data into the software. The initial input of data took considerable time. However, as the databases grew, it started to take only a couple of hours a week to enter new indicators.

In terms of environmental sustainability, the automatic calculation of fertilizer spray rates leads to less pollution from pesticides since human errors in the distribution of these substances are now eliminated.

CONCLUSION

There are several beneficiaries of this practice. The farm director improved the quality and speed of management decision-making and digitalized existing data on different crops.

Having a clear vision and dedication in implementing these practices, along with a step-by-step innovation and willingness to explain the benefits of digitalization to the farm workers, helped Talgat to successfully implement the farm management system and improve the efficiency of the farm as a whole.

LESSONS LEARNED

For farmers looking to increase yields, it is important to collect and analyse historical data on crops grown, including vegetation index, the amount of fertilizer used, and other agrochemical data. This helps to increase the yield per hectare and allocate available resources more efficiently.

- The practice can be used by both small farmers and large agricultural holdings. For small farms, the use of such innovative technologies could help improve the quality of work directly in the field. As for large agricultural holdings, the practice could facilitate recordkeeping of resources and monitoring work on the fields.
- For the practice to be accessible to small farmers, this technology could be provided to them by service companies working with several farms at once.

MORE INFORMATION

This case study was elaborated by the Kazakhstan Growers' Union (KGU) and the Food and Agriculture Organization (FAO).

It was developed through interviews with Aldazharov Talgat, farmer, in 2021.

For further information about this case study, please reach out to FAO at: REU-Digital-Agriculture@fao.org.

ENHANCED AGRICULTURE OPERATIONS AT FINGERTIPS: ZURAB'S HARVEST AND POST-HARVEST MANAGEMENT MOBILE APP

© Agrostore

Qvareli town, Kakheti region, Georgia

SUSTAINABLE DEVELOPMENT GOALS

INTRODUCTION

The Kakheti region is known for its fertile lands, which is why the cooperative Agrostore was founded by four friends from diverse backgrounds in Qvareli municipality in 2019. Agrostore primarily focuses on raspberry, strawberry, and persimmon production, but they have also recently started cultivating vegetables. The business operates on a total of 7 ha of land, with raspberries grown on 3 ha of land and persimmons on 1 ha. The company plants strawberries in between the persimmon trees. Agrostore had its first full raspberry harvest in 2021.

The cooperative also runs a refrigeration and storage facility with a capacity of 100 tonnes. In addition to their own harvest, Agrostore collects locally-produced products from various farmers. The refrigeration facility is mainly used for cooling the collected products before they are prepared, packaged, and exported to Gulf countries such as Qatar, Kuwait, Saudi Arabia, and the United Arab Emirates. Agrostore's main export products are sweet cherries, blackberries, strawberries, raspberries, plums, and peaches. The company participates in different international food exhibitions to increase the popularity of its products and gain access to new markets.

Zurab Alavidze, the manager of the Agrostore cooperative, is a highly business-minded young man with a pro-digital technology attitude. As a result, the cooperative uses various digital tools and technologies for business operations, and it is continuosly exploring new technologies to improve its practices. Representatives of the cooperative utilise different digital communication tools, including Google services and numerous web platforms. Additionally, Agrostore operates its own webpage (www.agrostore.ge).

OBJECTIVE

This good practice demonstrates how a cooperative in Qvareli , Georgia, deployed a mobile harvest application to improve planning, enhance the efficiency of seasonal harvest and post-harvest operations, and reduce costs and mistakes associated with agricultural processes. It illustrates the substantial advantages of using harvest accounting applications and software, as well as how such technologies can elevate product quality and employee productivity.

As the company has a long – up to 60-days harvest period, it is of utmost importance to efficiently manage the harvesting process. Hence, the cooperative recently introduced a digitally-enabled harvest system and mobile application developed by UGT, a Georgian IT company, within the framework of the USAID Georgia Agriculture Program. The so-called Mobile Harvest Application is a digital tool that allows systematizing and streamlining the accounting and inventory during the harvest and post-harvest (picking and storage) periods, which enables a simplified picking process, increased workers' efficiency, better planning and risk prediction in the post-harvest period.

Agrostore is using this digital tool to collect and analyse harvesting data, which allows for finding process-related inefficiencies and challenges, better planning the work of staff, the post-harvest period, and the use of its cold storage facility, and to better predict and deal with post-production risks. Before adopting this technology, Agrostore used Excel sheets to record the data where information was entered manually, and the probability of mistakes and errors was much higher.

GEOGRAPHICAL COVERAGE

Source: United Nations Geospatial. 2015. *Georgia*. Cited 27 December 2023. https://www.un.org/geospatial/file/1922/download?token=euWtsSCU

ACTORS AND STAKEHOLDERS

- Agrostore representatives and cooperative members
- local farmers in Kvareli municipality
- USAID Agricultural Program
- export partners

METHODOLOGICAL APPROACH

The owners and managers of cooperative Agrostore are actively seeking to introduce new technologies in their business operations. They research available technologies and gradually introduce innovative approaches to their activities. They participate in training and apply for the available programmes that contribute to the prosperity of the business.

To this end, the company took part in a USAID agricultural programme, which allowed them to introducethe Mobile Harvest Application developed by UTG within this program. The application registers the complete cycle of agricultural operations. Each employee involved in harvesting is given a special bucket with a barcode that tracks their harvest. This information is recorded by the system, enabling the management to track quantity, control quality and trace it back to the exact worker who collected the goods, and when. The application helps monitor individual workers' productivity, supports workforce planning, and decision-making, and provides incentives to workers.

Agrostore has provided their employees with a set of trainings to effectively introduce their application, eliminating manual entry of multiple parameters of the harvesting process and reducing the time required to register the harvest, thus minimizing human error. As a result, the majority of employees – who are mainly women - have been able to increase their efficiency and earn more.

The entire process is documented, allowing for the identification of Critical Control Points along the process phases. These points, along with quality and control measurements, help to improve the quality of goods and reduce food safety hazards. The documented cycles of operations also allow for greater traceability of the products.

The data collected through the system also provides opportunities to more precisely monitor the company's inventory, improve decision-making, and plann the day-to-day operations. The application aids the company to manage fieldwork more effectively, optimizing the use of resources and facilities, and making prompt interventions if any inefficiency or or issues are detected.

The harvest period for the company is quite long and may take up to 60 days. Hence, the harvesting software enables the company to disaggregate data on harvesting and sorting, including the costs and salaries associated with each process. The application analyses the collected data and helps the farm management to plan future harvest periods accordingly and estimate probable inputs, outputs, and costs in advance.

VALIDATION

Since adopting the technology, the company has achieved multiple positive outcomes such as better working conditions, better traceability of products, and other advancements. Over ten other farms have adopted the tool as part of the USAID project.

The digital harvest accounting tool belongs to the wide spectrum of digital Farm Management Systems (FMS) software solutions that can help farmers make the most of their resources, operations, and production activities via agricultural forecasting, planning, decision-making, monitoring, record keeping, and accounting.. FMS solutions are gaining popularity worldwide, with providers incorporating sensors, remote sensing, and to give farmers advanced data and services. However, low digital literacy and skills among farmers, and high training costs, could stop some, particularly smallholder farmers, from using such solutions. Programmes like USAID's can reduce the adoption costs for farmers and equip them with the necessary skills to capitalize on the insights and capabilities of FMS, showing the return on investment.

SUCCESS FACTORS

- Drive to constantly improve their practice and willingness to research and adopt innovative approaches to the production process.
- Active participation in training and development programs offered by donor organizations.
- Delivery of training to employees, and in particular female harvesters, to ensure the ability to use the application.
- Provision of incentives to employees to encourage the use of digital tools and to lower the resistance to change.
- Gradual adoption of the new practice.
- Eagerness to explore opportunities to enter new markets.

IMPACT

By addressing inefficiencies during harvest and incentivizing their workers, the farm was able to increase labor efficiency, improve working conditions, and reduce production costs. The solution also provided the farm with accurate and customized data and guidance to plan their agricultural seasons, which increased their capability to schedule, plan, optimize the use of resources, and accurately estimate the harvest volume and inputs for the next season. The application reduced the risk of errors in accounting and forecasting, which were previously done through Excel. The solution helped to introduce food quality and safety control measures through a barcode-based tracking system that facilitated better prevention of food safety hazards. The data collected allowed for better post-harvest management, reducing the risk of food loss and waste.

SUSTAINABILITY

In the agricultural sector, the ability to make data-driven, accurate decisions and forecasts regarding production and post-production is critical for ensuring the sustainability of farms reducing food loss and minimizing waste. Through the use of technology, the quality of products has been improved, labor costs decreased, and the livelihood of employees has been enhanced. Agrostore has employed local women, providing them with training to empower the local community and boost their digital skills.

Agrostore has bolstered its ability to manage fieldwork during the harvest and post-harvest processes with the adoption of digital tools. This has enabled the business to run efficiently even when production scales up significantly. Representatives of the company are open to new technologies, which has been demonstrated to be advantageous for their daily activities. To further improve its operations, Agrostore plans to implement new technologies for other activities, such as a software for export management. As Agrostore's products are perishable goods with a limited shelf life, even though its existing operational schemes are effective, with greater volumes, the need for such tools will increase.

CONSTRAINTS

The company representatives began the adoption process a bit late, as they applied for the programme just before the start of the harvest period. Though the application and system had features to automate inputs for the weight of harvested goods, they were unable to do so; the weight had to be entered manually into the application from the scales. The company representatives had to invest several resources into the adoption process as employees were accustomed to their old ways of operating and weren't familiar with digital input methods. The training was provided for the employees regarding the use of the application explaining its benefits and providing incentives for its use. Such changes and adaptation process took time, but the benefits that the company received from using this tool outweighed the costs. Although the trainings had a temporary impact on the employees' workload and overall operations, the positive outcomes outweighed the short-term challenges, resulting in several improvements to the farm's efficiency.

REPLICABILITY AND UPSCALING

Other farmers have expressed interest in the practice, having seen the success of the Agrostore. As of May 2022, the USAID Agriculture Programmes representatives in Georgia are providing access to the Mobile Harvest Application free of charge and offering training and support to teach users how to use and manage the application.

CONCLUSION

A positive attitude towards innovation and digital technologies is essential for achieving success in the modern world. Agrostore has utilized digital tools to reduce costs, improve efficiency, provide better working conditions for employees, streamline their planning and decision-making processes, and reduce the risk of food loss, waste, and safety hazards. By adopting harvesting software and applications and offering training to workers on how to use them, Agrostore has experienced increased revenues, improved worker efficiency, and enhanced analytical and planning capabilities.

LESSONS LEARNED

Introducing a digital harvest accounting application can provide benefits such as increased farm efficiency, improved working conditions, reduced risks of food loss and waste and improved food safety. By collecting and storing data from previous harvests, producers can gain valuable insight to aid in planning for future harvests.
However, when introducing new technologies, it is essential to ensure that everyone involved is included in the adoption process. This should include training and frequent communication to ensure that employees understand the benefits of the technology. If done correctly, this will result in quality and quantity improvements.

MORE INFORMATION

This case study was elaborated by the Georgian Farmer's Association (GFA) and the Food and Agriculture Organization (FAO).

It was developed through interviews with Zurab Alavidze, the manager of the Agrostore cooperative, in 2022.

For further information about this c ase study, please reach out to FAO at REU-Digital-Agriculture@fao.org.

STREAMLINED FARM MANAGEMENT: CUSTOM-MADE SOFTWARE SOLUTION IMPLEMENTED BY AIDARBEK

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Kazakhstan, Qostanay and Aqmola regions

SUSTAINABLE DEVELOPMENT GOALS

INTRODUCTION

When young farmer Aidarbek Khodzhanazarov became the director of one of the largest agro-industrial holdings in Kazakhstan a few years ago, he faced a difficult task. The holding includes several processing and manufacturing companies located in the Qostanay and Aqmola regions. The total area of cultivated land is 960 000 ha, storage capacity for crops exceeds 1.5 million tonnes, and the number of employees reaches 7 000.

The company implemented the most modern solutions designed for agriculture on the market: from auto trackers and GPS monitoring of machinery to precision seed drills, autopilot systems, and unmanned aerial vehicles. However, all the data collected by these devices was scattered and not analysed in any way. This did not allow for efficient operational management of a large holding.

Aidarbek had tried various software solutions available on the market, but none of them met his requirements. Therefore, in 2018, he decided to create a bespoke digital service that would solve the most urgent tasks for such a large company. Local programmers developed several applications for the holding that regulate the activities of agronomists and other specialists: Digital Agronomist, Digital Engineer, AgroNavigator. All applications work within one agricultural management system.

By introducing this innovative technology, Aidarbek pursued two goals:

- Consolidate data in one system, adjusting its analysis for more efficient planning of the holding's operations.
- Increase the production profitability by reducing material resource costs through more careful planning.

OBJECTIVE

This case study relays the experience of a farmer from northern Kazakhstan who has implemented digital solutions in the process of managing the agricultural holding he is in charge of. Unable to find a suitable solution on the market, he hired local specialists to create unique software for his enterprise, designed specifically for a large, diversified agricultural holding. As a result of the practice, the farm owner was able to increase yields and reduce the cost of fertilizers and spare parts for agricultural machinery. The case study explores the stages of development of these digital solutions and the ways they can be used in the management of a large agricultural holding.

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Aidarbek began to implement the practice in 2019; it started to show its effect within a year. The planning process in the holding accelerated twentyfold; if previously it took two to three months to form the crop structure, now it takes a maximum of three days. In addition, a separate service for tracking the operating history of agricultural machinery allows the farm to extend the service life of the equipment and carry out repairs in advance.

The employees of the holding also benefitted from the introduction of the practice. Agronomists who use the Digital Agronomist software received a salary increase. This motivates them to master new technologies.

GEOGRAPHICAL COVERAGE

Kazakhstan, Qostanay and Aqmola regions

Source: United Nations Geospatial. 2020. *Kazakhstan*. Cited 27 December 2023. https://www.un.org/geospatial/file/2015/download?token=wETZTp56

ACTORS AND STAKEHOLDERS

- manager of a large Kazakhstani agro-industrial holding;
- the enterprise's employees (machine operators, agronomists, economists, accountants, engineers);
- IT specialists who developed the software;
- other farmers interested in using custom-made software for a better quality of managerial decisions; and
- suppliers of agricultural equipment, fertilizers, herbicides, and other partners.

METHODOLOGICAL APPROACH

Before ordering custom-made software program, Aidarbek tried various software solutions for analysing and monitoring data. He was not satisfied with these programs because they did not cover all the problems that he needed to solve.

Aidarbek engaged not only IT specialists, but also agronomists and economists in the project, setting for his team a task to create a product that would let him know how profitable each cell (a plot of land 100 × 100 ha). If it turned out that a cell did not generate income, a mechanism was needed to understand why not. In addition, the farm director needed a tool for effective budget planning per cell.

As the most serious issue was with agronomic activities, the first service developed by the IT specialists in 2019 was the Digital Agronomist. This application tracks all stages of plant development, from sowing to harvesting, and notes how crops respond to moisture and fertilizers. The application stores a great deal of information about the field, including soil type and composition, options for chemical treatment of the site, yield, and even what machinery was used at any given time. The holding purchased about 100 smartphones, which were later distributed to every agronomist. Now the crops are monitored with the help of the phones. The agronomists receive daily tasks from the director in a mobile application: The messages let them know which fields they need to visit and which specific data to collect regarding the presence of pests and diseases.

Later, the holding launched another service called Digital Engineer. This program was created to manage the holding's fleet of agricultural machines, numbering 3000. It is impossible to effectively monitor the work, repair, and maintenance of such a large equipment fleet manually, even with GPS trackers. Digital Engineer stores the entire history of equipment, including spare parts replacement, operating time, and the names of equipment suppliers and engineers who service which machine.

The third important component of the farm management system is AgroNavigator, a service for quickly finding each plot of land based on digital field maps. This is especially relevant for the holding since its lands are located in different geographical and climatic regions.

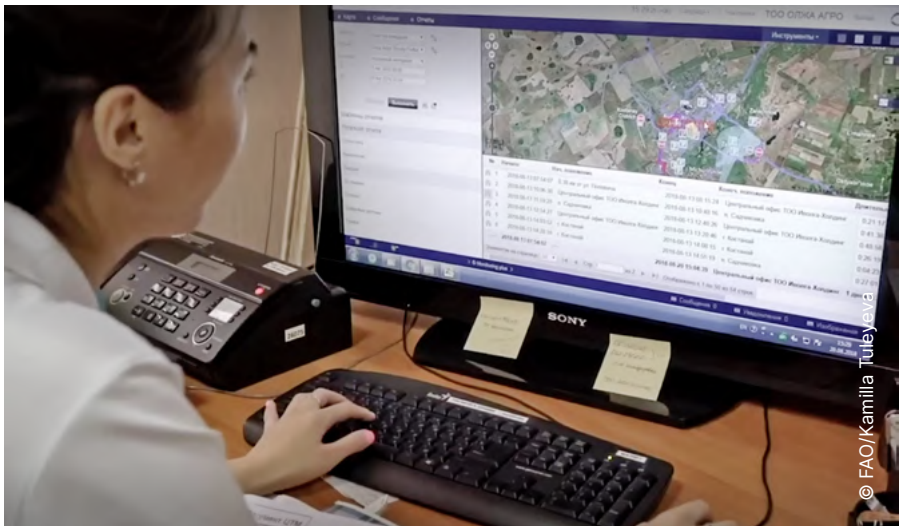
Data from all three applications is collected and processed in a single analytical centre.

SUCCESS FACTORS

- The farm director did not settle for existing software solutions on the market and showed an innovative approach by developing a proprietary farm management system that met his enterprise's needs.
- Because of an existing diversified business, the holding had sufficient funds to invest in the development of custom-made software.
- The technolgy was introduced in stages, in accordance with the enterprise's priorities. The most pressing issue was the planning of agronomic works, so an application for agronomists was developed first.
- Employees are motivated to use the innovative technology.

VALIDATION

The use of digital technologies, which neutralizes the human factor in accounting and control, allows Aidarbek to make decisions in a matter of hours and enables real-time monitoring of the situation in all of the holding's divisions.



IMPACT

The implementation of these innovations improved the quality of agronomic work, which in turn has had a positive impact on the growth of yields and economic efficiency from each cell. In addition, the system generates new recommendations for working with different crops as observations accumulate.

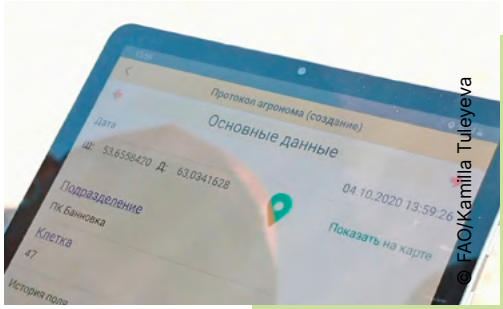
The quality of production solutions and the growth of the holding's income have a direct impact on the social life of rural areas because the company invests in the infrastructure of the territories in which it is present. It is important for the holding to ensure that the quality of life in the village is high and that the employees are comfortable living there and don't leave for the city.

CONSTRAINTS

- The main constraint was managing all the processes on the holding's vast agricultural lands in regions with different climatic conditions. The digitalization of field maps and the accounting of each unit of the holding's equipment, implemented within the framework of the farm management system, allowed it to identify the holding's weaknesses and begin work on their elimination.
- Another challenge the farm director faced was that it was not easy to train older workers to interact with digital technology. In the early stages of implementing the practice, it was rather difficult to involve them in this process.

SUSTAINABILITY

- This practice allows individual calculation of the capital expenses and income for each field, whereas before it was practically impossible in such a large company.
- Integration of the software with the databases of spare parts suppliers significantly reduce the delivery time of spare parts and the accumulation of spare parts in the warehouse. This, in turn, made it possible to reduce the volume of capital frozen in spare parts threefold, from KZT 1.5 billion (USD 3.5 million) to KZT 500 million (USD 1.17 million).
- With regard to environmental sustainability, the digitalization of land maps and the subsequent analysis of data in the AgroNavigator program led to the withdrawal from agricultural use of unsuitable land, such as fishing lines, estuaries, and lakes. The total area of such land was about 35 000 ha. Now fertilizers are not sprayed there, and the equipment does not work there, leading to a decrease in environmental pollution.



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REPLICABILITY AND UPSCALING

Software for managing and planning farm activities is relevant not only for large agricultural holdings, but also for smaller farms.

The holding's specialists are currently working on improving the methodological base of services and the architecture and design of their digital solutions to share their software with farmers all over Kazakhstan who need analytics but cannot afford expensive solutions.

CONCLUSION

This practice has several beneficiaries. The farm director was able to significantly speed up the process of planning the crops and the necessary chemical treatment of fields. Effective control and accounting of the use of inventories through a mobile application reduced the cost of spare parts and fertilizers by 20 percent. Prompt response to risks and balanced crop management, in turn, resulted in a 20-percent increase in yields.

The additional profit allowed the holding to pay a salary bonus to employees using the new software. This has motivated employees and will encourage them to master the new programs that the holding is currently developing.

The company is finalizing its software and is ready to provide it to other farmers interested in improving the quality of management decisions.

LESSONS LEARNED

- The huge amount of information on agronomy, previously stored on paper, was difficult to analyse, so it was not used in any way.
- The digitalization of this data allowed it to form a base for analytics, which accelerated the decision-making process.

MORE INFORMATION

This case study was elaborated by the Kazakhstan Growers' Union (KGU) and the Food and Agriculture Organization (FAO).

It was developed through interviews with Aidarbek Khodzhanazarov, farmer, in 2021.

For further information about this case study, please reach out to FAO at: REU-Digital-Agriculture@fao.org.

DIGITAL GREENHOUSES

REVOLUTIONISED FARMING: THE CLIMATE COMPUTER OF MYRZABEK FOR GREENHOUSE MANAGEMENT

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Kazakhstan, Almaty region, Karasay district, Chapayev village

SUSTAINABLE DEVELOPMENT GOALS

OBJECTIVE

This case study focuses on the experience of an agricultural enterprise in Kazakhstan, which launched a fully automated greenhouse for growing vegetables and seedlings. It describes how an automated greenhouse works and how it has benefitted the enterprise. It also explores the challenges the enterprise encountered during the implementation of this technology.

INTRODUCTION

The natural and climatic conditions of Kazakhstan do not allow growing fruit and vegetables in the open field year-round. Therefore, during the off-season, growing plants is possible only in greenhouses, where favourable conditions can be created regardless of the weather.

The smart greenhouse was launched in 2021. In the greenhouse area of 5 ha, farmers grow tomatoes and seedlings for sale. The annual production capacity of the complex is about 2 000 tonnes of tomatoes. Thanks to state subsidies, the owners of the enterprise were able to purchase advanced Dutch equipment for the greenhouse, including a climate computer.

By introducing this innovative technology, the owners pursued the following goals:

- Automate processes such as maintaining a certain level of temperature and humidity in the greenhouse, lighting, watering, and fertilizing.
- Reduce the workforce.

The greenhouse is equipped with a variety of systems that control the life processes of plants, including automated microclimate control, a meteorological station, a heating system with boilers, a drip irrigation system supplied with a nutrient solution, evaporative cooling, a fog formation system and more.

The climate computer serves as the brain of the greenhouse; it controls all of the systems mentioned. For example, if it is cloudy outside and little light comes in through the windows, then the computer turns on the electric lighting. If the temperature is too high, the computer turns on the fogging system, which reduces the temperature. If, on the contrary, it is too cold, it turns on the boilers for heating. The computer reacts to any deviation from the norm and maintains optimal conditions for plant growth in the greenhouse.

GEOGRAPHICAL COVERAGE

Kazakhstan, Almaty region, Karasay district, Chapayev village

Source: United Nations Geospatial. 2020. *Kazakhstan*. Cited 27 December 2023. https://www.un.org/geospatial/file/2015/download?token=wETZTp56

ACTORS AND STAKEHOLDERS

- an agronomist working at a greenhouse in Southern Kazakhstan;
- greenhouse employees;
- agronomists and other farmers interested in greenhouse automation;
- greenhouse equipment suppliers;
- government agencies; and
- wholesale and retail vegetable buyers.

METHODOLOGICAL APPROACH

Bekmukhanov Myrzabek, the enterprise's chief agronomist, has been working with greenhouses since 1994. He was well aware of the advanced technology available in this area. When the owners of the enterprise were planning to apply for public funds for the construction of the greenhouse, Myrzabek advised them to use Dutch technology.

The project took only two years to complete. First, the owners developed the greenhouse's concept, and then the state provided concessional financing for the construction.

When construction was finished, the agronomists and other specialists paid special attention to the start-up and commissioning work, to be sure that all systems functioned properly. Specialists involved in the installation of the equipment also helped to train on-duty personnel. The project started working in full force in June 2021.

VALIDATION

Myrzabek, the chief agronomist, confirmed the effectiveness of the practice. Automation of greenhouse management saved on wages. Thanks to the automated management of the greenhouse, fewer agronomists are required than to service a traditional greenhouse; with the help of a computer, one agronomist can service a larger number of plants than if they were working manually.

SUCCESS FACTORS

- Because of his experience, Myrzabek easily picked the most suitable greenhouse automation technology for this project.
- Financial support from the state made it possible to purchase equipment on favourable terms — at 6 percent per annum (while in a commercial bank the loan rate would be 12 percent per annum and higher).
- Qualified employees and agronomists with many years of experience helped to successfully launch the equipment and input the necessary parameters into the computer.
- Before launching the project, special attention was paid to setting up and adjusting all processes to prevent the possibility of breakdowns and the failure of expensive equipment.

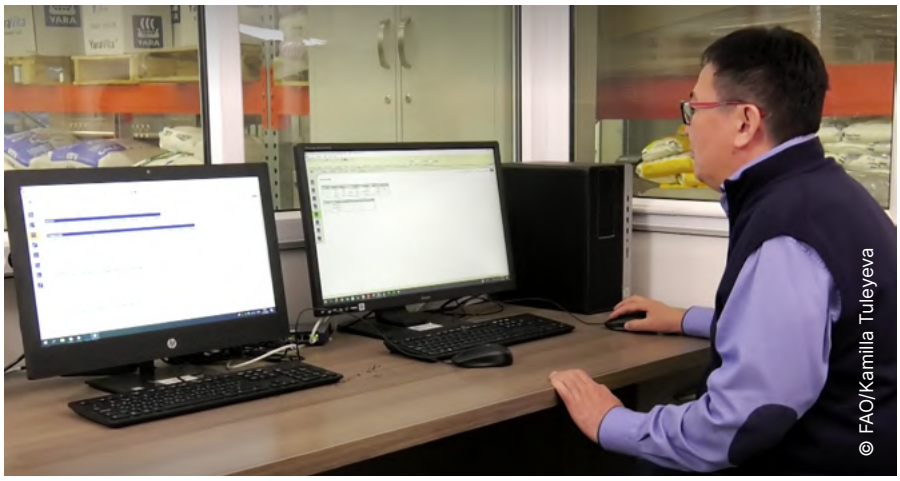
IMPACT

This practice made the work of highly skilled agronomists easier. Whereas previously they had to manually control the life processes of each plant in the greenhouse, now the computer informs them of any deviations or reasons for concern. Thus, agronomists can work more precisely.

The need for English-speaking specialists at the greenhouse has increased since the software is available only in English. In this way, the introduction of the practice created jobs for highly qualified English-speaking specialists.

At the same time, the automation did not affect workers engaged in crop harvesting. About 100 people work in the greenhouse. Around 70 percent of these workers are women.

The use of the climate computer also made it possible to use fertilizers and other chemicals more accurately, given that the program independently calculates the fertilizer application rate for each plant.



CONSTRAINTS

At the time of implementation, the enterprise's management faced a language problem, because all of the climate computer's software was in English. A Russian version was also available, but many of the terms in it were translated incorrectly. The specialists had to gauge whether each term was translated correctly. The greenhouse business is known for its abundance of specific terms, so it took the experts some time to get used to the new software and start working.

SUSTAINABILITY

- This technology significantly saves the time spent by specialists on routine tasks, thereby increasing people's job satisfaction. In a broader context, due to cost savings and efficiency, the practice helps to keep vegetable prices down during the off season.
- The practice is also sustainable in relation to the environment; thanks to accurate calculations, there is no overconsumption of water, fertilizers, and other resources.

REPLICABILITY AND UPSCALING

The greenhouse built with this innovative technology has all the process control systems needed to grow high-quality vegetable crops. Farmers can use this technology even if they do not have their own funds, since Kazakhstan has state support mechanisms for such projects. The state company Agrarian Credit Corporation provides farmers with loans of KZT 1 million (USD 2 230) for the purchase of agricultural equipment within the framework of the Agribusiness programme.

LESSONS LEARNED

- Automation of processes in the greenhouse helps to improve agronomists' working conditions and eliminate the possibility of human error during decision-making.
- When using foreign technologies, competent specialists who speak English are need. Or translators on staff who are familiar with the specifics of greenhouse production can be used.

CONCLUSION

The implementation of the practice made it possible to produce high-quality tomatoes and plants, while reducing the number of agronomists hired. The automation of greenhouse management facilitated the working conditions of the existing agronomists, allowing them to respond to emerging problems quickly and more accurately.

The presence of highly qualified specialists who are well acquainted with the greenhouse business and are aware of advanced technologies in this area played a main role in the success of the practice. An additional success factor was the availability of affordable funding from the state.

Thanks to the success of the first greenhouse complex, the owners of the enterprise have already secured support for the construction of the second one in 2022. The second greenhouse with an area of 5 ha will produce cucumbers.

MORE INFORMATION

This case study was elaborated by the Kazakhstan Growers' Union (KGU) and the Food and Agriculture Organization (FAO).

It was developed through interviews with Bekmukhanov Myrzabek, farmer, in 2021.

For further information about this case study, please reach out to FAO at: REU-Digital-Agriculture@fao.org.

INNOVATED EFFICIENCY: ALISHER'S HYDROPONIC GREENHOUSE AUTOMATION SYSTEM

Buka district, Tashkent region, Uzbekistan

SUSTAINABLE DEVELOPMENT GOALS

INTRODUCTION

Uzbekistan's favorable climate supports the growth of a wide variety of fruits and vegetables. However, environmental challenges such as water scarcity, soil degradation, and climate change are impacting agriculture and the quality of produce. To address these challenges, Alisher Abdulladjonov and his siblings drew upon their prior experience of cultivating various crops on open fields to establish an automated hydroponic greenhouse with glass cladding to grow tomatoes.

The inspiration for constructing an automated hydroponic greenhouse stemmed from Alisher's visit to the Kingdom of the Netherlands facilitated by an agricultural investment organization. Upon returning home, inspired by the Dutch greenhouse automation practices, Alisher secured a bank loan to create a 3-hectare greenhouse facility in Buka.

When Alisher procured the first automation systems from the Kingdom of the Netherlands, he had to engage Dutch specialists due to the scarcity of specialized workforce in Uzbekistan. These specialists assisted in configuring the solution to manage water disinfection, plant irrigation and fertilization. A Dutch agronomist was also brought to Uzbekistan to educate both Alisher and local workers on effectively managing the greenhouse's automated systems. The international expert predicted a first-year tomato yield of 250 tonnes per hectare. Impressively, the farm yielded 300 tonnes, setting a record for Uzbekistan.

OBJECTIVE

Uzbekistan's favorable climate for fruit and vegetable growth faces challenges such as water scarcity, soil degradation, and climate change. Alisher Abdulladjonov and his siblings addressed these issues by establishing an automated hydroponic greenhouse to grow tomatoes in Buka. Inspired by Dutch greenhouse automation practices observed during a visit facilitated by an agricultural investment organization, Alisher secured a bank loan to construct a 3-hectare greenhouse. Initial automation systems were sourced from the Kingdom of the Netherlands, with Dutch specialists assisting in configuration for water disinfection, plant irrigation, and fertilization. The automated hydroponic greenhouse not only addressed environmental challenges but also positioned the farm for international standards and increased productivity, showcasing the impact of technology on sustainable agriculture in the region.

After observing the abundant yield, Alisher decided to enhance the hydroponic greenhouse even further. He conducted research and acquired top-performing, high-quality, and long-lasting equipment from China and Italy to effectively manage variables such as natural light penetration, indoor humidity, indoor temperature, carbon dioxide (CO_2) levels, and more. The automation of various processes in the greenhouse not only reduced the need for human labour but also significantly boosted productivity while minimizing production failures attributable to human factors. The introduction of the automated hydroponic system led to a sixfold increase in production for the farm, considering that traditional farming only yielded 45 tonnes per hectare.

Alisher aimed to:

- boost production and quality;
- attain international standards for exports;
- extend growing seasons;
- counteract environmental challenges with controlled environments; and,
- reduce labour with skilled specialists;

Having gained experience in the Netherlands where greenhouse production has been present for many decades, Alisher can be considered pioneer agripreneur in Uzbekistan as he brought the best practices he learned abroad to the country.

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GEOGRAPHICAL COVERAGE

The farm is located in the Buka district, Tashkent region, Uzbekistan.

Source: United Nations Geospatial. 2004. *Uzbekistan*. Cited 27 December 2023. https://www.un.org/geospatial/file/2363/download?token=1nfVbpkg

ACTORS AND STAKEHOLDERS

- solution providers
- workers of the hydropnic greenhouse

METHODOLOGICAL APPROACH

After evaluating the return on investment, Alisher established a hydroponic greenhouse with glass cladding. Hydroponic greenhouses offer the advantage of maximizing plant growth on the available surface area compared to traditional soil-based production methods. They utilize gravel instead of soil, reducing the risk of pests and fungi negatively impacting crop yields. Furthermore, the use of glass cladding for the greenhouse provides several benefits, including improved natural light penetration, enhanced insulation, and better heat retention within the greenhouse.

Alisher directed his investment towards the use of smart automation to control the hydroponic greenhouse. More specifically, he installed high-quality, durable technologies equipped with IoT sensors connected to the internet to monitor and control various parameters and to automate their work.

Leveraging on knowledge gained from his visit to Kingdom of the Netherlands, Alisher installed a Dutch automated disinfection unit in the greenhouse that uses ultraviolet (UV) light radiation to eliminate harmful bacteria, fungi, and pathogens in the water of the hydroponic greenhouse. This technology allows the greenhouse to reuse its irrigation water. The unit is equipped with a pH monitoring sensor for water pH control during disinfection, so the radiation chambers are kept clean for longer and salts are unable to crystallize. The sensor in the unit transmits real-time time data to a desktop application that allows recording of process data, setting of an automatic disinfection program, control and monitoring of the UV system, radiation intensity monitoring, and flow monitoring during disinfection. An alarm goes off if the water flow stagnates, as this could affect the quality of the disinfected water.

Additionally, a Dutch automated dosing system was installed in the greenhouse that enables to manage irrigation and fertilization easily: the system doses the fertilizers in the water in any desired precise ratio regulating timing, frequency, and quantity of nutrient solution delivered to the plants. The system is connected to the desktop and mobile applications where it is possible to set up the irrigation programs.

Besides nutrients, direct sunlight is critical for growing plants in hydroponic greenhouses. Alisher therefore installed an automated window cleaning system. The greenhouses are also equipped with temperature and humidity sensors. The temperature, especially during summers, can vary drastically and sensors can significantly improve microclimate conditions and limit the stress put on plants to control indoor humidity, Alisher installed automated fogging system that uses specialized nozzles designed to break up the pressurized water into fine droplets. Through the network of pipes and hoses the fog is distributed throughout the greenhouse.

Alisher also installed carbon dioxide generators to increase its concentration in the greenhouse, aid photosynthesis and boost plant growth and yield. The generator burns propane or natural gas at controlled levels and uses the combustion of propane or natural gas to release CO_2 as a byproduct. To maintain the desired CO_2 concentration, a sensor monitors the CO_2 levels in the greenhouse atmosphere.

Furthermore, an automated hydronic heating system is installed in the greenhouse for thermal heating. This heating system involves circulating heated water through a network of pipes or tubes installed within the greenhouse structure. Sensors are installed in this system that allow monitoring of the temperature of the water in the pipes and temperature of the air in the greenhouse.

SUCCESS FACTORS

Several important success factors underpin Alisher's success:

- The farmer already had substantive agricultural experience, and available land. Alisher applied for a loan to procure high-quality materials and technology and establish an automated hydroponic greenhouse. His experience in agriculture also increased his credit worthiness that resulted in easier application for the loan to invest into the greenhouse facility.
- Alisher's great interest and curiosity coupled with the considerable time he dedicated to researching solutions aimed at boosting agricultural productivity and efficiency, ultimately led him to create a greenhouse that employs cutting-edge methods and technologies, resulting in outstanding performance and a significant return on investment. The availability of electricity, water, natural gas sources and internet connectivity at the area of the farm allowed the implementation of new and innovative solutions.

The system is connected to the desktop and mobile applications where it is possible to set programs to maintain specific temperature in the greenhouse.

All of the systems mentioned above have been integrated into the software available as desktop and mobile applications. Additionally, the greenhouse is equipped with three WiFi modems strategically placed around the greenhouse facility. All these technologies, including the modems, are connected to the greenhouse's electricity generators to ensure uninterrupted operations in case of electricity outages.

Even though automation reduces the need for human labour, the training systems require a workforce that possesses adequate skills. Alisher provides capacity development training both on how to control the systems as well as on its benefits.

VALIDATION

The adequacy of Alisher's approach has been reflected in several important ways. Firstly, after the establishment of the hydroponic greenhouse system, the company significantly increased their revenues. Higher yields – even up to six times higher tomato outputs – positively contributed to the return on investment. Traditional production methods allowed approximately 45 tonnes of tomatoes to be grown per hectare, while new greenhouses increased the yields to 300 tonnes per hectare. Secondly, the quality of output also rose. The Uzbek agricultural products frequently do not meet the international standards, however Alisher's company started issuing standard international certificates for their goods which ensured the actors on the international market about the quality of their products. Their success has been recognized in Uzbekistan as well, with other farmers visiting the company's premises to learn about the technologies and their benefits and adopting the same approach.

IMPACT

Automated glass hydroponic greenhouses in can provide a solution for mitigating the challenges of soil quality and water scarcity in Uzbekistan. Alisher's innovative approach has significantly improved agricultural productivity and the quality of agricultural outputs in comparison to traditional soil-based methods, enhancing the appeal of the products in the international markets.

The use of inputs is optimized, reducing the need for pesticides, fertilizers, and physical labour. Furthermore, the facility provides a more favourable working environment for seasonal workers due to controlled temperature and humidity, in contrast to the harsh conditions of fieldwork where they are exposed to heat under direct sunlight.

Locally hired workers receive training to undertake specific tasks within the greenhouse. This training not only enhances their proficiency in digital technologies and solutions but also expands their general knowledge of agricultural practices, from production to harvest.

This greenhouse can serve as a demonstration plot for other farmers in the region providing inspiration without the need to travel abroad. The universities and research institutions can utilize the facility as a hands-on learning resource, bridging the gap between theoretical knowledge and practical application to help students deepen their knowledge about digital solutions and their potential benefits in the agricultural sector.

CONSTRAINTS

When transferring this good practice into different settings, there are several constraining factors to consider:

- Creating the necessary infrastructure, importing the technology, and building the facilities to establish an automated hydroponic greenhouse rely on significant initial financial and technical investments.
- Alisher sourced technologies from China, Italy, and the Kingdom of the Netherlands, as they were not available in the local Uzbek market, nor were they localized in the Uzbek language. The absence of advanced technology solutions in a country can pose significant barriers to access, underscoring the challenges associated with importing and adapting innovations to local contexts. The successful operation of the greenhouse system necessitates adequate technical knowledge and capabilities. The absence of appropriate technical expertise, as well as its limited availability locally prompted Alisher to hire an international expert from the Kingdom of the Netherlands to train the local staff and provide technical advisory services.

SUSTAINABILITY

- The technologies in use have resulted in increased yields of high-quality tomatoes that meet international standards. These tomatoes are sold both locally and internationally, generating substantial revenue, thus ensuring financial sustainability.
- Additionally, Alisher's focus on procuring high-quality and durable technology and materials for his greenhouse not only increases the return on investment but also guarantees long-term sustainability.
- Leveraging on knowledge gained in Kingdom of the Netherlands and accumulated experience, Alisher provides capacity building trainings to his personnel on the effective operation of these technologies, addressing the challenge of a shortage of skilled personnel locally.

REPLICABILITY AND UPSCALING

The utilization of innovative technologies in the hydroponic greenhouse yielded a significant return on investment and generated substantial revenue. Consequently, Alisher made the decision to expand and establish a second hydroponic greenhouse for growing cucumbers in the near future.

Additionally, Alisher provides capacity development training to personnel working in the greenhouse on effective use of technologies and other agricultural practices. They can apply this acquired knowledge to replicate solutions on their own agricultural plots.

CONCLUSION

Hydroponic automated greenhouses are a new concept in Uzbekistan. During his visit to Kingdom of the Netherlands, Alisher took stock of smart methods to establish a greenhouse and innovative technologies to deploy. As a result, he pioneered an hydroponic glass greenhouse with innovative technologies equipped with IoT sensors to automate all processes. This resulted in increased production value and higher quality outputs. By increasing the quality of the products, the company can certify their goods according to international standards, that opens further market opportunities. While most of the tasks are fully automated in the greenhouse, including the water disinfection, irrigation, fertilization, glass cleaning, temperature and humidity control, and CO_2 generation, a reduced number of skilled workers are still required. Use of resources is maximized, and use of pesticides and fertilizers is minimized, leading to greener and climate-smart practices. Capacity development training on both digital literacy and general agricultural knowledge fosters capacity development and replication among the farming community.

LESSONS LEARNED

- Alisher's dedication to researching and seeking top-performing methods and technologies to be deployed at his hydroponic greenhouse, along with his investment in acquiring the necessary equipment from abroad, ensured that his greenhouse achieved exceptional efficiency, resulting in significantly higher yields.
- Obtaining support from industry experts to set up the technology and train personnel to operate the technology effectively was essential for the successful implementation of the innovative practices.

MORE INFORMATION

This case study was elaborated by the American University of Central Asia (AUCA), and the Food and Agriculture Organization (FAO).

It was developed through interviews with Alisher Abdulladjonov, farmer, in 2022.

For further information about this case study, please reach out to FAO at: REU-Digital-Agriculture@fao.org.

SUSTAINABLE UNDERWATER FARMING WITH AN AQUAPONICS CLIMATE CONTROL SYSTEM: THE STORY OF ALEXANDER

Kazakhstan, Zhambyl region, Korday district

SUSTAINABLE DEVELOPMENT GOALS

OBJECTIVE

This case study relays the experience of a farmer from Southern Kazakhstan who opened the first aquaponics greenhouse in Central Asia. It illustrates the main stages of the implementation of the practice, as well as what problems the farmer faced when trying to automate the farm management process. It also describes the conditions required for the successful implementation of this practice in other regions.

INTRODUCTION

Alexander Bochkarev, the managing director at a farm in South Kazakhstan, has been practising hydroponics, a modern method of growing plants without soil, for the past ten years. A few years ago, he learned about the existence of another method: aquaponics. This method involves growing plants while simultaneously producing fish.

This mechanism completely excludes chemical substances (herbicides or pesticides) from plant growing technology. Plants grown in an aquaponic farm get all their nutrients from the waste products of the fish. The water in which the fish live, in turn, is purified by the plants.

In 2019, the first and so far, the only aquaponic greenhouse of 0.5 ha in Central Asia was opened, where six types of green products (arugula, iceberg, and other salads), some types of aromatic plants (basil) and two types of fish (clarius and tilapia) are grown. The farm has plans to use a climate control system.

By introducing this innovative technology, Alexander had the following goal:

- Sustainably produce the maximum volume of green products and fish per square metre with the lowest cost of production.

The climate control system automatically adjusts the level of light, humidity, air, and water temperature in the greenhouse according to the needs of plants and fish.

The pH level of acidity is also regulated so that fish and plants feel comfortable.

However, due to an unstable internet connection, the processes in the aquaponics facility are currently not fully automated. For this reason, the company had to hire additional employees who manually measure data, adjust the temperature and humidity levels, and turn on the fans as needed. Thus, the practice is still under implementation.

So far, 50 percent of the technology has been implemented. All the necessary infrastructure has been installed in the greenhouse, but due to the internet disruptions, there are problems with the automation and data uploading.

ACTORS AND STAKEHOLDERS

- manager of an aquaponics greenhouse in Southern Kazakhstan
- greenhouse employees
- aquaponics greenhouse providers
- farm's partners and customers.

GEOGRAPHICAL COVERAGE

Kazakhstan, Zhambyl region, Korday district

Source: United Nations Geospatial. 2020. *Kazakhstan*. Cited 27 December 2023. https://www.un.org/geospatial/file/2015/download?token=wETZTp56

METHODOLOGICAL APPROACH

Alexander learned about the technology from the internet. With the help of his colleagues, he contacted suppliers, studied its benefits, and decided to invest.

The technology provider installed and commissioned the equipment in the greenhouse. The trays with plants in the greenhouse are placed above the fish tanks. In the process of their life activity, fish emit ammonia, which is converted into nitrite and nitrate with the help of bacteria. These substances in turn serve as a natural fertilizer for the plants, which consume the water containing fish waste.

VALIDATION

The practice fully satisfies Alexander's needs in terms of sustainability: With the help of aquaponics, he has managed to organize a completely waste-free organic production.

Impact: The project created 15 jobs. Most of the staff are women, who care for the plants and harvest both plants and fish.

In terms of environmental aspects, the production of greens and fish using the aquaponics method is completely organic. Using aquaponics eliminates the need for pesticides and other chemicals, as they are harmful to the fish. Additionally, only 6 tonnes of water are needed to maintain six pools of 3000 fish.

The greenhouse is heated with gas instead of fossil fuels, thus minimizing carbon dioxide emissions.

SUCCESS FACTORS

- The farmer had significant experience in growing plants without the use of soil.
- The technology provider independently installed the equipment and checked that it was functioning correctly, which greatly facilitated the process of implementing the practice for the farmer.
- A KZT 661 million (USD 1.55 million) soft loan from the Agrarian Credit Corporation financed 40 percent of the required amount.

CONSTRAINTS

Shortly after the launch of the project, Alexander encountered internet disruptions. The connection is regularly interrupted. At such times, many processes, including measuring water, air temperature, and humidity and turning on the heating have to be carried out manually.

SUSTAINABILITY

One of the most important elements necessary for the successful implementation of this practice is the availability of sufficient financial resources. The aquaponics greenhouse is provided as a package deal, i.e. it is necessary to purchase both equipment and technology. The company incurred heavy logistics costs as the equipment had to be shipped from South Korea. At the same time, the practice has not yet shown any economic benefits.

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LESSONS LEARNED

- Before starting a project involving the use of digital technologies, make sure that there is a stable internet connection in the region.
- It is advisable to build greenhouses closer to large cities with an abundance of restaurants in constant need of fresh green products.

REPLICABILITY AND UPSCALING

Given the high costs and long payback period, this practice is only suitable for farms with significant financial resources.

CONCLUSION

Growing green products and fish in an aquaponic greenhouse allows the production of products without the use of pesticides and other chemicals. Such products are in high demand in the restaurant industry.

However, due to interruptions in the internet connection, the practice has only been partially implemented. In this regard, some of the work that the technology would automate has to be done manually. The greenhouse has to pay workers replacing the automatic irrigation, air temperature regulation, and other processes.

The farm's management is currently trying to solve the internet problem with the telecommunications operator. Once a stable internet connection is established, Alexander plans to continue the digitalization of his business, introducing automatic pest control and automatic weighing of finished products before they are taken off the production line.

MORE INFORMATION

This case study was elaborated by the Kazakhstan Growers' Union (KGU) and the Food and Agriculture Organization (FAO).

It was developed through interviews with Alexander Bochkarev, farmer, in 2021.

For further information about this case study, please reach out to FAO at: "REU-Digital-Agriculture@fao.org.

Amidst the challenges confronting agriculture in Europe and Central Asia, this casebook unfolds the stories of 25 farmers and agripreneurs who have successfully embraced digital technologies. The accounts presented herein reveal that, despite the effects of climate change, the consequences of the war in Ukraine and the enduring impact of COVID-19, opportunities for innovation and resilience can still be found. The case studies presented here, grouped into five distinct use cases, illustrate the transformative power of digitalization in agriculture, and serve as tangible examples of the successes and lessons learned on the path to sustainable development.

By harnessing the power of digital technologies in agriculture, we can prepare ourselves for the digital transformation of agrifood systems, which are at the core of the 2030 Agenda for Sustainable Development, with effects on all 17 Sustainable Development Goals.

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