



Post-Harvest Infrastructure Study

September 2024

The Norwegian Afghanistan Committee

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The purpose of the organization is to work together with the Afghan people to contribute to the development of an independent, peaceful, and democratic Afghanistan; promote knowledge about Afghanistan in Norway; and promote friendship between the Norwegian and Afghan people.

Our Vision

NAC shall contribute to a peaceful Afghanistan, free from poverty, where rural communities are empowered and resilient, valuing equality and diversity.

Our Mission

NAC shall support the Afghan people in the development of a peaceful, just, and egalitarian society where universal human rights are respected. NAC shall be a nexus for knowledge of, interest in, and engagement with Afghanistan in Norway, promoting Afghan voices and perspectives in Norwegian public debate and advocating for informed and responsible policies towards Afghanistan.

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Acronyms and Abbreviations

AA	Afghan Aid
AMD	Afghanistan Meteorological Department
AKF	Aga Khan Foundation
CBOs	Community Based Organizations
CIGs	Common Interest Groups
DACAAR	Danish Committee for Aid to Afghan Refugees
DAIL	Department of Agriculture, Irrigation and Livestock (district level)
FAO	Food and Agriculture Organization of the UN
FFS	Farmer Field School
GDP	Gross Domestic Product
HH	Household
HVCs	High Value Crops
HVCDSP	Horticulture Value Chain Development Sector Project
INGOs	International Non-Governmental Organizations
LNGOs	Local Non-Governmental Organizations
MAIL	Ministry of Agriculture, Irrigation and Livestock
MOWE	Ministry of Water and Energy
MT	Metric Ton
NAC	Norwegian Afghanistan Committee
NHLP	National Horticulture and Livestock Program
PAIL	Department of Agriculture, Irrigation and Livestock (provincial level)
PHI	Post Harvest Infrastructure
PHS	Post-Harvest Storage
PPP	Public Private Partnership
PRT	Provincial Reconstruction Team
TLO	The Liaison Office
VC	Value Chain

Currency Unit = Afghani AFN

1 USD = 72 AFN

Unit of Measurement

1 sehr = 7 kilograms

Executive Summary

Current post-harvest infrastructures in Afghanistan include storage facilities, transportation networks, and processing centers for value addition activities such as drying and pulping. However, ongoing systemic challenges faced by farmers and other stakeholders in the post-harvest phase have been accruing for many years, becoming more apparent over the last three years as international donors have increasingly focused on shorter term humanitarian programs.

There remains a significant lack of context-related and environmentally sensitive storage facilities, inadequate transportation systems, and limited access to locally appropriate processing technologies. In addition, poor access to post-harvest infrastructure, the lack of processing plants, and unstable access to markets and market information, impacts food-security levels, economic development, and agricultural productivity. These challenges contribute to high post-harvest losses, estimated to be around 20-30% for fruits and vegetables.

The lack of proper storage facilities leads to spoilage and wastage of agricultural produce, impacting food security and economic development in Afghanistan. Additionally, the poor transportation infrastructure hinders the timely and efficient movement of crops from rural areas to markets, resulting in reduced market access for farmers and higher transaction costs.

Efforts to improve post-harvest infrastructure (PHI) in Afghanistan have been made through various initiatives, including the construction of cold storage facilities, the rehabilitation of road networks, and the introduction of modern processing technologies. However, more investment and support are needed to address the existing challenges and enhance the overall efficiency of the post-harvest supply chain in the country. The findings of this study suggest focus areas should also include mitigating climate change, improving food security and increasing market stability for farmers to trade their products.

Overall, improving post-harvest infrastructure in Afghanistan is crucial for enhancing agricultural productivity, reducing food losses, and promoting sustainable economic growth in the country, but it is only as good as the crops that require storage. With climate change, additional challenges will need to be met in the long run by introducing adapted fruit, nut and vegetable varieties that can survive the more severe and extended winters and have a longer shelf life in storage without losing overall quality.

The push for sustainable and low-cost options still lies with the community-based implementation of post-harvest storage (PHS) wherever possible. However, many comments, observations and reports from other implementation agencies all confirm the difficulty with taking a shared ownership approach.

Adequate post-harvest infrastructure contributes to food security by reducing food losses and ensuring a more stable food supply. Due to the perishable nature of horticultural products and inadequate storage practices, post-harvest losses are very high, and many small-scale farmers in Afghanistan are compelled to sell their harvests at low prices at harvest time and late in the season to buy the same commodities at much higher prices. With improved storage facilities accessible to small-scale farmers, post-harvest losses can be reduced considerably, and perishable crops can be stored for longer periods, reducing the risk of food shortages during lean seasons.

It is now time for the Ministry of Agriculture, Irrigation, and Livestock (MAIL) to increase the provision of incentives to attract and maintain private sector investments, offer subsidies to farmers, implement regulations that uphold food safety and quality standards, and promote exports by enhancing the capacities of export promotion bodies. Another vital aspect of government engagement is the development of the agricultural sector. Agriculture extension services play a pivotal role in engaging farmers and disseminating advances and best practices to agricultural communities. However, challenges such as insufficient human resources, unadapted inputs, financial constraints and the appropriate utilization of existing capital and resources impede these efforts. Additionally, during last 20 years or so, the focus of extension services and donor priorities has been on collaborating with the cooperatives and larger-scale farmers, which left small-scale farmers and remote farming communities underserved.

1. Introduction

Agriculture is the foundational basis of Afghan society. Approximately 80% of the population is engaged in agriculture either directly or indirectly. This sector remains one of the main drivers out of poverty and provides some of the greatest opportunities to build the future of Afghanistan's wealth and potential for capital accumulation.

While some of Afghanistan's former agricultural infrastructure has been restored, considerably more remains to be done. As new possibilities in the development of infrastructure and technologies emerge, agricultural producers, processors and traders are demanding increased assistance in providing stable access to existing

markets and identifying new markets for their products. Agricultural practices in Afghanistan represent an evolving narrative as seen by the increase in subsistence farming beyond the traditionally underserved and geographically remote areas. This has been brought about predominantly by severe climate-driven events and protracted drought cycles and greater barriers to the access of inputs, credit and technical support due to the cessation of the majority of internationally funded programs and projects.

It can also be argued that since 2001 the structure of the agriculture sector has been built on an externally designed market-based approach model, and on prioritizing counter narcotic interventions. Afghanistan's largest agricultural programs tended to function at a national level on the assumption that the State would ensure sub-national (provincial and district level) production would be taken care of by the appropriate Line Ministries along with a broad spectrum of smaller international non-governmental organization (INGO)-led complementary agricultural projects. As a result, PHI was left in the hands of MAIL with a limited budget, INGOs and local non-governmental organizations (LNGOs) who could only construct in their respective areas of operation, and a nascent private sector unable to invest in a strategically meaningful manner to the supply side of value chains.

With increased security, farmers are beginning to focus on improving produce quality and invest in the production of higher value crops. This surplus production is beginning to create demands of MAIL and other stakeholders to address increased wastage and provide improved transportation infrastructure, stable and consistent access to domestic and cross-border markets along with technical and financial support. At the same time, there is pressure to address growing food insecurity in more remote areas and from communities experiencing a series of natural disasters. While some of these issues can be addressed through a broader value chain and livelihoods-approach, some of these factors can be resolved through a greater focus on rehabilitating and constructing PHI.

This study explains the importance of cold storage in Afghanistan in Section 2; it explains the methodology used in Section 3 before defining the different types of storage currently available in the country and their key characteristics in Section 4. Based on field visits to Faryab, Ghazni, Paktia and remote discussion with key informed individuals in Badakhshan in Section 5, it provides insight into the current context, farmer practices, and the constraints and opportunities faced in achieving food security and increasing production for economic gain. Section 6 provides a set of consolidated observations and conclusions on priorities around the development of cold storage provision, followed by Section 7 where some more generalizable recommendations are made for further consideration.

2. The importance of post-harvest infrastructure

Food Security (diversity of food intake, quantity and quality)

The agricultural industry in Afghanistan sustains the livelihoods of roughly 75% of the population and remains a substantive constituent of overall Gross Domestic Product (GDP). However, more than 20% of the population continues to struggle with food insecurity and malnutrition, caused by volatile food prices, poverty, displacement due to conflict and climate change, inadequate basic agricultural services, and under-implemented institutional policies. In Afghanistan, like all other developing countries, there has been a steady rise in food production thanks to the introduction of improved agricultural practices and availability of farming inputs; however, losses to Afghan farmers persist at notably high levels during all stages of production, storage, and marketing. These losses stem from factors such as weight reduction, nutrient depletion, and degradation in product quality.

The extent of post-harvest losses within the food supply chain fluctuates significantly based on factors such as the type of product, agricultural practices and economic conditions. Particularly for perishable products like fruits and vegetables, a substantial portion is lost primarily due to inadequate handling, packaging, storage and marketing infrastructure.

A historical lack of funding on post-harvest systems has led to significant technological gaps in post-harvest processes with little emphasis on post-harvest storage and food processing in the agriculture rehabilitation agenda from 2001 to 2021. Despite recognizing the importance of post-harvest practices and infrastructure, they were scarcely included in rehabilitation programs implemented by various donor agencies. This persistent issue was highlighted once again in 2021 as a continuing obstacle for small-scale farmers with excess surpluses to sell. Therefore, it is very important to have consistent and lasting expansion of post-harvest infrastructure for eliminating poverty, ensuring livelihood security, reducing hunger and malnutrition, and fostering sustainable and inclusive growth among small-scale farmers across Afghanistan.

Economic security (income generation and job creation)

Afghanistan's climatic conditions are favorable for fruit and vegetables, tree crops and seed production. During the 1960s and 1970s Afghanistan was the world leader in the export of high-value horticultural products. It is estimated that income from horticultural products was three to seven times that of the main staple crop of wheat. The rebuilding of horticulture will allow Afghanistan to rise once again and provide abundant employment opportunities and livelihoods for up to 75% of its population, thus contributing to increased rural incomes and employment opportunities. This will also contribute toward poverty reduction by providing employment and wages to laborers and greater incomes for poor households. Labor demand will also rise in the post-harvest sector, since transport, packaging, sorting, grading and cleaning are all labor-intensive activities.

Major components within the Value Chain (value addition)

Post-harvest losses cover food lost along the agriculture supply chain, from harvest until consumption. The magnitude of post-harvest losses varies at the regional, provincial and even district levels in Afghanistan, depending on growing and climatic conditions, location of farming communities, pre- and post-harvest practices, etc. In high altitude areas of Afghanistan with single cropping seasons, post-harvest management is primarily done to preserve and store grain, fruit and vegetables to feed the household over the winter. At lower altitudes, with two distinct growing seasons and varieties of crops to grow, the farmers practice a range of post-harvest management practices including chemical treatment to control post-harvest losses.

Like in many other agricultural economies, in Afghanistan the post-harvest value chain involves various stages aimed at adding value to produce after being harvested. These value addition processes are crucial for increasing the economic viability of Afghan farmers, reducing wastage in the production cycle and enhancing overall food security and household income, especially for small-scale farmers in remote communities. This whole process follows a basic cycle shown below in Diagram 1.



DIAGRAM 1 - POST HARVEST VALUE CHAIN

Some key aspects of post-harvest value chain and value addition activities in Afghanistan are as follows:

1. **Storage facilities:** This forms the main topic for the study but is by no means the only requirement in ensuring food security and income generation. Adequate storage facilities allow farmers to accumulate their harvest and are crucial for maintaining the quality and extending the shelf life of agricultural products. Well-managed storage will allow the farmer to sequence the release of products into the market at a time when prices are at their highest. However, this is only practically possible for small-scale Afghan farmers especially in remote communities if they have access to low-cost (zero-energy), decentralized cold-storage systems and other relevant post-harvest facilities close to the farm gate that are designed to meet their needs.

2. **Packaging and Processing:** One of the primary steps in the post-harvest value chain is processing agricultural products into more refined and marketable forms. Value addition through the use of suitable packaging and processing increases the shelf life of perishable goods, prevents mechanical injuries, provides easy handling, enhances product quality and considerably increases the selling value of the product.

Depending on the geographical location of farming communities and their farming practices, various packaging methods are employed as products are placed into storage (e.g., jute sacks, crates primarily for fruits, baskets, airtight clay pots for fresh grapes, clamping for potatoes and silos mainly for wheat). In urban areas, warehouses and the limited number of cold storage facilities are commonly used by small and medium enterprises for supplying the regional or local markets at later times. However, due to the lack of centralized storage options for small and medium-scale farmers in Afghanistan, crops are typically stored at the farm level using traditional methods, leading to significant post-harvest losses. Any improvement in methods of storage and processing of produce – especially perishable products – can lead to lower levels of food loss and higher income for farmers.

3. **Value-Added Products:** Value addition in a post-harvest value chain refers to goods or commodities that undergo additional processing or refinement after harvest, thus increasing the economic market value of agricultural products.

These products often entail some level of transformation from raw agricultural products into processed or semi-processed goods. Examples of value-added products in a typical post-harvest value chain include processed food to improve shelf-life, packaged goods, beverages, oils and extracts, processed dairy products (like cheese and yogurt), specialty products (gluten-free products), and agriculture fibers processed into textiles and fabrics.

This offers the opportunity for market diversification and agricultural sustainability, resulting in greater household food security, additional income, and often the creation of job opportunities as post-harvest practices tends to be labor intensive. Depending on the geographical location of farming communities, these practices are mainly undertaken by women at the household level for personal consumption or to meet local demands. However, it should be noted that this is one of the main entry points for women's participation in the value chain and allows increased economic agency and an additional source of household income.

However, in Afghanistan the value-addition practices for agricultural products are limited to a few traditional practices like air drying in the sun of fruits (e.g., mulberries, apricots, grapes into raisins), processing vegetables (e.g., tomatoes, onions, eggplants, and pickles), processing dairy products (e.g., cheese, yogurt, dry yogurt or qurut). All these activities circle back to the quality of storage facilities.

4. **Transportation and Logistics:** In Afghanistan, the transportation phase often causes significant bruising and damage to agricultural produce on their way to markets or points of sale. Afghan farmers may either be unaware of the benefits of appropriate packaging material or unable to afford the costs associated with it, especially given their small-scale production. Improving transportation infrastructure and other logistical challenges is essential for efficiently moving agricultural products from rural areas to markets, both domestically and internationally.

Afghan farmers encounter dual challenges in distributing their products, whether for local consumption or international export. These hurdles primarily revolve around high transportation costs, limited farm accessibility and inadequate road infrastructure. To cope with the high transport costs, most Afghan farmers opt for economical means such as horses, mules and donkeys for local market access, while utilizing trucks, buses and other public transport for regional markets.

For exports to neighboring countries, they typically use semi-specialized trucks and trailers. Given the high cost of shipping by air, over 90% of fresh fruit exports are routed through land border crossings to neighboring countries by Afghan exporters. However, this approach has its own set of challenges including frequent border closures due to security and political factors, thus inflicting considerable post-harvest losses, especially to perishable products. This then brings us back to the quality and quantity of storage facilities available to manage such bottlenecks.

5. **Quality Control and Certification:** Implementing quality control measures and the presence of certifications can enhance the marketability of Afghan products as international markets and consumers prioritize quality and safety standards. Afghanistan's standards and certification regime is basic and lacks the necessary infrastructure to provide benchmarks, guidance and awareness-raising to farmers on what constitutes an appropriate storage facility. Due to non-compliance and use of poor-quality products and packaging, exports from Afghanistan appear to have gained an unwelcome reputation thus resulting in export products to be partially or fully rejected by importers. This leads to significant financial losses for exporters and the entire supply chain.

6. **Market Access:** Accessing existing and new markets, both domestically and internationally, is crucial for maximizing the value of agriculture products. This involves market research in the form of identifying potential new buyers and markets, as well as developing and connecting producer groups with distributors and exporters. In general, farmers who currently export to either neighboring markets or have limited access to western markets often do so through informal personal connections or foreign intermediaries.

3. Methodology, scope and scale of field study

Research Methodology

The methodology section outlines the processes and procedures employed to gather, analyze, and interpret data for the Post-Harvest Infrastructure study. This study aims to assess the current state of post-harvest infrastructure and challenges faced in four provinces (Badakhshan, Faryab, Ghazni and Paktia) and extrapolate common themes and their impact on food security, economic security, and market accessibility. The research methodology adopts a mixed methods approach using both qualitative and quantitative approaches.

Site Selection Criteria

The study was carried out in provinces where NAC is already implementing a variety of activities. Four provinces were selected of which three were visited in person (Faryab, Ghazni and Paktia), and due to adverse weather conditions, one province (Badakhshan) was dealt with remotely (Table 1).

Provinces	Districts
Faryab	Bilcheragh, Koja Sabz Posh and Maimana
Ghazni	Ghazni City and Khwaja Umari
Paktia	Ahmad Abad and Gardez
Badakhshan	Remote interviews

TABLE 1 - PROVINCES AND DISTRICTS VISITED

The site selection for this study is based on the following criteria:

1. **Geographical Diversity:** Sites were chosen to represent different climatic zones and agricultural practices across Afghanistan. This allows the study to account for differences in rain fed and irrigated production systems, single or double cropping zones, and also between low altitude (Paktia, and parts of Faryab and Ghazni) and high altitude (Badakhshan) areas, which in turn, impose different post-harvest storage challenges and opportunities.
2. **Economic Significance:** Priority is given to areas with significant agricultural activity and potential for post-harvest infrastructure development. Based on existing project data, sites were selected that reflected varying degrees of production and market access.
3. **Stakeholder Presence:** Locations with active involvement from stakeholders such as local government, NGOs, community-based organizations and common interest groups were preferred.
4. **Infrastructure Variability:** Sites with a range of post-harvest infrastructure models (traditional, community-based, semi-commercial, and commercial) were included to provide a broader analysis.

Data Collection Methods

A mixed-method approach was used to gather data, combining qualitative and quantitative techniques to ensure a thorough understanding of the post-harvest infrastructure landscape. The approach involved the use of structured and semi-structured lines of enquiry involving closed and open-ended questions, and included the following:

1. **Key Informant Interviews (KII):** In-depth interviews were conducted with key stakeholders, including representatives from the Department of Agriculture, Irrigation, and Livestock (DAIL), international and local NGOs, community-based groups, and individual farmers. These interviews aimed to gather insights on the challenges and opportunities related to post-harvest infrastructure.
2. **Focus Group Discussions (FGD):** FGDs were organized with various community members, including farmers, traders, local authorities and local leaders. These discussions helped to capture a broad range of perspectives on post-harvest practices, infrastructure usage, and its impact on livelihoods.
3. **Primary Data Collection:** Field visits to selected sites involved direct observation and documentation of existing post-harvest infrastructure. Data on current and historical crop production cycles, storage facilities, and climatic conditions (precipitation, temperature, etc.) were collected.

4. **Secondary Data Sourcing:** Existing research, reports, and data from government agencies, international organizations, and academic institutions were reviewed to provide context and support for the primary data collected.

Stakeholder Criteria

The selection of stakeholders for interviews and focus group discussions is based on their relevance and influence in the agricultural sector, specifically related to post-harvest infrastructure. The criteria include:

1. **Government Agencies/ Provincial and District Departments of Agriculture, Irrigation, and Livestock (PAIL/DAIL):** Officials who oversee agricultural policies and programs, both ongoing and planned.
2. **International Non-Governmental Organizations:** Organizations involved in implementing agricultural development and food security projects.
3. **Local Non-Governmental Organizations:** Local NGOs working directly with farmers and communities on agricultural initiatives.
4. **Community-Based Organizations (CBOs):** Local community groups and cooperatives involved in agriculture and post-harvest activities.
5. **Individuals:** Farmers, traders, and other stakeholders directly impacted by post-harvest infrastructure.

Data Analysis

The data collected from various sources are analyzed using a combination of qualitative and quantitative methods:

1. **Thematic Analysis:** Qualitative data from KIIs and FGDs are coded and categorized into themes to identify common patterns and insights regarding post-harvest infrastructure challenges and opportunities.
2. **Statistical Analysis:** Quantitative data on temperature and precipitation (climatic variables) are analyzed to identify trends and correlations.
3. **Comparative Analysis:** The effectiveness and efficiency of different post-harvest infrastructure models (traditional, community-based, semi-commercial, and commercial) are compared to determine best practices and areas for improvement.

Validation and Triangulation

To ensure the reliability and validity of the findings, the study employs triangulation by cross-verifying data from multiple sources and methods. Feedback from stakeholders is also sought to validate the accuracy of the data and interpretations.

Ethical Considerations

The study adheres to ethical guidelines, including:

1. **Informed Consent:** Participants are informed about the purpose of the study and their consent is obtained before conducting interviews and focus group discussions.
2. **Confidentiality:** The privacy of participants is respected, and their identities are kept confidential.
3. **Non-Bias:** Efforts are made to ensure the study is conducted impartially and without bias.

By following this comprehensive research methodology, the study aims to provide a robust analysis of the current post-harvest infrastructure in Afghanistan and offer actionable recommendations for improvement.

4. Current Post-Harvest Infrastructure found in Afghanistan

There are two types of post-harvest storage predominant in Afghanistan: 'traditional storage' and atmospheric controlled storage. Each type of storage facility plays a crucial role in ensuring food security, reducing post-harvest losses, and improving the livelihoods of farmers in the country.

Traditional Storage Structures

Farmers in Afghanistan often use traditional storage structures such as underground storage pits, mud-brick silos, and granaries to store grains, fruits, and vegetables. These structures help protect them from pests, moisture, and extreme temperatures. The structures themselves are constructed from locally available

materials and tend to follow a highly localized or project-introduced design that has demonstrated successful results over multiple years.

In principle they are relatively inexpensive, can be completed in a short time span, and are not reliant on electricity to function, and in some cases, lack ventilation. The cost of operation and maintenance is relatively low, and they tend to be small, often made for a small number of households (HHs) at most.

Modern Storage Facilities

In recent years, there has been an increase in the construction of modern storage facilities across Afghanistan, often through agriculture or livelihoods projects aimed at income generation or food security. Many of these projects use adapted local designs and evidence-based models from the region and elsewhere to influence or control storage atmosphere. These fall into two clear categories of (i) non-electric and (ii) electrically powered structures.

Non-electric post-harvest infrastructure are the next step up from traditional storage facilities. While using local construction materials they introduce metal and plastic piping and wooden pallets as flooring and shelving to ensure airflow and temperature inside the '*sard khana*' or cold room. The temperature and airflow are manually controlled.

This model of storage is widely found both in remote rural areas heavily underserved by transport infrastructure and agricultural extension outreach and in rural and peri-urban areas where it is viewed as an economical way to increase income through storage of fruit and vegetables for sale later in the year.

Electrically powered post-harvest infrastructure includes warehouses, cold storage units, and refrigerated containers. These facilities are equipped with temperature and humidity control systems to extend the shelf life of perishable products.

- *Mobile Storage Units:* Mobile storage units, such as refrigerated trucks and containers, are also used in Afghanistan to transport and store perishable goods from rural areas to urban markets. These units help reduce post-harvest losses and improve market access for farmers.
- *Solar-Powered Storage Solutions:* With the increasing focus on sustainability and renewable energy, some farmers in Afghanistan are adopting solar-powered storage solutions to preserve their harvest. Solar dryers, solar-powered coolers, and solar-powered irrigation systems are being used to enhance post-harvest management practices.

To date, there have been no formal attempts to harness wind power to generate electricity, despite many prime locations where this could be possible. This is partly due to a lack of quality research on areas best served by wind power and the difficulties around importing and adapting wind technology packages. As such, this is a renewable energy technology that would require further investigation by a specialist contractor.

Community-Based Storage Centers

Some regions in Afghanistan have established community-based storage centers where farmers can collectively store their produce. These range from multi-household (i.e., constructed for several landowners with smallholdings contiguous to one another) all the way to centers that often provide shared facilities and services, such as weighing scales, packaging materials, and transportation assistance.

5. Findings

Overview from Kabul

Based on meetings with a UN Agency and INGOs in Kabul that are engaged in PHI activities, the cessation of all development projects in 2021 left a large sector of the agriculture sector in Afghanistan with a series of partially completed PHI projects and a crucial lack of agricultural inputs. All stakeholders understood the importance of expanding PHI activities to meet a diverse set of priorities and needs amongst rural communities in particular.

While MAIL has managed to retain PAIL and DAIL staff, they are heavily under-resourced and are unable to increase their extension service outreach along with meaningfully coordinate non-governmental PHI projects and activities. They are acutely aware of the importance of post-harvest issues around storage and marketing, and acknowledge a critical lack of reliable storage facilities, namely a few strategically located clusters of primary level (on main commercial arteries close to cross-border markets and agro-industrial zones/parks), a larger number of secondary level storage (located at regional/multi-provincial crossroads at the provincial level) and the far more numerous tertiary level structures that form the backbone of the value chain by

providing accessible storage of surplus commodities within producers' reach for swift and effective storage and to form the basis of addressing elements of food security and market level production leading to export leverage.

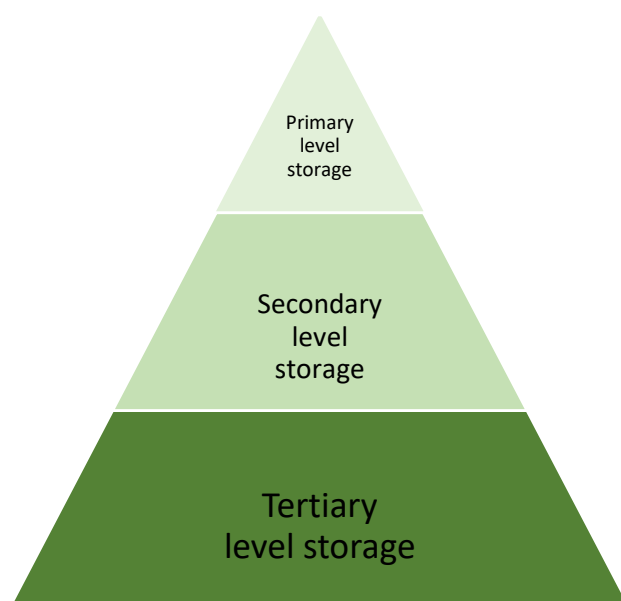


DIAGRAM 2 –RELATIONSHIPS BETWEEN DIFFERING COLD STORAGE FACILITIES

Adopting a sector-wide view of agriculture and livestock requirements, the United Nations Food and Agriculture Organization (FAO) looks at all PHI activities as part of a broader value chain approach, where establishing non-electric cold storage around High Value Crops (HVCs) such as grapes, selected vegetables and livestock offtake (dairy products) to promote food processing efforts is seen as building food and economic security and serving as a key entry point for supporting women in the community. They are currently targeting areas with easier access to outlets for these products and linking to markets (e.g., Balkh, Herat, Kabul and Jalalabad provinces) and may replicate these activities elsewhere if they continue to be successful. At the community level, FAO continues to promote Common Interest Groups (CIGs) and their use of zero energy post-harvest storage predominantly for food security purposes.

Again, based on their value chain approach, they also have significant supply-side interventions such as Integrated Pest Management to ensure fruits and nuts are in good condition prior to storage, thereby reducing wastage.

Looking at other INGOs in the agriculture sector, a certain amount of investment has been made in Tertiary Level PHIs but there has been little linkage or consultation between larger multilaterals or donors who have by far the largest budgets and have adopted a 'one size fits all' approach, and smaller localized (multi-provincial) PHI projects often run by INGOs providing PHI aligned to community needs and nuanced information on agricultural productivity.

Faryab

Faryab is mountainous in the south and rich in farmland in the west of the province. Agriculture is the main income source in four of its 14 districts (Bilcheragh, Kohistan, Kwaja Sabz Posh and Shirin Tagab) (IOM 2021),¹ mainly producing apples, potatoes, onions and grapes, with up to 70% of the population in/directly involved in the sector.² Sharing a border with Turkmenistan, with well-maintained border roads and a functioning railway between Andkhoy and the border point of Aqina Port, there is the potential for cross-border trade. However, the province remains heavily underserved in terms of infrastructure.

¹ IOM DTM CBNA Assessment, December 2021

² <https://elections.paihwok.com/en/content/background-profile-faryab-province>

Climate Variability and Trends – Faryab Province

Faryab continues to face significant climatic challenges with late frosts in early 2024 reducing yields of grapes and other fruits and nuts.

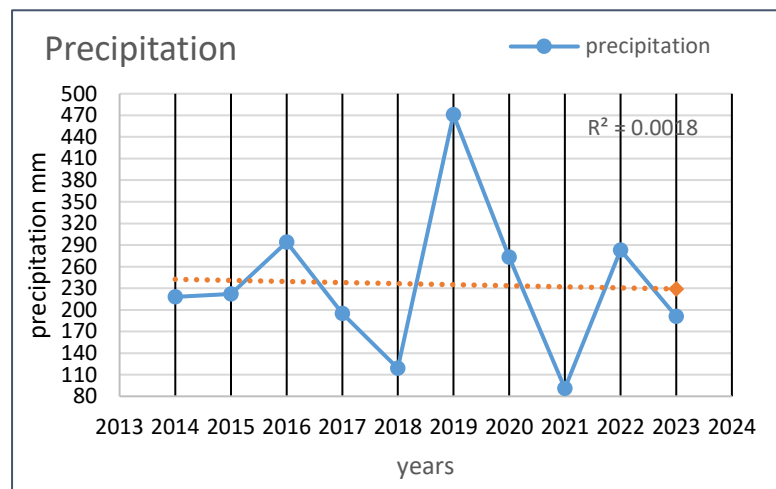


FIGURE 1 - TOTAL PRECIPITATION TRENDS, FARYAB PROVINCE (2014-2023) (SOURCE: MOWE, 2024)

Figure 1 gives a detailed account of the rainfall variability trend in the study area. The annual precipitation amount portrays a decreasing trend over the last ten years. From the graph, annual rainfall decreased drastically from 2009 to 2011 and in 2018 and 2021. The trend line of the annual rainfall shows a gradual decreasing which means that the annual rainfall pattern over the years (2014-2023) has been decreasing at a steady rate, also in line with lower snowfalls.

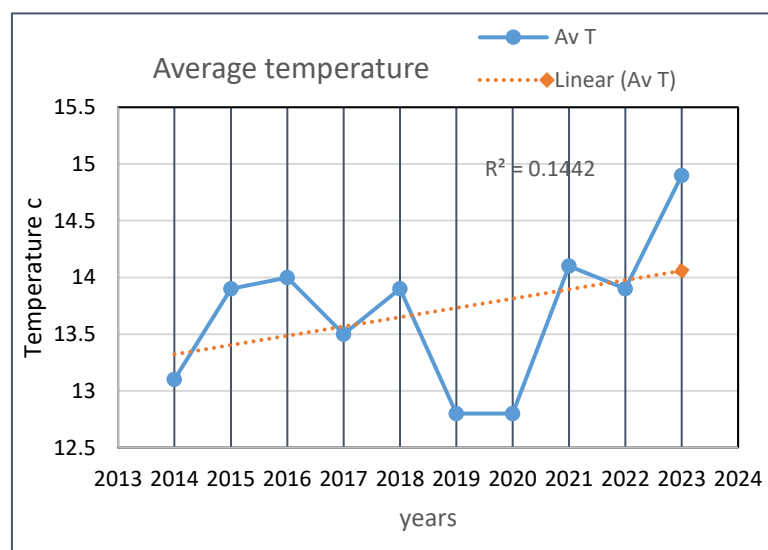


FIGURE 2 - AVERAGE TEMPERATURE TRENDS, FARYAB PROVINCE (2014-2023) (SOURCE: MOWE, 2024)

Figure 2 shows a relationship between the above rainfall graph and average temperature variance over the same period (2014-2023). Temperatures have spiked significantly between 2021-2023 as compared to the other years.

Cold storages in Faryab

Visiting the Bilcheragh District DAIL office, senior staff were well versed on NAC activities along with those of several other INGOs and LNGOs. The DAIL office had been supporting and coordinating the construction of a number of cold storage facilities which were either left incomplete or never started due to the fluctuating levels of security during recent conflicts which came to an end in 2021.

Over the last two years, production has stabilized and begun to increase, particularly for apples. At the moment, DAIL staff are working on opportunities to sell this commodity in the main provincial markets in

Maimana and Balkh where demand is very high. Yields have also increased for onions, potatoes and carrots, but due to the poor quality of roads, produce gets damaged during transportation, forcing many farmers to either sell at the local bazaar or by the roadside at very low farm gate prices. As a result, buyers from Mazar, Sheberghan, and Jawzjan regularly arrive in the province with their own transport in June-September (for apples) and August to September (for potatoes and onions).

Timing of sale is crucial for reducing wastage and gaining the highest price, for which they now require more cold storage facilities. In the case of apples, cold storage would significantly increase profit margins; at harvest time, apples are being sold for AFN 280/sehr (USD 4/7 kg) and by mid-winter the same apples are being sold for AFN 700/sehr (USD 9.7/7 kg). The same was mentioned about potato prices being AFN 40/sehr (USD 0.5/7kg) at harvest time and fetching AFN 200/sehr (USD 2.7/7 kg) in December/January. To capitalize on this additional income for the district, the DAIL staff were willing to assist in identifying locations close to major areas of production and would make government land available to facilitate construction.

Visiting two cold storage sites near Bilcheragh District Center constructed in 2020, both farmers and cold storage owners were unable to name the project or organization that constructed the infrastructure. Each farmer allocated their own land and agreed to pay a 10% contribution in locally available construction material and labor towards the total construction cost of approximately USD 7,000. The planned construction period of three months took five months to only partially complete; the plastic ventilation piping to regulate temperature in the cold storage by allowing air to pass through the structure was not installed due to a rushed completion as the area began to experience conflict and insecurity towards the end of 2020.



PICTURE 1 – SIDE ELEVATION OF POTATO COLD STORAGE IN BILCHERAGH DISTRICT CENTER

Designed for potato storage, both facilities can hold 0.7 MT (metric ton). Despite having access issues due to conflict in 2021, they have been used annually to store seed potatoes for 3-4 months after harvest. Both storage owners preferred to store seed potatoes due to the higher market price over normal ware potatoes. However, due to the poor rainfall and lack of irrigation water in 2023 the seed potatoes were sold off at the local bazaar for the same price as ware potatoes, making them a very small profit from storing and selling their produce in mid-winter. They explained that ware potatoes sold in-season (during harvest time) went for AFN 130/sehr (USD 1.8/7 kg) and off-season (approx. one month after harvest ended) for AFN 150/sehr (USD 2.1/7 kg) – had they been able to hold on longer and sell their produce as seed potatoes, they would

have sold at AFN 300/sehr (USD 4.2/7 kg). When asked the reason for the distress sale, both farmers independently of each other listed repayments on informal borrowing to purchase agricultural inputs as the main reason, followed by a reduction in family income since 2021. To offset this and diversify their income, both farmers had offered space in their cold storage for neighboring farmers for a nominal sum but the offers were not taken up.



PICTURE 2 - ENTRANCE TO POTATO COLD STORAGE IN BILCHERAGH DISTRICT



PICTURE 3 - RAISIN DRYING HOUSE / EXTERIOR, DEH SAYDAN, FARYAB

A third, much older storage in Nisar Village in Bilcheragh District was constructed in 2009 by the USAID-funded IDEA-NEW program which viewed PHL as strengthening the supply side of the value chain and often combined training, inputs and PHL as one package. The design was almost identical to the previous two in size and had been completely constructed with an identical contribution agreement. The cold storage owner confirmed he had received fertilizer and subsidized local varieties of seed potatoes and was still following the training given at that time. Notably, he was acutely aware of the need to cure (keeping potatoes in the storage without light and at high humidity for up to two weeks) and then sort potatoes by size before storage. He confirmed this reduced wastage by up to 20% and prolonged shelf life in the storage, allowing him to sell much later in the year for a higher margin.

As there is a concerted effort to increase grape production in the district, a grape drying facility (kishmish khane) in Deh Seydan Village of Khoja Sabz Posh District was visited to understand the current opportunities PHL can provide to increased productivity. The facility visited was constructed through the National

Horticulture and Livestock Program (NHLP) in 4-5 months in 2021 at a cost of AFN 400,000 (USD 5,550) with the standard 10% in-kind contribution from the landowner who has sole use of the facility. The owner said he could not remember the project or organization that undertook the construction.

The facility was constructed with sun-dried bricks³ and continues to meet the needs of the owner who harvests 50 sehr of raisins from 200 sehr of fresh grapes hung in the drying facility every 15 days. This has raised his income significantly from selling fresh grapes at harvest time which he has been forced to sell in the local bazaar because transportation costs are too high to sell anywhere else than the provincial center at AFN 350/sehr (USD 4.8/7kg), to selling raisins in the Maimana Center bazaar for 1100/sehr (USD 15/7 kg). Not only are the raisins easier to transport, but the profit has been used to construct concrete trellis poles and use better quality wire to further increase production (he is a beneficiary of training from DACAAR). In addition, the farmer has also diversified his crop production into fig and apple production and asafetida (hing).



PICTURE 4 - RAISIN DRYING HOUSE / INTERIOR, DEH SAYDAN, FARYAB

We visited a 2 MT potato cold storage in Arabi Charchakti Village of Khoja Sabz Posh District which was constructed by NHLP in 2021 for AFN 620,000 (USD 8,600) with a 10% contribution in kind from the farmer/owner. Although the owner stored almost 2 MT of seed potatoes in 2022, the owner began to store onions as well due to water scarcity forcing him to diversify his production. Currently, the onions are stored for up to six months with less than 5% wastage and fetch up to AFN 220/sehr (USD 3/7kg) off-season (seasonal price being AFN 90/sehr (USD 1.25/7kg)) in neighboring Maimana, where the owner has an outlet.

Overview of cold storage situation in Faryab

Overall, Faryab lacks consistent and stable political and financial support for its agricultural activities to contribute meaningfully to the provincial economy. With no plans for farm-to-market roads or improved commercial arteries to the main provincial bazaar and those of neighboring provinces, farmers will be forced to sell locally. It was also noted that late frosts would continue to affect nut production, and the overall reduction of rainfall could require importing adapted varieties of potatoes and apples that can be harvested earlier in the season and which could also take advantage of higher market prices.

³ The use of sun-dried bricks makes the drying house walls more porous to moisture and aids the grape drying process, as opposed to kiln-baked bricks which repel the moisture.



PICTURE 5 - FRUITS AND VEGETABLE MARKET, FARYAB

The main fruit and vegetable market is flooded with produce already found in Faryab, but lacks support for production, storage and market access. For example, red apples grown in Faryab arrive from Baghlan, Wardak and Iran and sell for AFN 80-250/sehr (USD 1 -3.5 /7kg) which the local produce cannot compete with.



PICTURE 6 - DRIED FRUITS MARKET, FARYAB

Constructing more cold storage facilities, grape drying houses and other PHI will allow farmers to benefit from increased margins in delayed sales and be prepared for the eventual increase in market access. Further tertiary cold storages will need to be constructed or rehabilitated to both meet the needs of surplus production storage and to replace those damaged by recent flooding to allow communities to recover quickly and support their resilience strategies.

Speaking with farmers and PAIL, DAIL, INGO and NAC's own staff, what Faryab lacks in opportunities due to external factors can be partially addressed by taking existing PHI approaches and adding contextual innovations. In order to foster this behavioral change in farmers and the private sector, more tertiary cold storage structures must be constructed to create longer-term commitments beyond season-by-season in terms of input supply (seed and sapling purchase or distribution) and value addition (increased jam and pickled vegetable production).

Ghazni

One of the largest provinces in Afghanistan, Ghazni is located in the south-east of Afghanistan, comprising 19 districts, all of which are engaged with agriculture and/or livestock activities.⁴ In agriculture, the main high value crops Ghazni produces are apples, potatoes, plums, and almonds, often exported to Iran and Pakistan.

Ghazni City, the provincial capital, is barely 150 km from Kabul and sits on the Kabul-Kandahar ring road, while also being a major intersection to get to the central highlands as well as to Pakistan via Maidan Wardak. This gives the province significant market access options to the capital and internationally, as well as a direct link to further smaller domestic markets, and ultimately, to act as a storage center for underserved production areas such as Bamiyan.

Climate Variability Trends

Ghazni is experiencing a gradual reduction in rainfall, making farmers even more reliant on aquifers, thereby reducing the current water table.

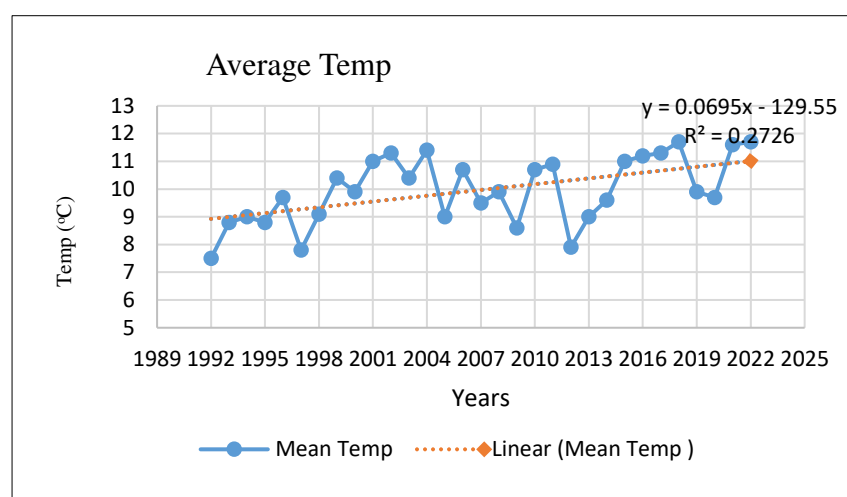


FIGURE 3 - AVERAGE TEMPERATURE TREND IN GHAZNI PROVINCE (SOURCE: AMD, 2023)

Figure 3 shows the average temperature in Ghazni is gradually rising with temperature spikes in 2018 and 2022.

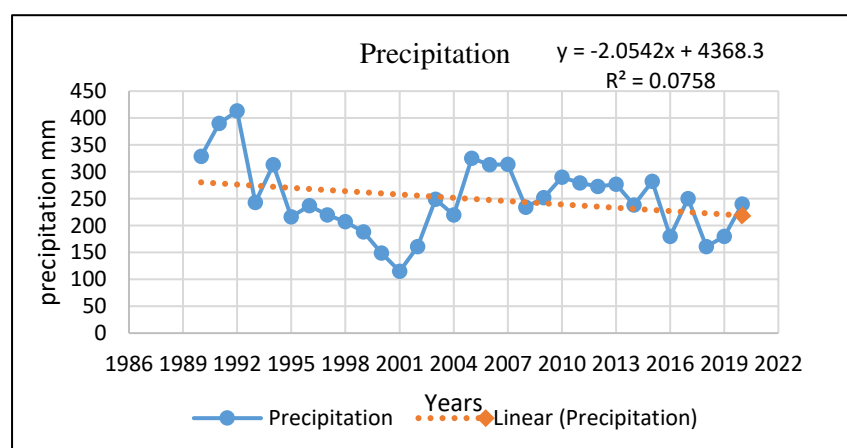


FIGURE 4 - ANNUAL PRECIPITATION TREND IN GHAZNI PROVINCE (SOURCE: AMD, 2023)

⁴ Data in Emergencies Monitoring Household Survey 2022: <https://microdata.worldbank.org/index.php>

Figure 4 provides a thorough description of the rainfall variability pattern, showing a declining trend over the last 30 years with a drastic decline in average precipitation from 2007 to 2022.

The PAIL office in Ghazni City confirmed the current constraints in promoting agricultural productivity is a legacy from Ghazni being on the frontline of a series of recent conflicts resulting in high levels of infrastructure destruction, making it impossible for farmers to work their land. The PAIL Director acknowledged the challenges of reduced agricultural productivity and increased food insecurity. With farmers now settled and engaged once more in successfully increasing production of a variety of produce, they are proactively seeking support from all available sources. Based upon consensus among the different DAIL offices across Ghazni the two main priorities remain value addition activities/processing and cold storage support and provision.

These two priorities have become of critical importance due to the unpredictable and frequent closures of the Pakistani border resulting in a loss of income due to crop wastage on the Afghan side of the border. The lack of storage facilities forces farmers to sell produce at in-season prices and increases wastage when local demand has been met. This could be partially addressed by constructing a set of cold storage facilities at the district level on government land, providing storage free of charge and coordinated and managed by the government.

Cold storage facilities in Ghazni

PAIL senior management confirmed that 39 potato storages were constructed (10-15 MT) from 2016 to 2017 in Ghazni Center and Qarabagh districts alone. They were 4m x 10m x 7m but some had ventilation issues as well as no shelving. As part of an economic development activity aimed at increasing farmers' income, potatoes were stored for up to four months with ware potatoes, increasing in value from an in-season price of AFN 70/sehr (USD 1/7kg) to an off-season price of AFN 200/sehr (USD 2.85/7kg) and seed potato increasing from an in-season price of AFN 175/sehr (USD 2.4/7kg) to an off-season price of AFN 250/sehr (USD 3.50/7kg).

The same storages may also be used for onions. PAIL confirmed local traders (for harvest 2023 and sale in 2024) have transported 100,000 MT of onions from Dih Yak, Muqur and Qarabagh districts and 80,000 MT of potatoes from Ghazni Center and Muqur districts. In addition, apple production is increasing and more cold storages will need to be constructed in Qarabagh because traders are informing farmers and horticulturalists that as their local apples are grown without pesticides they will fetch an even higher off-season price.

However, there is an appetite for investment by the private sector for fruit storage as demonstrated by the recent construction and opening up of the Nizar Faruki Commercial Cold Storage in Ghazni City. This company has replicated their warehousing model that has had much success in Herat. They started off with providing a temperature-controlled warehouse for apples with a capacity of 3,000 MT. Larger individual farmers and mainly small local traders harvest, sort and pack (into 10kg crates) and bring them to store at the facility. Contracts are signed based on a minimum amount of 3,000 crates per client to be stored for a minimum of three months. The demand for this service has been so great that the company is about to double the warehousing capacity for harvest late in 2024 and expand storage to include cherries, watermelons and tomatoes.



PICTURE 7 - INTERNAL STACKING AT NIZAR FARUKI STORAGE, GHAZNI CITY

Tertiary cold storage in Ghazni

Exploring tertiary storage facilities in Qabaldal Village, Khwaja Umari District, one of the main apple production areas of Ghazni, we visited two apple storages constructed by NHLP in 2020 in and around Qabaldal Village. Both storages are the identical two-story structure model used nationally. They were both built on land owned by heads of the local shura for their sole use and constructed over a six-month period. Each storage cost USD 40,000 with a 10% contribution in kind from the recipients. During the first harvest in 2020 one owner managed to harvest and store 17,000 sehr (119 MT) of apples of which 3,000 sehr was wastage. The second owner managed 14,000 sehr (98 MT) with 1,800 sehr wastage. Increased insecurity prevented the use of the storage in 2021, and for 2022 and 2023, both storages remained unmaintained and fell into partial usage and disrepair.



PICTURE 8 - EXTERNAL VIEW OF NHLP STORAGE, QABALDAL VILLAGE, KHWAJA UMARI DISTRICT

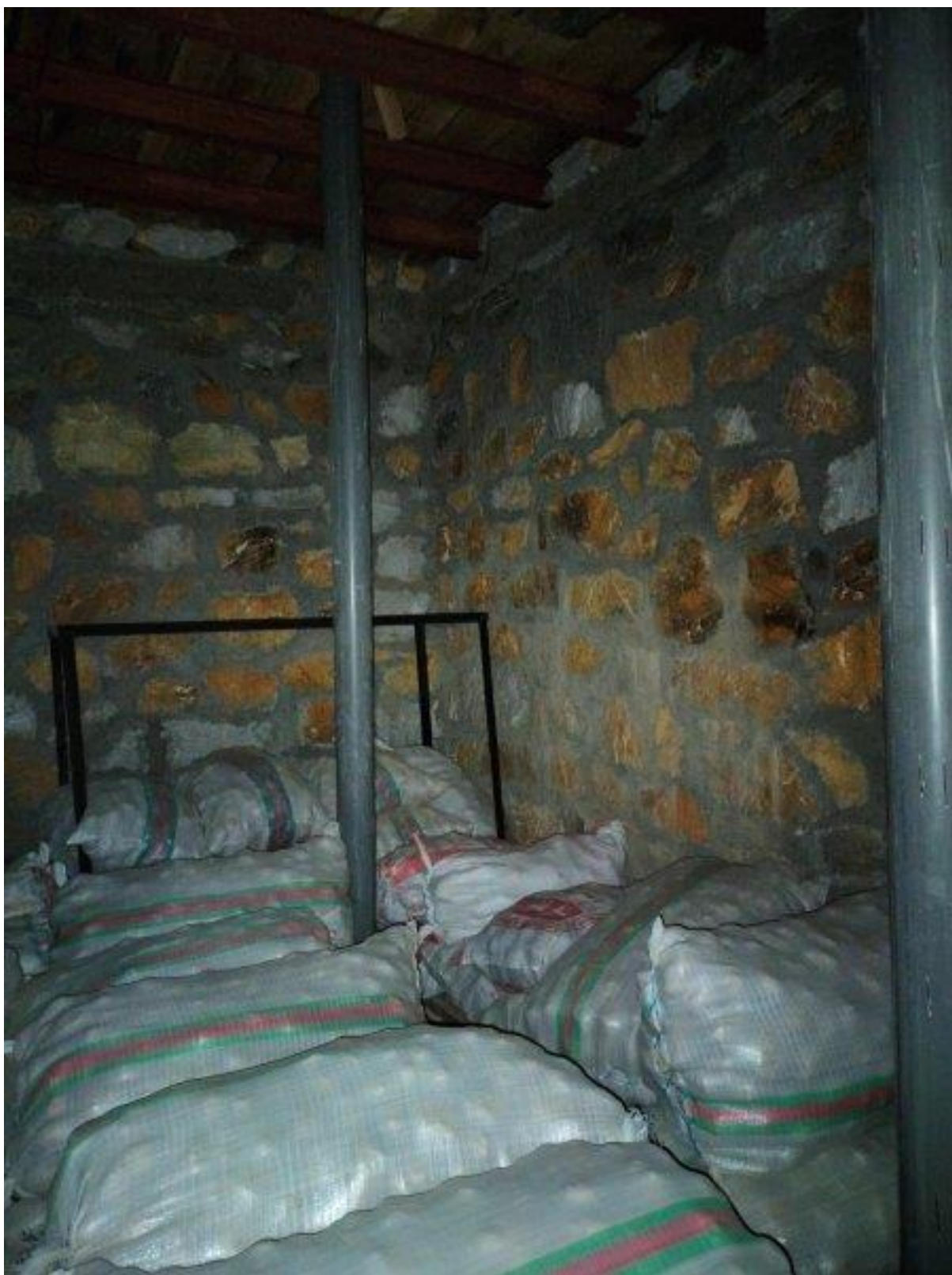


PICTURE 9 - POTATO STORAGE, QUSH VILLAGE, GHAZNI CENTER (VENTILATION)

In contrast, we visited a potato storage in Qush Village, Ghazni Center, that was constructed in 2020 by NHLP in two months for USD 7,000 with the standard 10% owner contribution in land, labor and local materials. It has a capacity of 13 MT and is equipped with pallets for the floor and good quality metal-framed shelving; the vertical plastic ventilation pipes running from the ceiling to the floor were finished to a high standard. Like all NHLP PHI packages, this was meant for the storage of produce and constructed on the farmer's own land. However, this particular owner's storage was shared with farmers of surrounding plots; each was given a key to the storage and the owner kept a joint record of the movements in and out of the storage for which the owner charged only a nominal amount that he did not disclose. At the time of the visit, the storage was still partially in use, with the potatoes showing no sign of deterioration even without a thermometer or humidity meter being used.



PICTURE 10 - POTATO STORAGE, QUSH VILLAGE, GHAZNI CENTER (ENTRANCE)



PICTURE 11 - POTATO STORAGE, QUSH VILLAGE, GHAZNI CENTER (INTERIOR)

Significant demand for cold storage facilities remains

Discussions with several stakeholders confirm that INGO/LNGOs are not able to meet the growing requirements for post-harvest storage. Over the last several years, NHLP and Roots of Peace have constructed a number of storage facilities, some of which are still in use. Almost all of them were underground storages and have had a variety of problems reducing or negating their utility, including improper ventilation design to manage potato/onion storage beyond four months. Additionally, no thermometers or humidity measures were supplied to manage atmospheric control. The Director of Ghazni City DAIL stated that two further local cold storages were constructed for USD 40,000 by NHLP using modern technologies that were meant for storage in warmer conditions (e.g., using cold water circulation) and were not suitable for the climate in Ghazni where the water freezes. These storages were not provided with shelving or baskets/crates and the recipients were not properly trained. As a result, apples were bagged and stacked on top of each other, increasing damage and wastage.

Overview of cold storage situation in Ghazni Province

The proximity of the province to large domestic and international markets has been responded to well with the expansion of primary cold storage facilities in Ghazni City and on the road between Ghazni and Wardak provinces.

While there are plans for secondary cold storage facilities, the DAIL office in Ghazni City is willing to provide land of up to 35 jeribs for a 5 MT potato storage facility and support any value addition activities on the same site, but they lack the funds. There is still little interest from the private sector to invest or subsidize such PHIs until economies of scale on the supply side have been reached. In the meantime, there is a vast scope for tertiary cold storage facilities at the sub-district level, either in the hands of individual farmers or possibly in community ownership.

However, cold storage without the necessary training will have limited impact, so the training and infrastructure will need to be a joint package. The training can be disseminated through replicating NAC's current Farmer Field School (FFS) and community-based trainings. In addition, seeds for different varieties of fruit and vegetables should be brought to promote cultivation of varieties that can withstand a longer shelf life in storage without quality deterioration.

Key areas for cold storage focus should be as laid out in Table 2:

Product	Districts
Grapes	Gelan, Ghazni City, and Muqur
Apples*	Ghazni City, Khwaja Umari, and Qarabagh
Plums	Ghazni City and Khwaja Umari

TABLE 2 - PROJECTED TERTIARY COLD STORAGE REQUIREMENTS IN GHAZNI PROVINCE

*Last year 300 MT apples were shipped to India in a DAIL/private sector partnership

Paktia

Lying in the southeast of the country, Paktia Province is a mountainous province with just over 35% of its land being semi-flat or flat and suitable for agriculture.⁵ Divided into 15 districts, the most agriculturally productive districts are Ahmadabad, Chamkani, Dand Aw Patan, Gardez, Aryub Zazi, Janikhil and Said Karam. It has excellent connections to the markets of Kabul and the Pakistan border via the Kabul-Gardez-Khost highway.

⁵ Mihara, M. and Dawlatzai, A. M. (2016). Current agricultural conditions and constraints in Paktia province of Afghanistan. International Journal of Environmental and Rural Development (2017) 7-2.

Climate Variability Trends – Paktia Province

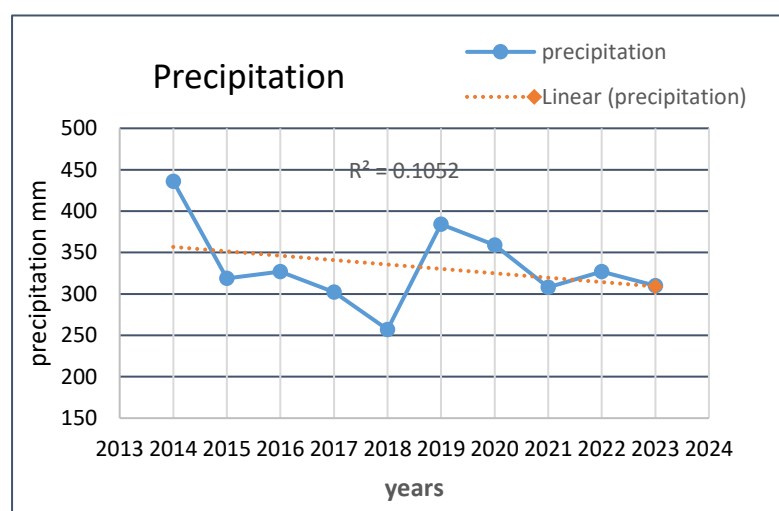


FIGURE 5 - TOTAL PRECIPITATION TRENDS PAKTIA PROVINCE (2014-2023) (SOURCE: MINISTRY OF WATER AND ENERGY, 2024)

Figure 5 indicates that the annual amount of precipitation shows a declining trend over the last 10 years. Initially, an increase in annual rainfall in 2014 was followed by a sharp decline from 2015 to 2018, which was offset by increased rainfall and snowfall in 2019. However, a drastic decline in average precipitation and snowfall has occurred from 2019 onward.

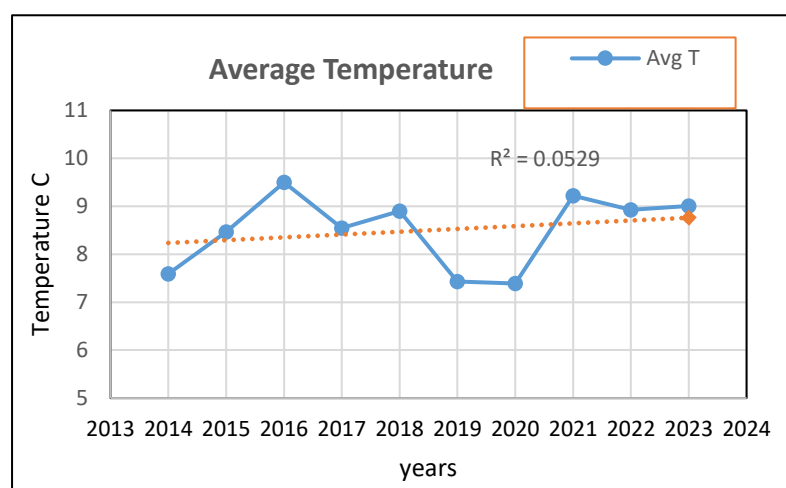


FIGURE 6 - AVERAGE TEMPERATURE TRENDS PAKTIA PROVINCE (2014-2023) (SOURCE: MINISTRY OF WATER AND ENERGY, 2024)

Although Paktia is seen as a colder province, Figure 6 shows a gradual increase in the average temperature between 2014 and 2023. This will ultimately affect the seasonal thaw of snow settled in the mountainous areas and create uncharacteristic surface water events such as flooding.

We visited two apple cold storages constructed by NHLP in 2019 with the standard 10% contribution in kind from single owners who provided the land for the structure, local materials and labor, and are able to fully utilize the 12 MT capacity of the cold store.

The owner of the first site in Baladih, Mangal Abad Village, Gardez District is able to fill the storage and keep products there between 4-6 months with 60 sehr (420 kg) wastage over the whole year. This has allowed the farmer to avoid selling his entire crop for AFN 60-90/sehr (USD 0.8-1.25/7kg); he now gets AFN 150/sehr (USD 2.08/7kg) several months later. His production has been steadily increasing, especially after receiving training in pruning and fertilizer application, and whatever does not fit in the storage is now sold in August to local traders who then store and sell the apples in Khost, Logar, and Nangarhar provinces for approximately AFN 250/sehr (USD 3.5/7kg).

The cold storage owner at the second site in Esakhil Village, Ahmad Abad District, stores apples for 2-3 months and has almost eradicated wastage by using plastic crates to store the apples. This allows the ventilated air to circulate more freely around the fruit and helps retain moisture and crispness of the flesh.

The delayed sale of apples has also provided a good profit margin by avoiding in-season selling at AFN 90/sehr (USD 1.25/7kg) and instead he sells at the off-season price of AFN 140/sehr (USD 1.95/7kg).

Also in Esakhil Village, Ahmad Abad District, a further potato storage in the same village was visited, which was constructed in 2019 by the Horticulture Value Chain Development Sector Project (HVCDS). As with NHLP, the same 10% model of contribution was used with this sole farmer who also provided his own land for the construction. The storage has a 13 MT capacity, and the owner has a sharing arrangement with three neighboring farmers who all store seed potatoes in the structure. The structure has resulted in all four farmers receiving a greater price by avoiding the in-season price of AFN 100-130/sehr (USD 1.4-1.8/7kg) and instead selling for AFN 180-200/sehr (USD 2.5-2.7/7kg).

An onion storage in a neighboring field was also visited. This was also constructed by HVCDS in 2019 under the identical 10% contribution agreement with a sole owner. There is a sharing agreement with the local community whose residents are allowed to store onions, increasing their sale price from the in-season August price of AFN 100/sehr (USD 1.4/7kg) to the off-season price of AFN 200/sehr (USD 2.7/7kg).

Finally, a grape drying house was visited in Habib Qala Village, Gardez Province which was constructed by NHLP in 2019 under the same contribution agreement and was used exclusively by the owner. The structure has a capacity of 10 MT and takes up to five weeks to dry the grapes to raisins; it takes approximately 4 sehr (28kg) of grapes to produce 1 sehr (7kg) of raisins. The price of in-season fresh grapes of AFN 150-200/sehr (USD 2.1-2.7/7kg) is more than compensated for by the sale of raisins several months later at a price of AFN 1,200/sehr (USD 16.7/7kg).

Current production opportunities and challenges in Paktia

Senior PAIL staff in Gardez stated the greatest areas of production, which are listed in Table 3 below.

Product	Variety and harvest period month(s)	Period of storage (months)	Production (MT)
Apples	Malling, Red & Golden Delicious (Aug-Sept)	3-5	43,928
Potatoes	Cardinal (July), Safid Gul & Sabz Gul (August)	6	N/A
Onions	Aug-Sep	2-3	2,571
Grapes	Aug-Sep	2-3	N/A
Pears	August	3-5	N/A

TABLE 3 - MAIN CROPS IN PAKTIA 2023 (SOURCE: PAIL GARDEZ)

One of the current challenges to increased income generation from agricultural activities is the lack of good quality cold storage. This was closely followed by an increase in pests and diseases (especially for potatoes and onions), early frosts and poor market linkages. With a lack of budget, the PAIL offices have only provided farmers with basic training on cultivation, post-harvest management and orchard establishment. They have been approaching INGO/LNGOs for financial support to increase basic extension services, but as this has not been possible, they are now promoting INGO/LNGOs to carry out the same extension and outreach.

Overall, Paktia remains one of the top apple producers in Afghanistan. Production is also increasing for certain fruits and vegetables such as pears in Ahmadabad and Said Karam districts and tomatoes in Chamkani and Zurmat districts.

Current market access and prices in Paktia

While a percentage of produce reaches the local market, because of limited local demand the surplus is usually mopped up by traders in Paktia and from Logar, Khost and Nangarhar provinces, who then sell these in their own markets and onward to Kabul and Pakistan. Usually there is a contract system, where the trader contracts the purchase of all the fruit in an orchard and provides a team of trained fruit-pickers along with employment of some local labor to grade and pack on site. In these arrangements, a fixed price in advance is usually agreed upon ranging from AFN 80 to 120/sehr (USD 1.1 to 1.6/7kg), which provides only a slim profit margin to the farmer. In the main market of Gardez, in February 2023, only imported fruits and vegetables were commonly available and were by far the cheapest, with apples from Iran priced at AFN 70/kg (1 USD), onions from Tajikistan at AFN 36/kg (USD 0.5), tomatoes from Iran for AFN 70/kg (1 USD) and Pakistani potatoes at AFN 22/kg (USD 0.3).

Current in-season (at harvest time) and off-season (mid-winter) prices based on aggregated data from several site visits are detailed below, showing the huge margins achievable with cold storage.

Product	Price in-season /sehr	Price off-season/sehr
Apples	AFN 80-120 USD 1.1-1.6	AFN 350-500 USD 4.9-6.9
Onions	AFN 100-120 USD 1.4-1.6	AFN 200-250 USD 2.75-3.5
Potatoes	AFN 120-130 USD 1.6-1.8	AFN 150-160 USD 2.1-2.2
Grapes	AFN 120-200 USD 1.6-2.75	AFN 250-330 USD 3.5-4.6
Raisins		AFN 1000-1200 USD 13.9-16.7

TABLE 4 - IN-SEASON AND OFF-SEASON PRICES FOR KEY AGRICULTURAL PRODUCTS IN PAKTIA

When farmers were asked why they favored this arrangement, they explained that it provided them with a guaranteed income well in advance that they could then plan around financially and also order additional inputs and goods knowing they will have the money to pay for them. In addition, as there were an inadequate number of cold storages available, they had little choice, as they would be selling their products locally with no guarantee of price and demand, which would potentially lead to significant wastage. There are also no value-addition facilities in the area - two processing centers in Said Karam District and Gardez Center were constructed by the US Provincial Reconstruction Team (PRT) but these have not been functional and the structures are now damaged and required rehabilitation.

Cold storage in Paktia

The province still lacks any primary storage facilities. Ten underground cold storages have been constructed in Chamkani District by CARE (INGO). Co-owners were provided trainings and workshops on fruit and vegetable production and post-harvest management. The Liaison Office (TLO) has also constructed greenhouses and plastic tunnels, distributed certified seeds (wheat, corn, vegetables and saplings) and trained farmers on post-harvest management and marketing.

Both the World Bank and Asian Development Bank-funded NHLP and HVCDSP have constructed cold storage throughout 2018 and 2019 as per Table 5. Unlike the INGO model, these cold storages were exclusively contracted to single owners and all appear to be functional except for the onion storages due to poor harvests and increased humidity creating wastage.

Crop	District
Apple	Ahmadabad, Gardez and Said Karam
Potato	Ahmadabad, Aryub Zazi, Chamkani, Dande Patan, Gardez, and Janikhil
Onion	Ahmadabad, Aryub Zazi, Chamkani, Dande Patan, and Gardez
Grapes	Ahmadabad, Chamkani, and Gardez

TABLE 5 - COLD STORAGES CONSTRUCTED BY NHLP AND HVCDSP IN PAKTIA

Overview of cold storage situation in Paktia Province

Despite limited arable land compared to many of its neighboring provinces, Paktia remains a leading producer of apples and is now diversifying into pine nuts and expanding production in grapes and almonds as a response to climatic challenges of reduced rainfall/snowfall and gradually rising temperatures. In addition, the province lies on a highly lucrative commercial artery to Kabul and Pakistan, which opens up significant backward and forward market linkages from access for produce of the province to a good supply of agricultural inputs such as fertilizer, chemicals and seeds originating from Pakistan. However, much of the surplus is being purchased at below farm gate prices by local and external traders who leave a slim profit for the farmers and either store or sell their produce for much higher margins elsewhere. With an increase in well-located cold storage facilities (i.e., in areas of highest production and preferably close to a road) this economic barrier can be partially addressed. An increased understanding of production trends and adequate training on the pre-storage preparation and storage management (temperature and humidity control) would yield a significant return to the provincial economy.

Badakhshan (remote study)⁶

The north-eastern province of Badakhshan is divided into 28 districts. It is dominated by mountainous or semi-mountainous terrain with steep riverine valleys covering almost 90% of the province,⁷ leaving barely 10% of the province with potentially arable land. The province continues to experience a series of natural disasters, most recently earthquakes and flooding. The precarious nature of the province's physical environment has made agricultural activities for surplus production very difficult. Much of the agriculture and livestock sector is effectively geared towards food security first and market production as a secondary concern. The main districts where fruits, nuts and vegetables are grown in surplus are Baharak, Jurm and Keshem.

Climate trends in Badakhshan Province

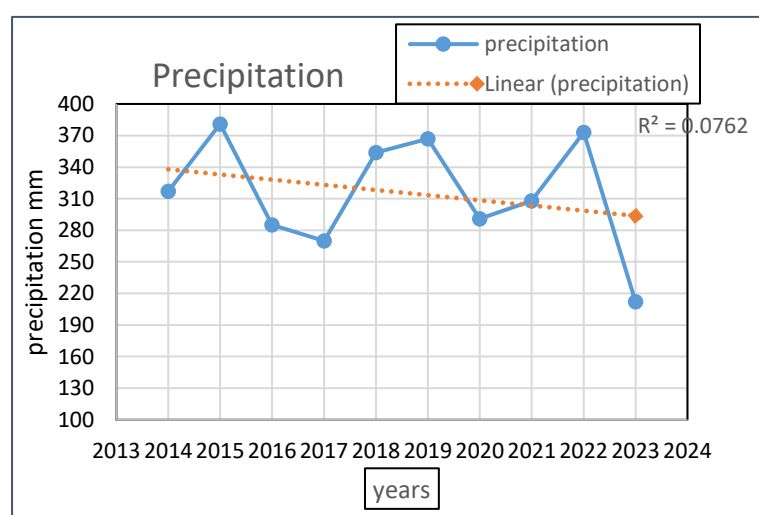


FIGURE 7 - TOTAL PRECIPITATION TRENDS OF BADAKSHAN PROVINCE (2014-2023) (SOURCE: MINISTRY OF WATER AND ENERGY, 2024)

Figure 7 shows that the annual amount of precipitation remains in a declining trend over the last 10 years, despite gradual increases in rainfall and snowfall between 2020 to 2022. This continues to impact the choices farmers are making over staple crops (e.g., wheat, potatoes, and beans) to feed themselves and more lucrative cash crops (e.g., apples, apricots, walnuts and vegetables) to sell at the markets.

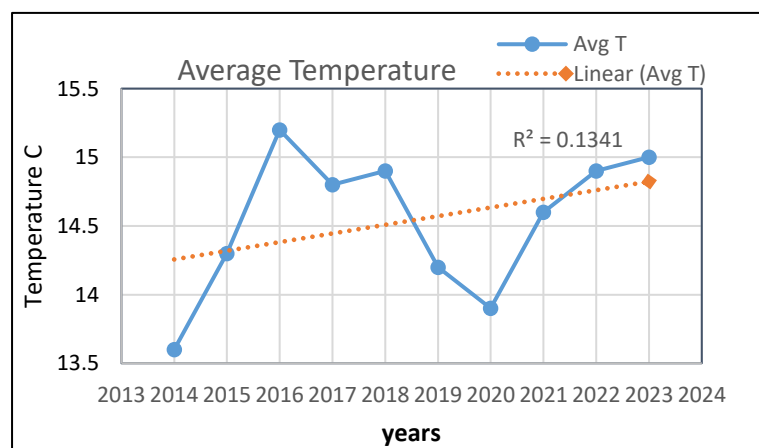


FIGURE 8 - AVERAGE TEMPERATURE TRENDS BADAKSHAN PROVINCE (2014-2023) (SOURCE: MINISTRY OF WATER AND ENERGY, 2024)

Figure 8 portrays the average temperature trend in the study area from 2014 to 2023. Despite a steady drop in temperature resulting in early frosts and late snow melt (reducing the agricultural production season) between 2016 to 2020, the average temperature is on the rise again. The impact of increasing temperatures on agriculture crops is that it will affect photosynthetic activities of produce which may in the long run affect the storage shelf life of horticultural crops in particular.

⁶ Due to heavy snowfalls in February 2024, it was not possible to complete an in person site visit to Badakhshan province.

⁷ Afghan Aid (2016). Fruit and vegetable value chain Assessment in eight districts of Badakhshan province, Afghanistan: A Value Chain Approach.

Food security versus market-led production

Detailed discussions with DAIL, UN and INGO (including NAC) staff confirm a constant process of selecting food security over market-led production when it comes to agricultural choices. Currently, most smallholders are opting for wheat, rice and potato cultivation, which is actively supported by NAC, the Aga Khan Foundation (AKF) and Afghan Aid (AA). Larger landholders are diversifying their production to include vegetable production and fruit orchards to capitalize on the increased income derived from sales of their produce in the local markets, and those of Faizabad.

Currently, the province's largest and main market in Faizabad is filled with local in-season produce, but by January/February of each year, the lack of stored produce allows the market to be filled with goods from outside of the province being sold at up to 500% of the price of similar in-season crops. In the case of apples from Baharak, they are sold in-season at AFN 60/sehr (USD 0.8/7kg), compared to apples from Wardak Province and Iran sold in February at AFN 250/sehr (USD 3.5/7kg) off-season. There is a similar price difference for potatoes and vegetables from Takhar Province.

Cold storage in Badakhshan

There is no commercial or primary level storage in the province. There is a pilot secondary level storage facility for onions constructed following a Turkish design as a pilot project costing AFN 500,000 (USD 7,000) with a reported capacity of 200 MT capacity in Faizabad that may have the ability to store for six or seven months.

However, the majority of cold storages are built underground predominantly in Baharak, Jurm, Keshem, Shognan and Yaftal-e-Payan districts. They fall into three categories:

- (i) Larger storage for cash and high value crop storage: These include those constructed for apple storage in Baharak, Jurm, Keshem and Yaftal-e-Payan districts.
- (ii) Smaller storage for food security: Due to the limited production volumes, these are often 6 m long, 2.5 m in width and up to 2.5 m in height. Often, they lack any form of ventilation, heating and humidity control. Most of the underground cold storage has been constructed in Baharak, Jurm, Keshem and Shognan districts.
- (iii) Traditional storage: These usually take the form of pits dug in the ground on the farmer's own land. In some cases, larger pits are dug for the use of several farmers with contiguous smallholdings.

In addition, greenhouses were constructed by NHLP to help prolong the growing season of higher value soft fruit and vegetables, but these have not been successful.

The Faizabad PAIL acknowledges the need for better post-harvest management practices and with limited budgets, they are trying to persuade INGO/LNGOs to fill this gap. At the same time, they acknowledge the large number of unsuccessful cold storage projects constructed by NHLP and other projects. Almost all of these storages have high levels of wastage due to a lack of humidity control and overall poor management of produce being stored and removed. In addition, the PAIL staff stated that the storage designs were not suited to the agro-eco zone and overall temperature fluctuations prevalent in Badakhshan. For the PAIL staff, the NHLP approach of selecting individual owners also seemed to be contentious and they advocated for a community-based approach with shared ownership as a more acceptable approach, placing the management in the hands of key lead farmers and establishing an element of peer pressure to ensure accountability and suitable storage management practices.

The main challenges for cold storage across the province are described below in Table 6.

Challenge	Consequence
Reduced amounts of available irrigated land	This mainly applies to Faizabad, where even irrigated agricultural land is being converted into housing plots.
Climatic	Decreasing rainfall and snowfall has reduce apple production in Jurm and Keshem districts.
Location and design	Many cold storages were not constructed close to production areas, had poor quality cold storage design that lacked standardization, and lacked ventilation.
Skills and capacity in post-harvest practices	There is limited awareness of the preparatory work required before placing produce in storage (such as grading, sorting and curing) and the use of thermometers, humidity meters and moisture control.
Ownership and management of cold stores	As the main reason for most cold storage is related to food security, it would be better to adopt a shared ownership model, where 5-6 farmers combine their produce for storage in winter.

TABLE 6 - COLD STORAGE CHALLENGES IN BADAKHSHAN PROVINCE

Overview of cold storage situation in Badakhshan

The province has little purchasing power and any surplus stored will fetch greater returns outside of the province. The best trade route is through Takhar to Kabul, but the roads are poorly maintained, which increases costs and reduces profits through increased transport time and potential damage/bruising of produce. Commonly during harvest time when produce is at its most plentiful and cheapest, local traders tend to sell surplus in the markets of Kunduz, Mazar and Kabul where there is a growing demand for Badakhshi apples, pears, plums, cherries, pistachios, and walnuts. Given the provincial production figures for 2023 in Badakhshan (stated below in Table 7), there is the scope for a limited number of additional cold store facilities for high value produce along with a significant increase in smaller community-based storage for food security, ensuring adequate supplies over the long and harsh winters.

Commodity	Total Annual Yield (MT)
Apples	3,500
Pears	900
Walnuts	4,470
Apricots (dried)	7,560

TABLE 7 - ANNUAL PRODUCTION OF SELECTED COMMODITIES IN BADAKSHAN FOR 2023 (SOURCE: PAIL, FAIZABAD)

6. Observations and Conclusion

While such a study is by no means comprehensive, there are generalizable lessons, trends and strong indicators that can be extrapolated and applied to the agriculture sector in terms of the critical role and multiple responsibilities of cold storage as part of a value chain and as a food security resilience mechanism.

From MAIL's perspective, it faces challenges such as insufficient human resources, unadapted agricultural inputs (seeds, fertilizer, etc.), financial constraints, and the appropriate utilization of existing capital and resources. Additionally, during last 20 years or so, the focus of extension services and donor priorities has tended to be on collaborating with cooperatives and large-scale farmers, which leaves smallholders (forming the vast majority of farmers) and remote farming communities under-served. In some provinces, the government collaborates at best or coordinates at worst with some INGO/LNGOs on the initiatives such as Participatory Technology Dissemination (PTD), Farmer Field Schools and demonstration plots as part of extension services but these efforts are not sufficient at all in providing the assistance and guidance needed by so many farmers across the country.

From the farmer's perspective, with continued sanctions and fluid borders and an increase in climate-driven natural events, agricultural productivity and markets remain unstable with prices varying significantly even when selling products off-season. As a result, farmers end up selling at harvest time for a low price because they can have guaranteed cash in hand even though it is less than they could get later on.

Improvements in post-harvest practices among smallholders and associated infrastructure like proper storage, packaging and processing capabilities and transportation will play a pivotal role in ensuring food security, fostering diversity of household food intake (both in terms of quantity and quality), and guaranteeing continued food supplies throughout the year. Moreover, such infrastructure enables the diversification of food options by facilitating the storage and distribution of various crops, thus enhancing dietary diversity and nutritional intake of households. Addressing these challenges at the community level through targeted investments and comprehensive strategies is imperative for ensuring a stable and resilient food system that meets the diverse nutritional needs of the households, especially in remote regions of Afghanistan such as Badakhshan.

It is obvious that any improvement in post-harvest infrastructure will positively impact the household income, nutritional uptake and employment opportunities for Afghan farmers, women's groups and other stakeholders in the agricultural supply chain. These improvements could be in the form of:

- **Rehabilitating and improving existing Post Harvest Infrastructure:** While MAIL does not yet have the capacity to undertake a Post-Harvest Infrastructure Survey, it can offer small sums to PAIL offices to support cold storage rehabilitation for tertiary (community-level) facilities which would be selected on a set of criteria best serving the local economy or food security situation. In addition, it can formulate guidelines to promote INGO/LNGOs and private sector actors to allocate a modicum of resources for the rehabilitation of tertiary cold storage structures in the communities that fall under their respective areas of operation. This will be a quick and cost-effective way to consolidate existing public, private and community assets. It will greatly contribute to minimize post-harvest losses, ensuring that more of the agricultural produce reaches the market in good condition.

- **Expanding existing cold storage development:** Developing post-harvest infrastructure creates employment opportunities in various sectors. Construction of affordable storage facilities, transportation links and processing plants require labor that will in turn provide job opportunities for both skilled and unskilled workers, enhancing the ability of the Afghan agricultural sector to become more efficient and productive. This will also stimulate job creation in related sectors like small scale food processing, marketing and logistics.
- While MAIL will have a limited budget to invest in regional and provincial level electrically powered temperature controlled storage facilities, private trading companies have shown a demonstrable interest in construction if the government can provide incentives such as well-placed government land or subsidies along with Public Private Partnership (PPP) packages to encourage national and international companies to systematically invest in the Afghan agriculture sector (as was beginning to be demonstrated in the establishment of Agri-Business Parks and Zones, warehouses and processing plants). At the secondary or district level, there is less interest from the international private sector, so this will have to be led by MAIL and domestic private actors, along with local business enterprises. In the past larger cooperatives, fruit and vegetable associations and local traders were willing to provide the required capital and inputs but lacked a coherent approach and reception from the government.
- **Ownership and management of community level (tertiary level) cold storage facilities:** The push for sustainable and low-cost options still lies with community-based implementation of Post-Harvest Storage wherever possible. However, many comments, observations and several reports of other implementation agencies all confirm the difficulty with taking a shared ownership approach. Looking at cold storage and grape drying houses in all provinces visited, the most predominant model implemented is under sole ownership which is a vital step forward in ensuring those with adequate and surplus production capacity can already contribute to the supply side of value chains, while also increasing income generation. However, greater emphasis needs to be placed on cheaper and smaller versions of the same basic low cost/zero-energy cold storage designs in areas where smallholders dominate and require the storage to increase food security, especially with the impact of increasing climate change further exacerbating floods and droughts.
- **Enhanced market access:** By having better post-harvest infrastructure including roads and market facilities, farmers' access to markets (both domestically and internationally) will improve and allow them to sell their produce at better prices, increasing their incomes and contributing to overall economic security of their households. However, the provision of stable markets remains a challenge with little control exerted over the quality of fruit and vegetable imports and the constant closure of borders, especially the Pakistani border which closes at strategic times, negatively impacting Afghan exports and increasing both food wastage and economic insecurity for farmers.
- **Improving skills and awareness of post-harvest practices:** Improved post-harvest infrastructure and comprehensive extension services to educate and train small-scale farmers and women's enterprise groups at the community level on simple food storage and processing techniques will allow Afghan farmers to add value to their produce before selling it. There is a lack of knowledge among farmers in prolonging shelf life in storage (e.g., humidity control and even spraying specific oils or water on fruits to prolong shelf life). This would not only yield higher prices but also creates new income streams and job opportunities in processing and related sectors.

7. Recommendations

Donor considerations

With subsistence farming on the increase and exacerbated by the negative effects of climate change, long term prospects for improving security are further challenged. There has to be a greater focus on strengthening local markets and livelihood diversification in the agriculture sector to build community resilience and coping mechanisms to combat climate and environmental risks.

An activity with a focus on value chains, such as post-harvest infrastructure investment can provide not only employment creation but income generation opportunities for on-farm and off-farm labor. The reduction of wastage, increased market prices, adding value to food and subsequent cash injections into the local economy will provide greater sustainable income-generating livelihood and entrepreneurial opportunities for rural communities in particular.

As agriculture remains one of the main drivers out of poverty for Afghanistan, investments in post-harvest technologies and activities will contribute to a stronger and more informed response by communities as they adapt to future environmental and climate shocks.

Government Support and Policies

Government policies and support programs play a vital role in fostering a conducive environment for value addition in the agriculture supply chain. In the case of cold storage, the three types of cold storage categorized in this study will require three different types of support.

- Regional and Provincial level: As stated in previous national agricultural plans, MAIL must continue to lead the investment strategy for large-scale cold storage facilities and value addition enterprises such as juicing, pulping and drying plants. Potential sites for these include agri-business parks and zones, provincial capitals and border areas located along major commercial arteries. MAIL will need to develop incentive packages for a combination of public and private investment along with grants from the World Bank, the Asian Development Bank and bilateral donors to catalyze large scale enterprise.
- District level: MAIL will need to mobilize and lead domestic private actors, along with local business enterprises, cooperatives, fruit and vegetable associations and local traders to invest and support the establishment of a combination of renewable energy and electrically-powered cold storage facilities. Further discussions will need to be undertaken on a case-by-case basis on the capital and inputs required to develop a mutually beneficial partnership that strengthens the supply side of key value chains per location. Again, incentives can be offered for initial investors to promote such technologies and infrastructure.
- Community level: This is where the largest number of cold storage facilities still need to be rehabilitated and constructed to meet growing demands from farming communities. Many of these were constructed by local and national development projects, which need to be started once more. MAIL staff should approve appropriate technical designs for cold storage and work with donors and INGO/LNGOs to expand the number of cold storage facilities in a consultative manner to ensure appropriate location selection, the use of renewable energy (solar or wind power), and application of the most sustainable ownership, management and operations model.

As a pilot, in some provinces, the government can coordinate with some INGO/LNGOs and donors on initiatives such as Participatory Technology Dissemination, Farmer Field Schools and demonstration plots as part of extension services to begin to address the significant needs for assistance and guidance by farmers across the country. This will become more important as climate change presents further barriers to production using current fruit and vegetable varieties, as the search must continue for adapted seed varieties that can thrive in the changing weather and harvest patterns and those that can last longer in storage without quality deterioration to ensure optimal productivity for farmers.

NAC and NGOs working in the Agriculture, Livestock and Rural Development Sector

In the absence of a government presence due to limited outreach, civil society actors such as NAC will continue to provide a variety of post-harvest interventions delivered in close consultation with communities along with an in-kind construction contribution. These activities will need to take into account many of the findings from the study, namely:

- Site selection. The location of cold storage facilities created significant problems when they were constructed in areas far from the cultivation or production of the specific products intended for storage. It is recommended that storage construction be undertaken in a location adjacent to a production area or selecting the site based on relevant DAIL recommendations.
- Design. Wherever possible, NAC and other actors should construct multiple forms of post-harvest storage and processing facilities to meet the demands of varying degrees of food insecurity and surplus production alike.
 - In the case of areas with high production, where good roads and transport are available, budgets should be found for the construction of secondary storage facilities that have up to 15 MT in capacity powered by renewable energy technology. These will act as catalysts in the value chain, assisting in providing larger, strategic storages close to transport infrastructure, easing access to markets and reducing overhead costs.

- In areas less well served by infrastructure but where production is increasing (which could lead to greater wastage without storage), construction must be continued of partially or fully underground cold storage rooms of approximately 4 x 10 meters using local construction materials, ensuring the roof is covered with soil. These will need to be constructed with a capacity building and maintenance equipment package (see capacity building section below).
- Where there is acute food insecurity and widespread subsistence agriculture, smaller stores will need to be constructed for the use of large households, extended families and multiple households. Based on passive evaporative technology or insulated double walls, these smaller stores built close to houses will preserve food stuffs to allow households to survive the lengthy and severe winters and lean months leading to the spring season.
- Beneficiary selection. Ironically, where multiple or community-wide users were placed in charge of cold stores, this created conflicts within the community because ownership and management were not always recognized even when it was clear. While NAC and other actors should continue to identify locations where these forms of ownership and management can work, it is recommended that constructing storage facilities for individuals who have at least 5 to 10 jeribs of land would be more effective for management and maintenance.

Training and Capacity Building of stakeholders

Providing training and technical assistance to farmers and other stakeholders along the value chain is essential for enhancing productivity, improving post-harvest handling practices in the supply chain and adopting modern, low-cost technologies and best practices.

Commencing from storage, at every level of the Afghan agricultural system, farmers and other stakeholders face challenges due to a lack of knowledge or access to adequate inputs on various aspects of crop production, protection, and pre- and post-harvest practices, such as conservation, storage, drying, processing of grains, fresh fruit and vegetable production and creation of animal products.

Growers and exporters often lack awareness of the latest pre- and post-harvest techniques to preserve their produce and are unaware of export market requirements. This is primarily attributed to poor extension services and insufficient coordination among government departments, donors and NGOs. Government support services predominantly benefit larger farmers and cooperative members, neglecting the vast majority of small or subsistence farmers. Currently, farmers obtain technical and market information from government extension services, peer networks and various training programs, field days and FFSs provided by different NGOs and donor agencies.

In the case of NAC and other actors, as part of any post-harvest construction activity, farmers must be given training on storage methods before the construction of storage facilities. This must include the ability to select, grade and prepare products before placing them in bags or crates for storage, the rotation of stock in the cold storage and handling as they are removed from storage. They must also be given environmental control equipment, such as thermometers and humidity meters, which are inexpensive in cost, but essential in ensuring optimal ambient temperature in the cold store and longer shelf lives for produce.

Annex 1: List of KIIs and locations

Name of KII	Location/Village	District	Province
Mawlawi Idris Hanib, Director Haji Gafoor, NRM Director Mr. Hotaki, Plant Protection Director Mr. Zaki, Horticulture and Vegetable Director Mr. Ahmadullah Tasal (ex-proj. manager for ADB-funded agriculture value addition activities)	Ghazni PAIL	Ghazni City	Ghazni
Mr. Abdul, Manager for Nizar Faruki Commercial Cold Storage	Ghazni City	Ghazni City	Ghazni
Mr. Mohammad Gafoori	Qabaladal Village	Khawaja Umari	Ghazni
Mr. Shafaq, Snr Provincial Coordinator	Action Aid Office	Ghazni City	Ghazni
Mr. Abdul, Tech Head NRM Mr. Rahematullah Sherzad, NRM Specialist Mr. Gul Rehman, Agriculture Specialist	DACAAR Office	Ghazni City	Ghazni
Mr. Robert Kluivert (Comms and Strategy), Khalil Ur Rahman, Eng Safi (Climate Change and DRR)	Head Office	Kabul City	Kabul
Mr. Moh'd Tahir (Head of Agriculture Dept) and Abdullah (Head of Shura)	DAIL Office	Kalcharb District	Faryab
Haji Mohammad, Kishmish Khane owner	Deh Seydan	Maimana	Faryab
Mr. Abdul Basit Rahman (Head of Agriculture)	ACTED Provincial Office	Maimana	Faryab
Mr. Nooruhuda Mutawakil (Deputy DAIL Director), Planning and NRM Directors	DAIL Office	Maimana	Faryab
Mr. Ziauddin Masoomi (PM for Agriculture & Livestock) and Mr. Ahmad Rashad Rahimzai (Agriculture Extension Officer)	World Vision Provincial Office	Maimana	Faryab
Mr. Nakib Ahmad Jalali (Regional Manager)	DACAAR Prov Office	Maimana	Faryab
Mr. Abdul Nasir, Kishmish Khane owner	Bimarghle	Khoja Sabz Posh	Faryab
Mr. Abdul Qadir, Onion storage owner	Arabi Chackchaktia	Khoja Sabz Posh	Faryab
Mr. Assadullah Serdash, Regional expert on agriculture and rural development	NAC Guesthouse	Maimana	Faryab
Mr. Jalili (Regional expert on rural development and agriculture)	Faizabad	Faizabad	Badakhshan/Remote
Mr. Ehsanullah Shirazi (Director Agriculture) and Mr. Faridullah Sharahni, (Director Agriculture Research)	DAIL Faizabad	Faizabad	Badakhshan/Remote
Dr. Hakim	UNAMA Office, Faizabad	Faizabad	Badakhshan/Remote

Annex 2: Itinerary

Ghazni

DAY 1, 18th February 2024

DAY 2, 19th February 2024

Travel Day

DAY 3, 20th February 2024

Kabul

DAY 4, 21st February 2024

DAY 5, 22nd February 2024

Travel Day

DAY 6, 23rd February 2024

Faryab

Day 7, 24th February 2024

Day 8, 25th February 2024

Travel Day

DAY 9, 26th February 2024

Badakhshan

DAY 10, 27th February 2024 – remote interviews for BDK

DAY 11, 28th February 2024 – remote interviews for BDK

Kabul

Day 12, 29th February 2024

Annex 3: Research recommendations for Ghazni University

- Selecting one site to focus on food security through prolonged storage of local produce (in traditional storage) and the availability of nutritional diversity throughout the winter, with accompanying economic analysis of impacts on HH costs.
- Selecting one site where surplus production is available (with atmospheric control via wind over solar power), possibly near local certified plum orchards and with a fruit drying room (e.g., Kishmish Khane).
- On-campus construction of one small PHS facility (type TBD) to research the water and nutrient retention of fruits and vegetables and how to prolong the shelf life of horticultural produce.
- Synthesis and development of a basic curriculum for training in PHS (manual with narrative and diagrams).

Afghanistankomiteen
Norwegian Afghanistan Committee



کمیته ناروی برای افغانستان
د افغانستان لپاره د ناروې کمیټه