

Asian Journal of Agricultural Extension, Economics & Sociology

39(7): 51-63, 2021; Article no.AJAEES.69995
ISSN: 2320-7027

Baseline Study on Pine Nuts Industry in Khost City, Afghanistan

Rafiq Atif^{1*}

¹*Agribusiness Management Department, Agriculture Faculty, Shaikh Zayed University, Khost, Afghanistan.*

Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/AJAEES/2021/v39i730608

Editor(s):

- (1) Dr. Philippos I. Karipidis, International Hellenic University, Greece.
- (2) Dr. Jurislav Babić, University of Osijek, Croatia.
- (3) Dr. Roxana Plesa, University of Petrosani, Romania.

Reviewers:

- (1) Sônia Milagres Teixeira, Federal University, Brazil.
 - (2) Magdalena Kozera-Kowalska, Poznan University of Life Sciences, Poland.
 - (3) Tatiana Marinchenko, Federal State Budgetary Scientific Institution (Rosinformagrotekh FSBSI) Russia.
- Complete Peer review History: <http://www.sdiarticle4.com/review-history/69995>

Received 25 June 2021

Accepted 01 July 2021

Published 08 July 2021

Original Research Article

ABSTRACT

This study was conducted on the pine nuts industry in the southeast of Afghanistan. This is a baseline study, which has conducted between May 2019 and December 2020. This study aims to provide essential information about the pine nuts industry, especially focused on the supply chain of pine nuts. A structured questionnaire has been used for the data collection to collect demographic information, and information regarding the pine nuts supply chain, pine nuts processing, challenges and opportunities, trade, and marketing. Due to the small size of the population, the census method was used. I interviewed directly the stakeholder and entrepreneurs who are working in the pine nuts industries; the interview has been conducted on local language (Pashto). Chilgoza plays an important role in the socio-economic development of rural societies existing nearby Chilgoza forests. Chilgoza pine forests not only provide pine nuts as a cash crop product but also provide fuelwood, medicinal plants, pasture, and shelter for livestock as well as environment habitat and other ecological services. Nuts of Chilgoza pine are highly valued, collected, and sold by local villagers is a good source of income for them. After extracting nuts from the cones, the owner, sells the empty cones to the people of Khost province of Afghanistan, usually used as fuelwood.

Keywords: *Pine nuts; industry; Khost; Afghanistan.*

*Corresponding author: E-mail: rafiq.atif88@gmail.com, rafiq.atif@gmail.com;

1. INTRODUCTION

Pine nuts guardian or Chilgoza pine is one of the important forest tree species in the Khost Province forests. This species plays an important role in both environment and the livelihood of peoples living adjacent to the forest in the Khost Province. In the last few decades, pine nuts were very low-priced due to the lack of international markets. Nowadays the country has an air corridor with China and other countries, so the price of pine nuts is greatly high and the local veliger and government receive a huge income from its international trade. The important thing is that the unshelled pine nuts are highly valued in international markets and domestic trade as well.

Besides, there is no reliable information about the pine nuts' ecology, biology, genetics, stand structure, soils, natural regeneration, and market value chain in Afghanistan and especially in Khost Province. Thus, it is important to study the aspects of the industry (value chain and marketing) to manage it better and increase its value. This study needs security, budget, expertise, and time. The main challenge to this study is unspecific measurement units and the high rate of illiteracy among the vendors.

According to the latest data from the Global Forest Resources Assessment 2020, the proportion of forest area of the world's land area has gradually decreased from 31.9 percent in 2000 (4.2 billion hectares) to 31.5 percent in 2010, then down to 31.2 percent (4.1 billion ha) in 2020. Forest area losses amounted to almost 100 million hectares in the past two decades, however the rate of loss has slightly slowed down within the past ten years [1]. Moreover, studies show that pine nuts are declining due to severe deforestation. In Afghanistan, due to the lack of public unawareness and unstandardized methods of cone collection, the pine nuts forest is dramatically deteriorating. These factors challenge natural rejuvenation and result in the gradual degradation of forest stands. Heavy cone collection does not allow trees to release enough seeds onto the forest floor to create new cohorts of Chilgoza trees. Over-grazing is another factor that removes the new germinated pine nuts plant and leads to deforestation.

This report is based on research, which was conducted in the Khost Province over 15 industries. The report contains an introduction, study objective, purpose of the study, research

methodology and used techniques, sample size and data collection, data analysis, limitations of the study, cone harvesting, challenges and opportunities, and SWOT analysis for the observed industries. The above-mentioned topic is successively cited in this report.

1.1 Study Objectives

- Collect baseline information about pine nut companies' performance and challenges in Khost province.
- This research illustrates the various functions of the supply chain and shows reliable information about the pine nuts' collection, transportation, process, and marketing in Khost province.

1.2 Study Purpose

If Saffron is the red gold of Afghanistan, pine nuts are the black gold yet an underdeveloped industry due to a lack of basic and sufficient information regarding the industry operations, practices, and the supply chain. This presents challenges for policymakers and agricultural development organizations on how to help the industry grow and develop.

A baseline study is required to obtain credible first-hand information of the Khost local pine nut industry to have a better understanding of the current, and potential economic contribution the industry would offer to the local economy.

The key purpose of this study is to assess the status of the pine nuts sector in the Khost province in terms of its problems and opportunities. The research will find the gaps between the requirements of the sector and its current conditions, recommend ways to develop the institutional and regulatory context, and make stronger market strategies, both internationally and domestically.

1.3 Study Area

Khost province is located ~1180 m above mean sea level between 33_590–33_460 North latitudes and 69_190–70_210 East longitudes in southeast Afghanistan. Around (40%) of Khost province is mountainous or semi-mountainous terrain, while more than one-third (37%) of the area is flat. Khost boasts 123,500 ha of forest and has 14,911 ha of agricultural land [2]. This region is a typical semi-arid climate with 478 mm annual rainfall [3].

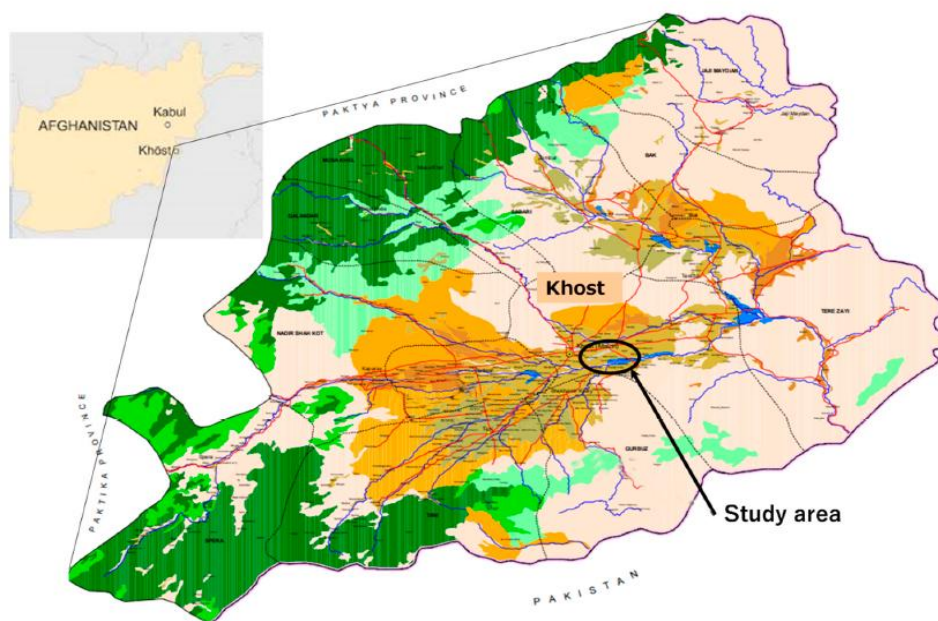


Fig. 1. Map showing the study area- Khost city, Afghanistan

2. RESEARCH METHODOLOGY

2.1 Sample Size and Data Collection

This survey was based on interviews/questionnaires, a review of literature, and site studies. Due to the very small sample size of the sample, the census procedure is used to collect the information. Data is collected from all pine nut processing companies (all the reviewee were the people who work closely with the pine nuts), which operate in the pine nuts industry in Khost province. A structured questionnaire is used and collected demographic information, and information regarding the pine nuts supply chain, pine nuts processing, challenges and opportunities, trade, and marketing. Census refers to the quantitative research method, in which all the members of the population are enumerated. (S, 2016). The data collection instrument will be developed according to the research objectives. The data used are from primary resources. The data will be collected through pretested questionnaires and interview schedules from all pine nut processing companies in Khost province.

2.2 Data Analysis

After data collection responses from respondents are summarized, using excel,

average, ratio, percentage, deviations, etc. the analyzed data is described, interpreted very well, and is understandable.

2.3 Limitations of the Study

Farmers' and trader's low level of formal education and knowledge was a problem with the study. Due to the lack of education, they were not able to determine the quality of production, they do not have the skills of the interview and they were not able to manage their time efficiently, which affect the process of data collection. The research was worthless for them because they did not know about the value of research in society. The lack of a specific measurement unit was another big problem; the unit of cost, time, and other things are different among the local trader. The foremost problem was the lack of standardized data due to the corruption, lack of government attention to the agriculture sector, and endless war, which was important for this research.

3. RESULTS AND DISCUSSION

3.1 Socio-Economic Importance of Pine Nuts

Chilgoza or pine (*Pinus gerardiana*) is one of the most valued plants in Afghanistan. Pine nuts are

the core non-timber forest product yielded from these trees. The income produced from the sale of pine nuts contributes to local communities' livelihoods in Afghanistan. [4].

Pine nuts are currently highly valued in international markets. Their collection might be one of the most important livelihood strategies for residents in the forest and adjacent areas and harvesting them might have a profound positive influence on forest farmer's economy [5,6].

Chilgoza pine or pine nuts play an important role in the socio-economic development of rural societies existing nearby Chilgoza forests [7] (Kumar et al., 2013). Chilgoza pine forests not only provide pine nuts as an economic product but also provide fuelwood, medicinal plants, pasture, and shelter for livestock as well as environment habitat and other ecological services. Nuts of Chilgoza pine are highly valued, collected, and sold by local villagers are a good source of income for them [8]. After extracting nuts from the cones, the owner, sells the empty cones to the people of Khost province of Afghanistan, usually used as fuelwood.

Species of pine nuts are edible [9]. The most important pine nut-producing species are; *Pinus Pinea*, *Pinus Edulis*, *Pinus Cembra*, *Pinus Pummeled*, *Pinus Koraiensis*, and *Pinus gerardiana* [9]. Among them, *P. gerardiana* (Chilgoza pine), *P. koraiensis*, and *P. pine* (pinyon pine) are important pine nuts produced and traded in large quantities [10]. Chilgoza pine or pine nuts are the only edible pine species in Khost, Afghanistan. Pine nuts are an important NTFP in Khost province. Local villagers harvest and roast the nuts for their use or sell them to locals.

Many people have been receiving money by taking out pine nuts from pinecones in Khost province. The pine nut cones are unpacked at an open ground west of the Administrative Complex in Khost City to dry them up under the sun that becomes estranged cones and pine seeds.

Many poor women, men, and children are involved in gathering the empty cones for heating their homes in winter. They take the empty cones home against the daylong work to separate nuts from cones. Ahmadullah, a 25-year-old man, who works to isolate pine nuts from cones, said that he is working from the morning until the evening. "We gather cones to use them as sources of energy for heating our houses during winter.

Another worker's name is Gulab, who collects pine nuts cones in the pulverized for use in winter as firewood. He hoped by gathering cones he would be able to care for his family from severe winter. "We don't have money to buy wood in winter, so we burn pine nuts empty cones," he said. Ziarat Gul, an entrepreneur, said that around 40 people, including women and children, were busy with him separating pine nuts from cones. He said this year 62 kilograms of pine nuts would cost 125,000 Afghanis but the rate was going down with each day.

Pine nuts are merchandised universally and used raw, roasted, or mixed with other ingredients [11]. The nuts of Chilgoza pines are a good source of unsaturated oily acids with no cholesterol. Chilgoza pine nuts are rich in carbohydrates, proteins, and minerals as well. Every 100 grams of pine nuts contain 31 grams of protein [10]. In addition, fresh seeds enclose 4.1% sugar, 52.1% oils, and 24.4% moisture [12].

The tree bark, wood, leaves, and cones are resinous and produce oleoresins [7] (MAIL, 2012) [13]. Oleoresins can be obtained by tapping tree bark, though; it is not created in large quantities [13]. These chemicals contain turbine oil and other substrates that are used for different purposes such as; cosmetics, waxes, traditional medicine, cooking oil, varnishes, and pitch (MAIL, 2012); [13].

Hafizullah Shahnoori, director of Agriculture, irrigation and livestock of Khost province said, that there is pine nut market in Khost Province, with a traded volume of around 38, 000mt/yr. This year, the price has risen to 3,000 AFs because of its increased export," said Haseebullah, a pine nut seller in Kabul. People are buying less pine nuts because the price is high. Even I don't take pine nuts home," said one retailer, Shah Nawaz. The Afghan Chamber of Commerce and Industries (ACCI) said that more than 1,000 tons of black pine nuts has been exported to China and European countries and that the ACCI is trying to raise the amount to 2,000 tons in the upcoming year.

Afghanistan's pine nuts are popular in foreign countries. But the only problem is that we do not have certificates of quality. Pine nut retailers have though called on government to support increase supply in order to cover both domestic and foreign markets. Demand in the Chinese market for healthy pine nuts has increased since

the launch last month of an air cargo corridor. The price of pine nuts has increased severely in local markets following the inauguration of an air corridor between China and Afghanistan Chamber of Commerce and Industries (ACCI) meanwhile said air corridors play an important role in increasing the export of agricultural and other domestic products of Afghanistan.

3.2 Cone Harvesting, Transporting, Drying, and Nut Extraction Methods

There are three successive products according to the processing phase; pine cones, pine nuts, and kernels. The process of obtaining the final product, the shelled and clean kernel begins with the collection of the cones, which takes place between September and December, and on the excellent crop year can extend to next spring and summer.

Harvesting of the cone is done manually in autumn (September). In Afghanistan, cones of Chilgoza pine are usually collected with a sharp hook attached to the end of a long stick (Fig. 2 a, & b) and in some areas, small axes are used. The contractor or local villagers use their hooks to detach pine nuts cone from tree twigs. Although these hooks facilitate pine nuts cone harvesting. The local villagers or contractors also used to break or cut the meristematic tips and end of branches, to down multiple pine nuts cones. This type of collection of cones affects the seasonal growth and natural growth habit of pine nuts tree. The long-term effect of this type of

harvesting on lifetime cone productivity is not well understood.

Other equipment may increase time efficiency and reduce damages to branches during cone collection. Pole pruners are designed to prune the upper branches of trees. These can be used to prune pinecones from branches instead of breaking branches with common hooks. Bakhtawar, a farmer in the Spira district, told me that now they unprofessionally collected pine nuts.

He believed now as they were equipped with new and cutting-edge tools, his pine nut production and revenue would increase. “We would before be using a hook for shaking branches of pine nut trees but the branches would get broken, nowadays we have a hook and it does not harm the trees,” he said. Another farmer of pine nuts from the Qalandar district of Khost province, Noorshah khan told that pine nut trees were tall and the tools they had acknowledged would help collect the cones from trees effortlessly.

“The advantage of the mentioned tools is that they do not damage the pine cones while harvesting cones from the trees and it also avoids the fruit from dropping to the ground,” he said. Khost province agriculture director Eng. Hafizullah Shah Noori said that most farmers in the Khost province collected pine nuts unprofessionally and that was the cause they distributed new tools for them.

Table 1. Equipment is used for cone collection in Khost province, Afghanistan

Cone collection equipment	Count(N)	Percentage
Hook attached to a long stick	53	94
Small ax and hook	2	4
Small ax	1	2

Source: from the report of ABADE.



Fig. 2. a) Pine nuts cone removal hook b) Green color cones after collection (Photo by Wali khan)

3.3 Storage

Pine nuts can be stored, though factors such as metabolism of nuts, microorganisms, storage conditions, temperature, moisture, and gas composition can affect the quality and durability of nuts [14]. Seeds can become infected with different types of fungi especially throughout transport and in normal open storage situations [15]. The most common fungus that spoils pine nuts throughout storage is *Penicillium citrinum* [16]. An increase in O₂ and reduction in CO₂ throughout storage can increase the respiration of nut tissues and lead to the development of molds [14]. Unshelled pine nuts are very sensitive to lipid oxidation [17]. Higher oxidation in pine nuts indirectly leads to the creation of aliphatic aldehydes, ketones, and alcohols [18,19]. Oxidation can result in fungi growth and change in nut color and taste [20,21]. Fungus disinfections and nut quality can be improved using fungicides throughout processing [22]. To prevent pine nut deterioration during storage (especially without shell), anti-oxidative coats are suggested. In addition, with the use of edible coatings, pine nuts can be conserved from fungi spoil and moisture content controlled [21,23,24].

The temperature throughout storage and moisture are other issues that challenge pine nut storage and storage life. Using old processing and storage, pine nuts have high moisture content, which typically leads to fungus growth and reduced quality. Mostly, pine nuts would be dried to a moisture content of 2-5 percent [25]. Unshelled pine nuts can have a longer storage life if stored between -5o C to 2o C [10]. Storage of pine nuts at a lesser temperature (-3o C) and lesser moisture content (13.3%) is very good and decreases respiration rate throughout long-time storage [14]. At this temperature and moisture content, not only respiration of nuts is decreased, but the growth of molds is inhibited as well. The

packaging techniques also affect nut quality and durability. Glass pots and aluminum laminate pouches work the greatest for nut storage [26].

For a long time and/or market storage, application of an edible coating, use of fungicides, decrease of moisture content, control storage temperature and moisture and air-tight (hermetic) packing is utilized. However, for propagation purposes, normal ambient storage conditions can provide acceptable germination results [27,28] (Bhardwaj & Gupta, 1998) [12]. Malik [29] reported that the feasibility of pine nuts seeds in fresh situations was 95% with 25.4% moisture content and resulted in 85.3% mean germination. However, viability reduced to 92.5%, 90%, 80%, and 64.2% after 3, 6, 9, and 12 months of storage, correspondingly, below room temperature.

3.4 DRYING

Whenever the cones are harvested, they store the cones in a locked room because beforehand to put them under sunlight the cones should be stored in the mentioned room for few days aimed at guttation. When the guttation happens, after that they put the cones under sunlight to open the cones.

Drying methods for pine nuts in Khost city are used is only for sunlight. The process companies are not using solar driers or other methods of drying.

3.5 Net Extracting

When the cones become fully open, the process of nut extraction become starts. The cones, which are opened, are easy to extract the nuts but the cones, which are not open, are not easy to extract the nuts.



Fig. 3. Pine nuts drying under sunlight; Chilgoza market, Khost (Photo: by Wali khan Ahmadzai)

Table 2. Effects of various cone-drying methods on Pine nuts cones; Adapted from: ABADE (Assistance in Building Afghanistan developing enterprises)

Method	Cone opening (days)	Modes of Temperatures (C ⁰)	Nut moisture	1 kg nuts extraction time(hours)
Putting in pit	90	10	45	7
Poly ethylene tunnel drier	25	47	15	1.3
Sun	33	24	20	3
Shade	56	14	28	3.3
Glass, solar drier	19	52	17	2
Burning of cones	-	-	22	1.45
Cabinet drier	7	60	10.6	1.45

Source: From the study report of ABADE

Table 3. Methods of pine nuts seed extraction in Khost province, Afghanistan

Seed extraction	Count(N)	Percentage
By cutting the cone to open	0	0
By beating on a hard surface	48	86
Both methods	8	14

Source: From the study report of ABADE



Fig. 4. Nut extraction and cleaning in Chilgoza market, Khost province, Afghanistan (Photo: by Rafiq Atif)

3.6 Production

According to the said of local people, on average a cone can yield 45 – 56 seeds. 100 kg of cones can yield 15 – 22 kg of unshelled nuts. In general, one tree of Chilgoza pine yields 20 – 40 kg of unshelled pine nuts, however, an adult Chilgoza pine tree can yield 1.8 kg of shelled pine nuts, on average, and every Chilgoza tree produces 7.4 kg of nuts per year.

According to the said of local people and Pine nuts traders, three area's pine nuts are available in the Khost pine nuts market which are: Zadran's Pine nuts, Mangal's pine nuts, and Waziristan's pine nuts. Among the three types, Waziristan's pine nuts have low quality and low market price because of black spots on unshelled nuts.

3.7 Flowering and Cone Production

As other pines or Chilgoza pine trees are monoicous, it has the reproductive system as other pines have which bear in the different parts of the tree and bear at the same time. The cones of the Chilgoza tree produce in spring between May – June. The tree is dependent on wind for springtime pollination. Female cones mature in the autumn (September – October) of the following year. The seeds are released from cones in November, normally within 30 days following cone maturity. Chilgoza pine trees begin bearing female cones between 25 – 30 years of age cone production is associated with age, height, diameter, and environmental circumstances. Typically, every cone yields seeds. 100 kg of cones can yield 15 – 22 kg unshelled nuts and one kilogram of pine nuts can contain. Generally, one tree of Chilgoza pine yields 20 – 40 kg of unshelled pine nuts, however, an adult Chilgoza pine tree can yield 1.8 kg of shelled pine nuts, on average, and every Chilgoza tree produces 7.4 kg of nuts per year.

3.8 Pine Nuts Production and Processing

As I mentioned before that, the cones of Khost pine come to be ripe one and a half year after

spring pollination. They fall regularly in autumn with the first chills and on windy times, though some can remain on trees until winter. The sizes of ripe pinecones are around 8 to 17 cm in length; they are ovate-elongated with deflected scales. Each cone weighs about 280 g fresh (120 g dry) and covers about 120 seeds, or pine nuts (55 g, 47% of the weight of the dry cone, 20% of the fresh cone); each seed (less than 0.5 g, 12-16 mm) is coated with a hard, woody shell (60% of its weight). The kernel (0.18 g) appears within is cream white, covered with a thin, dry tegument or film that is easily removed. These yield rates suggest that only one-sixth (18%) of the dry cone weight are edible kernels, i.e. 8% of the weight of freshly harvested cones: for 1 kg kernel, about 12 kg cones are processed [30].

On the other hand, cone production is very supple not only among zones in the same year but also between years. The variable that mostly determines cone production of a tree is its size (stem and crown diameter), and the per hectare output, depends also on the number of cone-bearing trees per hectare and the spot value. However, since the breakdown of effective forest administration due to these 4 decades' endless war, no sound annual data of cone and seed yields per zones are available.

Pine nuts are prepared to yield around 10 days before the green cone starts to open. The cones are dehydrated in a burlap bag in the sun for 20 days, to rapidly up the procedure of ventilation and opening. The cones are then cracked (as a way to quickly release the seeds) and the seeds are detached by hand from the cone remains. There are three consecutive harvests according to the processing stage; pinecones, pine nuts, and pine kernels. The procedure of procurement the ending product, the shelled, starts with the collection of the pinecones, which happened between September and October, and on the outstanding crop year can extend to next spring and summer. In fall, the scales of the cones are already fairly dry and hence release the pine nuts easily removed. The unshelled pine nuts can be kept and, rendering to the demand, shelled, and handled.

Table 4. Numbers of seeds that one cone can yield by the difference of area

SI. No.	Name of Pine nuts	Number of seeds
1	Mangal	50 – 60
2	Zadran	47 – 57
3	Waziristan	40 – 50

Source: From this study.



Fig. 5. Cone and kernels of Pine nuts or Chilgoza pine

3.8.1 Attempts to organize a local market in Khost province

Pine nuts are traded globally. Unshelled pine nuts are highly valued in international markets; however, local villagers receive less than \$10 per kilogram. [31]. Pine nuts or Chilgoza pine is an excellent source of fine turpentine resin. The seeds are used as anodyne and stimulants while seed oil is used against wounds and ulcers. [32].

The report shows that the annual export of pine nuts reaches from 31 to 34 thousand tons inside the country, which will help to deliver rational revenue to both administration and national businesspersons and to create job occasions. New pine nuts processing and packaging factory is being established in Khost province. Governor, who laid the basis stone of the factory, told to Pajhwok Afghan News, pine nuts processed at the factory would be exported to China and some European countries. The factory, costing \$2 million, is being recognized by the private sector on two acres of land near the local administrative complex south of Khost city, the provincial capital. "Pine nuts from Paktia, Paktika, Khost, and some other eastern provinces will be brought to this factory. It is a great initiative for the development of Afghanistan's economic development and it shows our province has the appropriate environment for private enterprise. Meanwhile, the Khost Chamber of Commerce head said; the company would enable Afghan traders to sell pine nuts in the international market at higher prices. The governor said 8000 to 12000 tonnes of pine nuts were annually smuggled from Khost primarily to neighbouring Pakistan and then other countries. "Before our traders sell a kilo of pine nuts for eight dollars to Pakistani traders who sell the same nuts to China at 22 dollars, but in global market, the price reaches up to \$80 per kilo." A

member of the pine nuts trader's union, Shazadah Zadran said, pine nuts shaped in Afghanistan were sold in the global market in the name of other countries. He said they would be able to sell the nuts themselves in the global market at a better price after the founding of the factory in Khost. Fortunately, when the air corridor, established by the government between Afghanistan and China, our traders exporting their pine nuts to china at a healthy price.

3.82 Pine nuts sales and income distribution

When the pine nuts are extracted, then it is sold to contractors and local traders. Only a small percentage of the pine nuts harvester sells their products to pine nuts contractors (Fig. 6a). While, most of them sells their products to local traders because unavailability of the local market and due to the long distance to a major market, that is why pine nuts are generally sold to the different customer each year. The generated revenue from pine nuts is equally distributed among the community members or villagers, however, in some regions; the money that is earned through pine nuts is distributed based on the work done by workers (Fig. 6b).

Most of the community members and villagers surveyed for the Chilgoza or pine nuts forest and pine nuts' revenue distribution, report says that there is conflict while distributing such things, however, sometimes; there are conflicts among the villagers for pine nut revenue and Chilgoza forest access (Fig. 7a). Tribal leaders or tribal shuras are most commonly responsible to resolve the issues in case of conflict among the villagers or community members. (Fig. 7b). Pine nuts were sold in Afghani currency to local traders. The price per kilogram of unshelled pine nuts is about 2000 AFs. On average, families receive 70000 Afs (\$897) per year from the sale of pine nuts.

Table 5. Swot analysis]

	Strength	Weakness
Internal	High production capacity is available if increase conservation of forests. High-quality product, high economic value. Nice product with high demand in the global market. Seasonally complementary economic activity for rural societies. Opportunity	Manually in Afghanistan especially in Khost province, the harvest is done by tree climbing, which is associated with high labour risks. Lack of Policies regarding pine nuts production and market. Lack of knowledge and skills regarding the process and packaging of pine nuts. Lack of new technology regarding the process of pine nuts Treats
External	Good marketing chance for a well-collected product. Growing demand in the world market due to problems of competing pine nuts species. Chance of high income if a good quality product is produced.	Deforestation is decreasing the area of the pine nuts forests and has negatively influenced on its production. Lack of enforcement of clear national and regional policy, regulation, and standards in this sector and products.

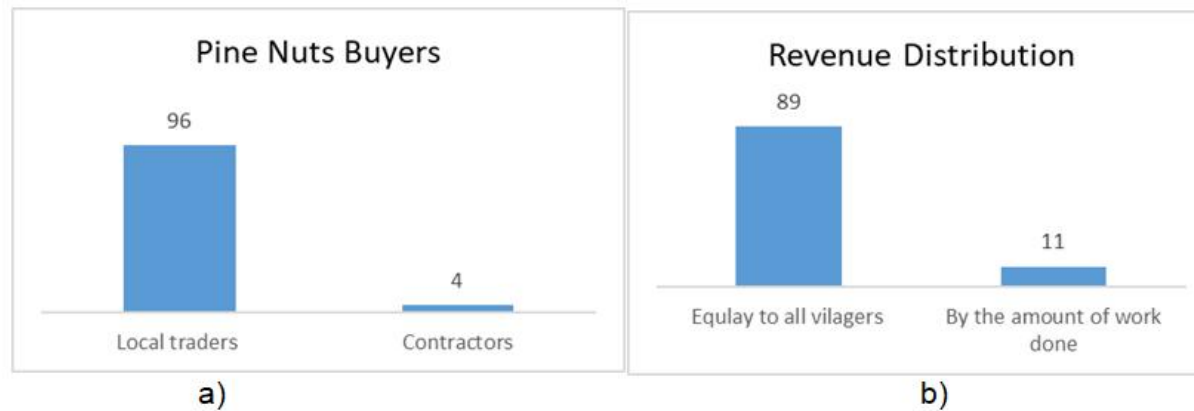


Fig. 6. a) Percentage of Pine nuts purchasers in local villages; and b) distribution of revenue produced from pine nuts among community members

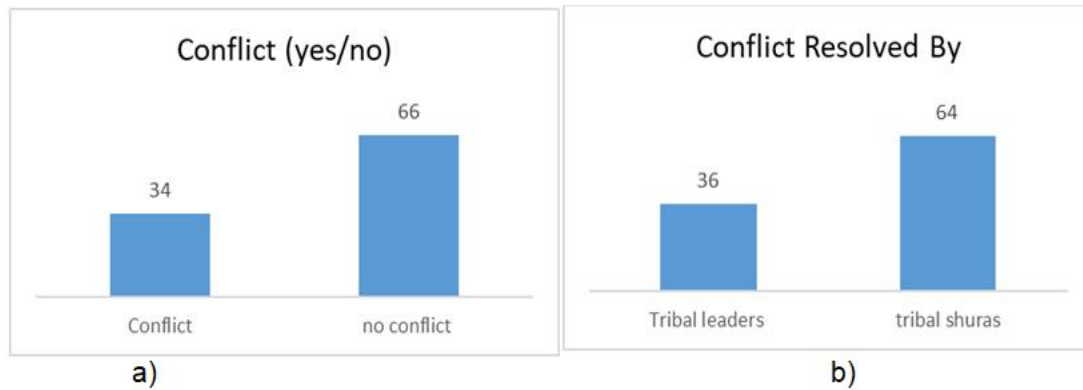


Fig. 7. a) Level of conflict b) Conflict resolve during pine nuts forests distribution among local Communities

3.9 Challenges and Opportunities

To find out the problems, opportunities, strengths, and weaknesses against the Chilgoza production and industries in Khost province, I think it is necessary to undertake a SWOT analysis for them.

4. CONCLUSION

Pine nuts play a significant role in the living of local communities. People harvest pine cones and sell pine nuts in local and international markets. Mostly, cones are unsustainably collected by local traders and or outside contractors. Throughout the cone, collection trees are damaged and normal regeneration is suppressed. The use of traditional methods and tools is not very effective throughout cone harvesting. Most of the time, tree bark and branches are damaged with the use of locally made tools. To avoid damage to pine nuts trees, cones have to be harvested by skilled people and developed tools. The traditional pine nuts cone drying and nut extraction technique is unsuccessful and time-consuming as well. Traditional pine nuts cone drying and extraction not only decreases yield but also reduces the quality of nuts. In addition, the nut extraction procedure is not standard as well.

The most common pinecone-drying manner is sun and air-drying which is not very effective. Additionally, manual seed extraction results in decreased yield. Cabinet drier is a good method of pinecone drying and seed removal. With the use of a cabinet drier, not only seeds are removed rapidly, but the quality is enhanced by controlling seed moisture as well. Compared to

pine nuts prices on local and international markets, local villagers receive very little revenue. As well as, the annual revenue received from pine nuts is varying. Similarly, local and regional markets are unorganized and absent storage facilities. Beforehand our traders sell a kilo of pine nuts for eight dollars to Pakistani traders who sell the same nuts to China at 22 dollars, but in the global market, the price reaches up to \$80 per kilo. Fortunately, when the air corridor was established by the government between Afghanistan and China, our pine nuts traders exporting their pine nuts to china at a healthy price. Government, must provide opportunities for the farmer and traders to export there product directly to the international markets, it will help them to increase their income and pay the tax to government. Furthermore, the agriculturist and extension workers in the area must aware the people from the cons of deforestation, to take care of forests and work for its renovation. Future researchers are requested to work on the improvement of the value chain of Pine nuts to standardize the life of rural inhabitants.

5. RECOMMENDATIONS

1. The government has to support upgrade technology and possible automation for both the collecting and processing of childhood pine or pine nuts in Khost province, Afghanistan.
2. Found systems of traceability to assure the quality and source of the pine nuts to the last consumer:
3. Control the authorization process of traceability in all phases of production, conversion, and distribution of pine nuts.

4. Promote the expansion of reasonable practices in the trade.
5. Monetary sustenance for the transformation and marketing of pine nuts.
6. Establish standards of quality with exact rules that allow customers to know the product.
7. Promote quality packing that confirms a cover of quality.
8. Established integrated centers for pine nuts products collecting, processing, and storage.

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

ACKNOWLEDGEMENT

I take this opportunity to extend my heartfelt thanks to HEDP (Higher Education Development Program) my partner in the implementation of this research for funding this research. I also deeply appreciate their cooperation and guidance for this research.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. FAO. Tracking progress on food and agriculture-related SDG indicators, A report on the indicators under FAO Custodianship harvesting; 2020.
2. Wali E, Datta A, Shrestha RP, Shrestha S. Development of a land suitability model for saffron (*Crocus sativus* L.) cultivation in Khost Province of Afghanistan using GIS and AHP techniques. Arch. Agron. Soil Sci. 2016;62:921–934.
3. Hashimi, Rahmatullah, Matsuura, Eri, Komatsuzaki, Masakazu. Effects of cultivating rice and wheat with and without organic fertilizer application on greenhouse gas emissions and soil quality in Khost, Afghanistan. Sustainability. 2020;12. DOI: 10.3390/su12166508.
4. Khurram S, Shalizi MN. Socio-economic importance of chilgoza pine forest of afghanistan: a survey based assessment. Asian Journal of Science and Technology. 2016;07(09):3556-3559.

5. FAO. Non-wood forest products from conifers. Rome, Italy;1998.
6. FAO. Forest sector study in the Russian Far East roadmap for value-added investment in forest industry annex report ii assessment of forest resources, forest management, harvesting, and forest certification in the Russian Far East. 2013;70.
7. Malik AR, Shamet GS, Butola JS, Bhat GM, Mir AA, Nabi G. Standardization of seed storage conditions in chilgoza pine (*Pinus gerardiana* Wall.): an endangered pine of Hind Kush Himalaya. Trees. 2013;27(5):1497-1501.
8. Eckenwalder JE. Conifers of the world: the complete reference. Portland, Oregon: Timber Press;2009.
9. Harrison SG. Edible pine kernels. Kew Bulletin. 1951;6(3):371-375.
10. Kuhn G, Hayashi E, Zach Lea JD. Eastern region dried fruits & nuts subsector/market assessment. Roots of Peace for Development Alternatives, Inc;2006.
11. Sharma S, Gupta D, Sharma YP. Aflatoxin contamination in chilgoza pine nuts (*Pinus gerardiana* Wall.) commercially available in retail markets of Jammu, India. International Journal of Pharmacy and Biological Sciences. 2013;4(2):751-759.
12. Malik AR, Shamet GS, Ali M. Germination and seedling growth of *Pinus gerardiana* in a nursery: Effect of stratification period and temperature. Indian Journal of Forestry. 2009;32(2):221-225.
13. WCS. Eastern forest program: Timber trade survey. Kabul, Afghanistan: Wildlife Conservation Society;2008.
14. Cai L, Liu C, Ying T. Changes in quality of low-moisture conditioned pine nut (*Pinus gerardiana*) under near-freezing temperature storage. CETA-Journal of Food. 2013;11(3):216-222.
15. Singh P, Gupta MN. Internal mycoflora is associated with different parts of fresh and market samples of *Pinus gerardiana* seeds. Journal of the Indian Botanical Society. 1989;68:155-157.
16. Yadav PV. Studies on seed-borne fungi of Chilgoza (*Pinus gerardiana* Wall.) and their effect on seed health. (Unpublished M.Sc thesis). Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Solan, Himachal Pradesh, India;1992.
17. Destailats F, Cruz-Hernandez C, Giuffrida F, Dionisi F. Identification of the botanical origin of pine nuts found in

- food products by gas-liquid chromatography analysis of fatty acid profile. *Journal of Agricultural and Food Chemistry*. 2010;58(4):2082-2087.
18. Bett KL, Boylston TD. Effect of storage on roasted peanut quality: descriptive sensory analysis and gas chromatographic techniques. In *Lipid Oxidation in Food* (pp. 322-343). ACS Symposium Series American Chemical Society. 1992;500.
 19. Frankel EN. *Lipid oxidation, 2nd edition*. Bridgwater, UK: The Oily Press;2005.
 20. Gills LA, Resurreccion AVA. Sensory and physical properties of peanut butter treated with palm oil and hydrogenated vegetable oil to prevent oil separation. *Journal of Food Science*. 2000;65(1):173-180.
 21. Nepote V, Mestrallet MG, Ryan L, Conci S, Grosso NR. Sensorial and chemical changes in honey roasted peanuts and roasted peanuts stored under different temperatures. *Journal of the Science of Food and Agriculture*. 2006;86(7):1057-1063.
 22. Sharma RC, Yadav PV. Effect of fungicides on Penicillium rot and quality of chilgoza seed. *Indian Phytopathology*. 1996;49(1):77-79.
 23. Quezada-Gallo JA. Delivery of food additives and antimicrobials using edible films and coatings. In *Edible Films and Coatings for Food Applications*. New York: Springer. 2009;315-333
 24. Haq MA, Alam MJ, Hasnain A. Gum Cordia: a novel edible coating to increase the shelf life of Chilgoza (*Pinus gerardiana*). *LWT-Food Science and Technology*. 2013;50(1):306-311.
 25. Khan M, Khan R. *Woody Plant Seed Manual (Pakistan)*;1992. Available:http://pdf.usaid.gov/pdf_docs/PNABW321.pdf
 26. Thakur NS, Sharma S, Joshi VK, Thakur KS, Jindal N. Studies on drying, packaging and storage of solar tunnel dried chilgoza nuts. *Archives of Applied Science Research*. 2012;4(3):1311-1319.
 27. Singh PL. Studies on seed-borne disorders of Chilgoza (*Pinus gerardiana* Wall.) during storage. (Unpublished Ph.D. thesis). Agra University, Agra, India; 1982.
 28. Singh PL, Gupta N, Singh AL. Deterioration of physicochemical properties of Chilgoza (*Pinus gerardiana* Wall.) seed during storage. *Indian Journal of Plant Physiology*. 1992;3:231-237.
 29. Malik AR. Studies on natural regeneration status and nursery technology in Chilgoza pine (*Pinus gerardiana* Wall.). (Unpublished Ph.D. thesis). Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Solan, Himachal Pradesh, India;2007.
 30. Nguyen TT, Tai DT, Zhang P, Razaq M, Shen HL. Effect of thinning intensity on tree growth and temporal variation of seed and cone production in a Pinus koraiensis plantation. *Journal of Forestry Research*. 2019;30(3):835-845.
 31. Shalizi MN, Khurram S, John W, Groninger, Charles M. Ruffner, Owen T. Burney. Indigenous knowledge and stand characteristics of a threatened tree species in a highly insecure area: Chilgoza pine in Afghanistan. *Journal of Forest Ecology and Management*. 2018;413(2018):1-8 Pajhwok Afghan News).
 32. Aziz MA, Adnan M, Hussain SK, Hashem A, Alqarawi A, Elsayed Fathi Abd Allah SF. Comparative regeneration status of Pinus gerardiana in two forest-use types of Sulaiman mountain range near the Pak-Afghan border region: Historical, current, and future perspectives. *Pak. J. Bot*. 2017;49(1):227-236, 2017.

© 2021 Atif; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<http://www.sdiarticle4.com/review-history/69995>