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Economic, social and environmental impacts of the liquorice production in the Republic of Karakalpakstan (Uzbekistan)

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Abstract

Economic, social and environmental impacts of the liquorice production in the Republic of Karakalpakstan (Uzbekistan)

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Liquorice (or licorice) root is becoming more competitive in the global commodity market. Liquorice is used in many areas of production, and it is gaining popularity in new fields. It is widely used in food production, cosmetics, medicine, light and heavy industries. Liquorice grows in abundance in the northwest of Uzbekistan. In Uzbekistan, farmers collect wild liquorice plants and sell liquorice roots to liquorice processing companies. The leaves and stems of liquorice are utilized as livestock forage.

It is proven that liquorice production is beneficial for Uzbekistan in three ways: ecological, economical and social. In the light of environmental problems in Uzbekistan as Aral Sea drought, soil salinity, climate change, sandstorms and water shortage, producing liquorice has a primary role in mitigating harsh side effects of ecological severities. It is considered to be a low-cost land rehabilitation option. Liquorice is a good alternative cash crop for low-income farmers in rural areas; Companies involved in the liquorice production can create more than 1000 new job places for Uzbek population. It is proposed that liquorice growing would contribute to sustainable development of the region in the long run.

Uzbekistan possesses all prerequisites needed for cultivation of liquorice. They include favorable conditions for liquorice growing, processing and exportation. The liquorice production has many perspectives in Uzbekistan. It is expected to become one of the main exporting products of the Republic of Karakalpakstan.

The Uzbek government facilitates the production of liquorice in the Republic Karakalpakstan. The Cabinet of Ministers of the Republic of Uzbekistan issued two resolutions which provide the establishment of plantations for the production of liquorice in the Republic of Karakalpakstan for 2017-2021, and the development of the liquorice production sector by all means. The producers engaged in cultivation of liquorice in plantations are exempted from dozens of fees, taxes and payments for 5 years. Besides, credits with four-year grace period will be offered to the producers who want to create industrial plantations and the enterprises, engaged in the industrial processing of liquorice. These measures are expected to bring the production of liquorice in Karakalpakstan to a new level.

The thesis paper focuses on social, economic and environmental impacts of the liquorice production in the Republic of Karakalpakstan (Uzbekistan). Liquorice cultivation has a lot of positive impacts. To begin with, it can restore degraded soil of the Republic of Karakalpakstan. From an economic point of view, due to increasing demand and price for liquorice an expansion of liquorice production would provide farmers and entrepreneurs with considerable income. The liquorice production will indirectly trigger the development of road infrastructure in rural areas. Finally, it will lead to a drop in unemployment and poverty rates of the Karakalpak population.

Keywords: Liquorice production, Liquorice root, Liquorice extract, Impact analysis, Positive impact.

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Acronyms and Abbreviations

CACILM	Central Asian Countries Initiative for Land Management
CGIAR	Consultative Group for International Agricultural Research;
FAO	Food and Agriculture Organization of the United Nations
FE	Foreign Enterprise
FGFO	Foreign government financial organizations that finance (co-finance) investment projects in the Republic of Uzbekistan
G.glabra	Glycyrrhiza glabra;
G.uralensis	Glycyrrhiza uralensis;
ICARDA	International Center for Agricultural Research in the Dry Areas;
IFAS	International Fund for saving the Aral Sea
IFPRI	International Food Policy Research Institute;
IWMI	International Water Management Institute;
LLC	Limited Liability Company
MFA	Ministry of Foreign Affairs of the Republic of Uzbekistan;
PRC	People's Republic of China
SPISS	Single Portal of Interactive State Services;
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme;
USD	US dollar
UZS	Uzbek sum (Uzbek currency unit);

I. Introduction

Liquorice (or licorice) root is becoming more competitive in the global commodity market. Today, it is used in many areas of production, and it is gaining popularity in new fields. The liquorice roots have been popular since ancient times. A Greek scientist Theophrastus from the fourth century B.C. wrote that the sweet Scythian root (liquorice plant) is good for asthma, dry cough, and other respiratory diseases. Moreover, Central Asian philosopher and healer Avicenna pointed out the use of a liquorice root in the treatment of inflammatory liver diseases (Armanini, Decio, et al., 2005, p. 392). It is no coincidence that licorice called Central Asian ginseng (Vlasenko, 2016).

Liquorice industry in Uzbekistan was not much popular until the 2000s when Chinese companies started to import more and more liquorice roots and extract, and later invested in Central Asian countries where this plant grows in abundance.

Liquorice production is beneficial for Uzbekistan in three ways: ecological, economical and social. In the light of environmental problems in Uzbekistan as Aral Sea drought, soil salinity, climate change, sandstorms and water shortage, producing liquorice has a primary role in mitigating harsh side effects of ecological severities. Since the demand for liquorice roots and extract in the international market is continuously increasing, liquorice production is becoming more lucrative for farmers in Uzbekistan.

The present thesis paper focuses on the potential economic, social and environmental impacts of the liquorice production in the Republic of Karakalpakstan (Autonomous Republic in the Republic of Uzbekistan). The research question of the paper sounds as the following:

- How does the production of liquorice affect the agents (economy, society, and ecology) in the Republic of Karakalpakstan?

In my hypothesis, I assume that liquorice production has indirect positive impacts on the economy, society and ecology of the Republic of Karakalpakstan.

For the analysis, I have used mainly peer-reviewed literature, empirical studies, field trip results, governmental and international organization reports. Due to unavailability of data on the volumes, costs, and prices of liquorice for given years, I readjusted the analytical framework suitable for my research question and hypothesis. In other words, I suggested the methodology of my own. The methodology represents an illustrative impact analysis incorporating three consecutive steps: 1) identification of agents, 2) identification of positive and negative impacts, and 3) monetary valuation of impacts.

As for the originality of the thesis paper, I should say that there has been no analytical paper, containing three aspects: economic, social and environmental impacts of the liquorice production in the Republic of Karakalpakstan (Uzbekistan). In this regard, this is the pioneer paper on the topic.

1. Statement of the problem

Karakalpakstan is an autonomous republic in the northwest of Uzbekistan. Karakalpakstan is famous for its hospitable people, and unique museum of Russian Avant-garde Art named after Savitsky. However, unfortunately, it is notorious for its dreadful water contamination, soil and air pollution. One of the world's biggest natural lakes, The Aral Sea has disappeared, leaving all these posers.

The Aral Sea crisis has negatively affected households near the Aral Sea basin. An increasing salinization of ground waters leads to depletion of irrigated land.

According to estimations, approximately 20,000 ha of irrigated land in Uzbekistan are lost annually to salinity and are constantly abandoned (Qadir, Manzoor, et al. 2015). This is extremely critical for the population of Karakalpakstan because more than 30 per cent of it is employed in the agricultural sector (UNDP. 2014). The problems with salinization of soils, climate change and shortage of water had a negative reverberation on the agricultural output and labor productivity. The quality of potable water and river water deteriorated. This caused many health problems to the population of the whole country (Ataniyazova, Oral A. 2003).

On top of that, a huge gap between the income of rural and urban population emerged. For example, poverty in the poorest region, Karakalpakstan, where livelihoods are especially affected by the continuing Aral Sea crisis, reached 32 per cent in 2013, whereas poverty rate in the country's capital[1] made only 2 per cent (UNDP. 2015).

The people in rural areas like Muynaq, Karauzyak, Chimbay, and Takhtakupir face employment dilemma. The unemployment rates are significantly higher than official 10-11 per cent. Furthermore, there is almost no high paid job in these regions. Public spending on rural roads and other infrastructure is very low and not systematic.[2]

The government of the Republic of Uzbekistan has been channeling all its efforts into alleviation of the problems and restoration of the region after the catastrophe. Particularly, the Cabinet of Ministers of the Republic of Uzbekistan adopted the Resolution 'On the Comprehensive Program of Measures to

[1] Tashkent – the capital of the Republic of Uzbekistan

[2] From the interview with the Deputy Minister of Economy of the Republic of Karakalpakstan, Dawletbay Urazimbetov;

mitigate the consequences of the Aral catastrophe, the restoration and socio-economic development of the Aral Sea region for 2015-2018' (MFA. 2017).

Nevertheless, above mentioned actions alone cannot solve those acute problems in the short-run. Degraded soils require substantial investments that are beyond government and farmers' capacity. Fortunately, there is an opportunity to partially improve on. The Minister of Foreign Trade of the Republic of Karakalpakstan has recently[3] proposed to grow more liquorice plants on the fields used for cotton and rice before. In his opinion, liquorice growing can solve urgent issues like soil salinization, poverty in rural areas in the Republic of Karakalpakstan, poverty in remote villages.

2. Significance of the study

Summarizing all the points made by the Minister of Foreign Trade of the Republic of Karakalpakstan and the Deputy Minister of Economy of the Republic of Karakalpakstan, we can derive the following picture (Table 1):

Table 1. Problems Existing in the Republic of Karakalpakstan

Economic concern	*Social concern*	*Environmental concern*
- The least developed region in Uzbekistan; - No plants producing value-added products; - Deteriorated infrastructure;	- High levels of unemployment; - No specialists; - Poverty;	- Devastated area after Aral Sea drought; - Pesticide infected soil; - Poor vegetation due to saline soil; - Pernicious climate; - Low quality of drinkable water;

In the light of these issues, the introduction of liquorice production into the agricultural sector of the Republic of Karakalpakstan is of paramount importance.

[3] December 2016

There is evidence that development of liquorice plantations produces numerous financial, ecological and social benefits. First of all, the agricultural sector will benefit from liquorice production. An income can be obtained from green biomass and rhizomes of the liquorice plant. The liquorice biomass, that is, its leaves, seeds, and stems are considered livestock forage. The liquorice roots are also marketable. In sum, liquorice production generates ‘quick and tangible’ outputs for farmers (Kappas, Martin et al. 2016). Second, liquorice plant is considered a halophyte - a plant that grows on soil with a high concentration of salt. Not only the liquorice plant is more resistant to saline soil, thus attractive to Karakalpak farmers, it also contributes to remediation of salt affected soils. Third, most liquorice producing companies in Karakalpakstan are located in rural areas. Those companies contribute to the employment of the rural population. Some companies employ up to 150 workers during harvest seasons (Djalilov Takhir. 2011).

II. Background

1. Liquorice Definition, Utilization

1-1. What is Liquorice?

Liquorice (or licorice) is a perennial, spreading, deciduous, woody herb that grows to a height of 1.5-2.5 m (Kushiev et al. 2005). ***Glycyrrhiza glabra L***. is one of the types of liquorice plant. *Glycyrrhiza glabra L.* has been used in food and medicine from ancient times. It is also known as sweet root. Liquorice root is considered to be 50 times sweeter than sugar (Cumo, 2013).

Figure 1. Illustration of *Glycyrrhiza glabra L.*

http://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:496941-1

"Licorice has an extensive branching root system. The roots are straight pieces of wrinkled, fibrous wood, which are long and cylindrical (round) and grow horizontally underground. Liquorice roots are brown on the outside and yellow on the inside" (CACILM.2017). They can be harvested after 3-5 years in autumn and dried to be ready for further applications (Stanikzai, M. T. 2007). The most interesting thing about Glycyrrhiza glabra is that it can be grown in marginal land such as saline-alkali soil resulting in soil remediation (Dagar, J. C., et al., 2015).

Glycyrrhiza glabra L. grows on lands of south-eastern Europe, southwest Asia, Middle East and Central Asia. It grows on well-drained soils in deep valleys with full sun close to running water. Currently, most liquorice is produced in India, Iran, Afghanistan, PRC (China), Pakistan, Iraq, Azerbaijan, Uzbekistan,

Turkmenistan, and Turkey (CACILM. 2017).

Glycyrrhiza glabra L. is found in wild but it also can be cultivated in farms. Farmers use wild liquorice seeds for cultivation since the liquorice seeds cannot be produced by specific seed cultivation (Chen, Kevin Z., Hu Song, and Chen Ruyu, 2015)

1-2. Utilization

"Liquorice root has been used in both Eastern and Western medicine to treat a variety of illnesses". (Chen, Kevin Z., Hu Song, and Chen Ruyu, 2015: 83)
Liquorice is mostly consumed in dry and fresh forms (Stanikzai, M. T. 2007). Next are the varieties of the product:

- Dried liquorice sticks;
- Liquorice powder;
- Liquorice extract;
- Liquorice syrup;
- Liquorice paste;

Figure 2. Varieties of Liquorice Products

Source: Compiled by the author

In food production

Today, a majority of confectionary products contains the liquorice extract. This attests to the interest of food producers in liquorice. “Liquorice flavor is found in a wide variety of liquorice candies or sweets” (Chen, Kevin Z., Hu Song, and Chen Ruyu, 2015: 83). In the production of halva, licorice extract is used as a foam forming component, which gives the product openness and friable structure (Karaoğul, Eyyüp, et al. 2016). The liquorice extract is also used as flavoring agents in baked foods, alcoholic beverages, soft drinks, chewing gums, and seasonings (Karkanis, Anestis, et al. 2016).

The liquorice plant can be consumed in its natural form. People wash raw roots of the plant and chew as a mouth freshener. Dried liquorice root can be chewed as a sweet, too (Chen, Kevin Z., Hu Song, and Chen Ruyu, 2015).

The liquorice root is a well-proven livestock supplement. The liquorice leaves contain twice as much protein as alfalfa (Lucerne). It is a valuable fodder in the dry form, especially if used in fodder mixes – briquettes. It is also used for feeding bees. Liquorice plant offers pollen and nectar for bees. (CACILM. 2017).

In medicine

The liquorice flavor is usually used in medicines to mask unpleasant flavors (Chen, Kevin Z., Hu Song, and Chen Ruyu, 2015). Liquorice is known for its anti-allergic, anti-arthritic, anti-inflammatory, demulcent, emollient, estrogenic, expectorant, laxative, soothing properties (CACILM. 2017). It is a cure for such diseases as stomach ulcers, heartburn, colic, and ongoing inflammation of the lining of the stomach (Mokler, David J., Amber Rigdon, and Samantha Schildroth. 2016). Liquorice is also used for a sore throat, bronchitis, and cough

(Cumo. 2013). It heals tuberculosis as well (Chen, Kevin Z., Hu Song, and Chen Ruyu, 2015).

Liquorice cures diabetes and diseases radiating from diabetes. One of the greatest properties of liquorice is an anti-cancer formula. Liquorice protects the liver and lowers the risk of developing subsequent liver cancer [Hepatitis C] (Functional Medicine of Houston. 2017).

However, liquorice roots can be harmful if an inappropriate dose is consumed. For example, it might entail hypertension, hypokalemia, edema and other unwanted side effects (Armanini, Decio, et al., 2005). Therefore, liquorice should be consumed with caution.

In cosmetics

The liquorice anti-inflammatory, anti-microbial, anti-allergic properties are very useful in cosmetics. Producers of cosmetics utilize mainly Glycyrrhizin salt, Glycyrrhizic and Glycyrrhetic acid derived from the liquorice extract. The Glycyrrhizic acid is known for antibacterial properties, which make it particularly suitable for use in deodorants. It soothes skin inflammation and irritation, prevents bacterial growth and combats skin impurities. Liquorice provides UV protection for skin (Chen, Kevin Z., Hu Song, and Chen Ruyu, 2015).

Not only liquorice cleanses, soothes and relieves irritation, but it treats atopic dermatitis (Saeedi, Muadhamm, K. Morteza-Semnani, and M-R. Ghoreishi. 2003), burns, wounds, boils, abscesses, and etc as well (Chen, Kevin Z., Hu Song, and Chen Ruyu, 2015).

In industry

As mentioned before, liquorice is known as a foaming agent. This property to churn is actively used in metallurgy in the process of electrolysis of non-ferrous metals. Liquorice foam formed on the surface of electrolysis bath can hold deposited poisonous vapors of sulfuric acid and zinc sulfate. This affordable and cheap way reliably protects workers alongside with the microclimate inside dozens of production workshops and, therefore, prevents the emergence of a number of occupational diseases.

The licorice is used in soap making, textile, leather and chemical industry, metallurgy, as well as an additive to cement mortar to improve its properties, for the production of mixtures for fire extinguishers, and even for drilling oil and gas wells (CACILM. 2017).

III. Liquorice Production in Karakalpakstan (Uzbekistan)

1. Liquorice Production in Karakalpakstan (Uzbekistan)

Liquorice production in the Republic of Karakalpakstan has been enhancing since the 2000s. The liquorice growing has not been essential until the 2000s because little was known about the positive impact of liquorice plants on the soil.[4] An essential fact about the liquorice production is that the government of Uzbekistan actively supports the liquorice production and processing. Unlike China, the Uzbek government conducts a full-fledged policy supporting the liquorice production. For example, the Uzbek government introduced a new policy on 'Measures to Improve the Liquorice Processing' in 2013. The main objective of the order was an improvement of the business environment for liquorice processing sector by simplifying the approval procedures to establish processing facility. Specifically, producers will no longer need government approval if the purchase and sale contract is signed between any entity (individual or entrepreneur) and the local liquorice processing plant. Before, all producers were charged 225 US dollars per ton for obtaining the permit to export unprocessed liquorice, and 100 US dollars per ton for processed liquorice products (Chen, Kevin Z., Hu Song, and Chen Ruyu, 2015).

According to the Chamber of Commerce of the Republic of Uzbekistan, there are more than 30 enterprises with different forms of property, involved in the liquorice production in different regions of Uzbekistan (CGIAR-CAC. 2015). Traditionally, the liquorice plant grows in the northwest of Uzbekistan – in the Republic of Karakalpakstan and Khorezm region. It grows in the valley and delta of the Amudarya River. The two types of liquorice are found there -

[4] From the interview with the Minister of Foreign Trade of the Republic of Karakalpakstan, Ajiniyaz Seytakhov;

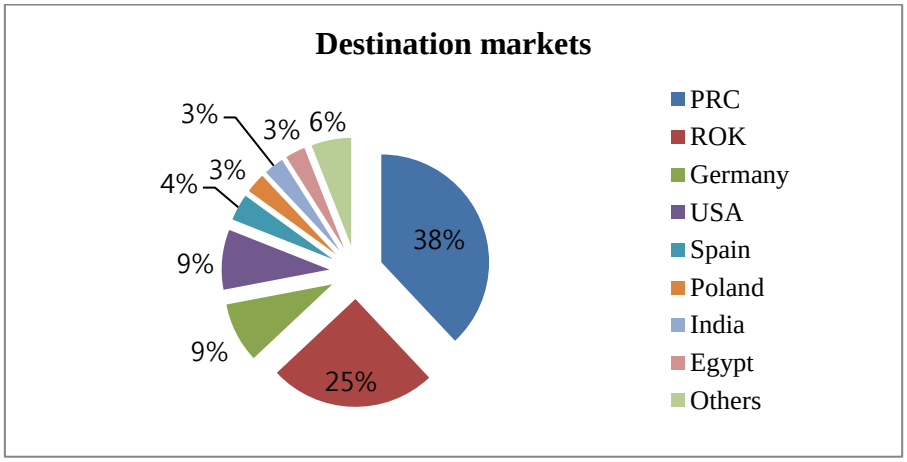
Glycyrrhiza glabra Linn and Glycyrrhiza aspera Pall (Juridical information Portal. 2012). “The liquorice roots harvested in Uzbekistan are all wild up to present. The lands growing liquorice are typically owned by small farmers who collect and sell liquorice or lease out” (Chen, Kevin Z., Hu Song, and Chen Ruyu, 2015: 13).

Wild liquorice is preferred by processing industry to a cultivated one due to a higher content of glycyrrhizic acid and substance called liquiritin. Therefore, the quality of cultivated liquorice should be enhanced considerably so that it will be able to compete with wild liquorice.

In the international market, the demand for the liquorice roots is higher than the demand for liquorice extracts or powder. It is obvious since non-value added raw liquorice roots are cheaper than value-added liquorice products (Chen, Kevin Z., Hu Song, and Chen Ruyu, 2015).

Uzbekistan is considered the second largest exporter of liquorice roots in Central Asia (Chen, Kevin Z., Hu Song, and Chen Ruyu, 2015). The liquorice grown in Uzbekistan is exported to China, South Korea, Germany, US, Spain, Poland India, and others countries (See Figure 3).

Figure 3. Destination Markets of the Liquorice Roots and Extract from the Republic of Uzbekistan (2016)



Source: Inner database of the Ministry of Foreign Trade of the Republic of Karakalpakstan

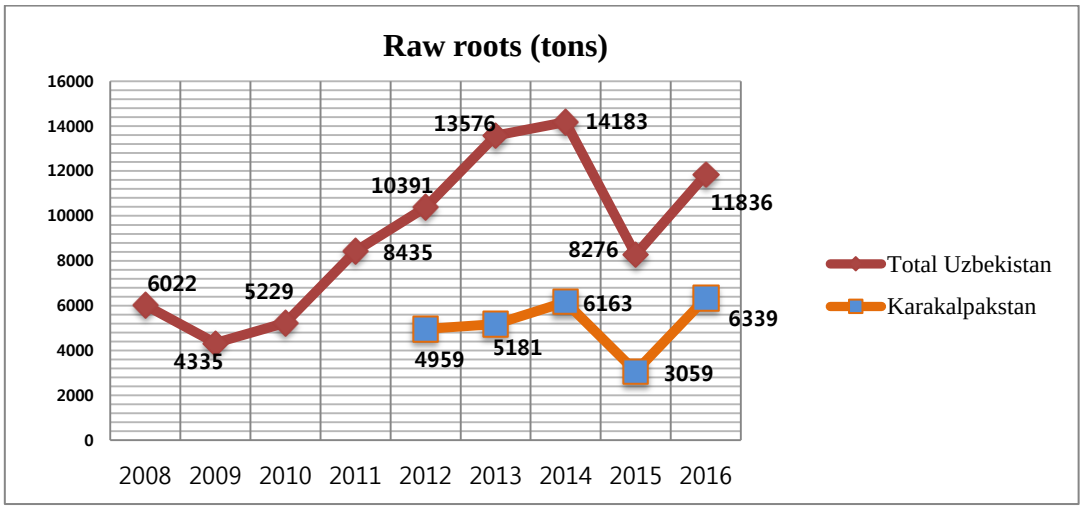
From 2009 to 2014 the export volumes of liquorice root in the Republic of Karakalpakstan had steadily risen. However, in 2015 there was more than a two-fold drop in exports of liquorice roots in the Republic of Karakalpakstan compared to 2014 (See Figure 4).

Two factors may be responsible for the decrease of exports of licorice roots in 2015.

1) A decrease in demand for the liquorice root in the world market;
2) An increase in the number of liquorice root processing plants, thus, an increase in the production volumes and exports of the liqorice roots in the Republic of Uzbekistan[5].

[5] Explanatory note on the liquorice production report of the Ministry of Foreign Trade of the Republic of Karakalpakstan, 2017 (not for public use)

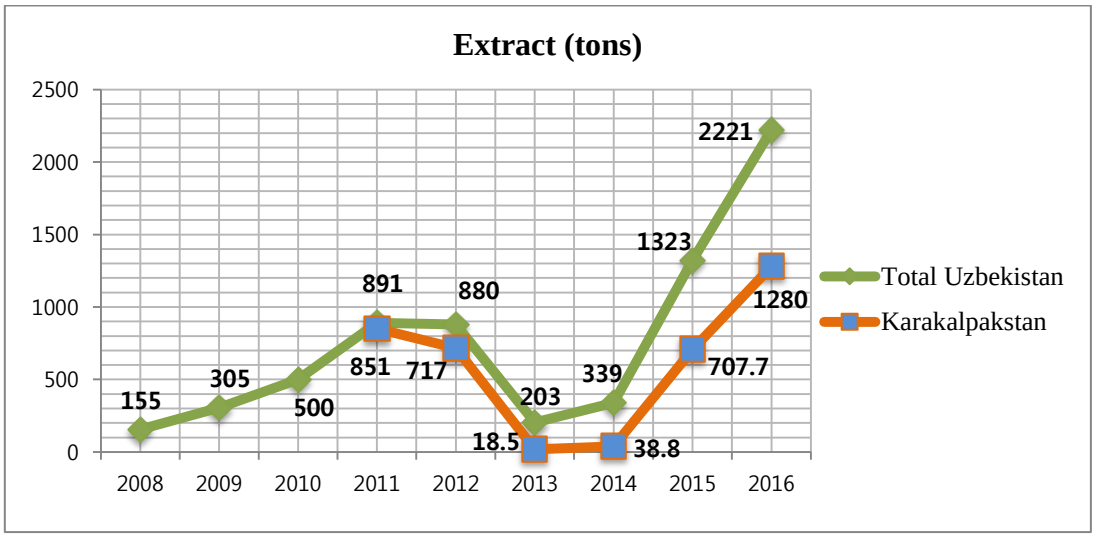
Figure 4. Volumes of the Liquorice Root exported from the Republic of Uzbekistan



Source: Inner database of the Ministry of Foreign Trade of the Republic of Karakalpakstan

As for the liquorice extract in the Republic of Karakalpakstan, export volumes increased more than 18 times in 2015 (See Figure 5).

Figure 5. Volumes of the Liquorice Extract exported from the Republic of Uzbekistan



Source: Inner database of the Ministry of Foreign Trade of the Republic of Karakalpakstan

Main producers of liquorice in Karakalpakstan

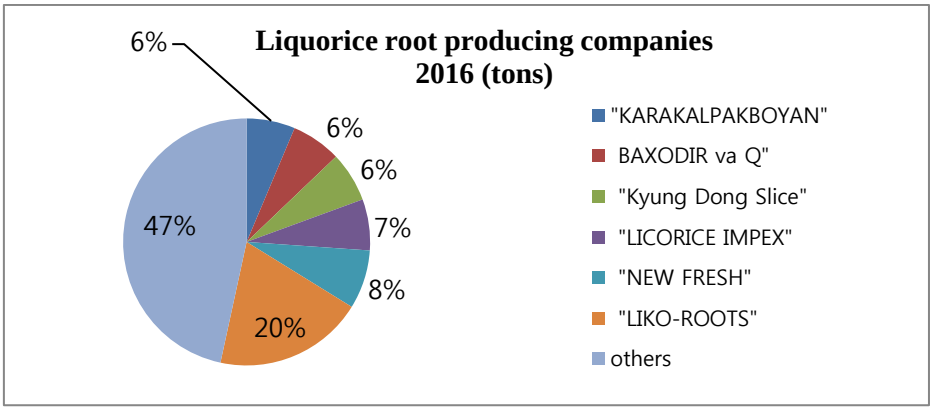
OJSC Karakalpakboyan (Khojeyli region) is one of the largest companies in Karakalpakstan involved in producing and processing of liquorice roots. The main activity of the 'Karakalpakboyan' is gathering and pressing of the liquorice roots. Its products are exported to US, Germany, France, South Korea, China, Japan, Ukraine, Poland, and Kazakhstan. Additionally, the company is engaged in cultural planting and growing of liquorice. The volume of production in 2015 reached 1.7 thousand tons, which equals to 1.5 per cent increase in comparison to 2014 volume[6].

'Karakalpakboyan' was established in 2003 with the participation of an Iranian partner. In 2014, 24.99 per cent of 'Karakalpakboyan''s shareholders package was acquired by the Hongkong investment enterprise (Leyla Mirzaakhmedova. 2014).

In 2016 **'Karakalpakboyan'** produced much less compared to other companies. This indicates that other companies are effectively competing with **'Karakalpakboyan'** (See Figure 6).

[6] From the presentation on the liquorice production by the Ministry of Foreign Trade of the Republic of Karakalpakstan, 2016 (not for public use)

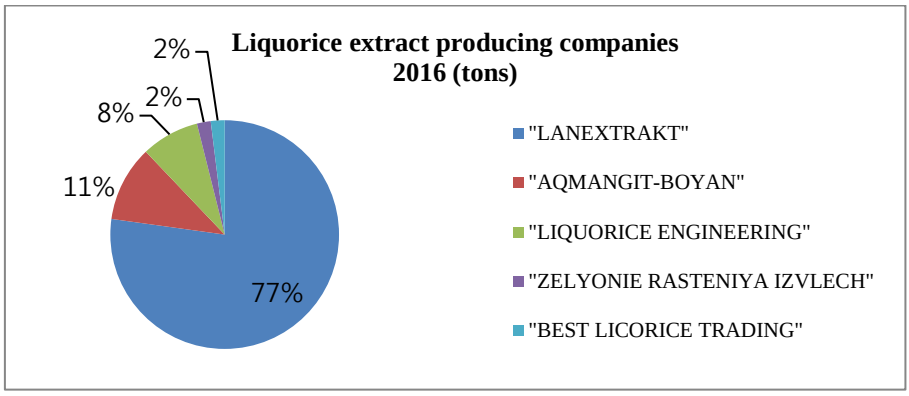
Figure 6. The share of the Liquorice Root Producing Companies in the Republic of Karakalpakstan



Source: Inner database of the Ministry of Foreign Trade of the Republic of Karakalpakstan

The Uzbek-Chinese JV 'LanExtract' (Chimbay region) was established in 2006. The main activity of the enterprise is processing and sale of the liquorice extract. It produced almost 80 per cent of all liquorice extract in the Republic of Karakalpakstan in 2016 (See Figure 7.). The production volumes reached nearly a thousand tons of liquorice extract[7].

Figure 7. The share of the Liquorice Extract Producing Companies in the Republic of Karakalpakstan



Source: Inner database of the Ministry of Foreign Trade of the Republic of Karakalpakstan

[7] Explanatory note on the liquorice production report of the Ministry of Foreign Trade of the Republic of Karakalpakstan, 2017 (not for public use)

At present, there is no specific information on the detailed costs of pre-export product preparation.[8] The Ministry of Foreign Trade of the Republic of Karakalpakstan itself cannot monitor the price formation of liquorice products. It is supposed that there are some major reasons for such an ambiguity.

One of the reasons is that there is no single price per kilo of liquorice roots among farmers. It is because the price is negotiable. Some enterprises contact the farmers and discuss the terms favorable for both sides. For example, a representative from the FE LLC 'NukusExtract' told in the interview (See Appendix I) that they make arrangements with farmers. The company offers to collect the liquorice roots using its machines such as tractors, trucks and etc from the farmer's field. The price for the roots per kilo in such cases costs the firm no more than 1 cent USD.

Even if it is hard to track variable costs, we can find some fixed costs. They include obtaining permits and other procedure fees. So, for any enterprise that plans to export liquorice roots without having its own plantations, fixed costs comprise around 558 US dollars per ton, including:

- Cost for obtaining a permit (quota) for harvesting liquorice plants (collection): 333 US dollars per ton;
- Cost for obtaining a permit (export permit) for export liquorice: 225 US dollars per ton;

Experts in the Ministry of Foreign Trade of the Republic of Karakalpakstan consider that other fixed costs may be somewhat between 250 and 450 US dollars per ton of liquorice root. Thus, the cost of liquorice root per ton will amount around 800 to 1000 US dollars. An average export price of one ton of

[8] Explanatory note on the liquorice production report of the Ministry of Foreign Trade of the Republic of Karakalpakstan, 2017 (not for public use)

liquorice roots comprised 729 US dollars in 2016[9].

2. Perspectives of the Liquorice Production in Karakalpakstan (Uzbekistan)

According to the report of the experts from the International Food Policy Research Institute (IFPRI), Uzbekistan possesses all prerequisites needed for cultivation of liquorice. They include favorable conditions for liquorice growing, processing and exportation. First, the natural conditions (weather and soil) in the northwestern region are ideal for liquorice growing. The northwestern region consists of deserts and steppes. Small-scale experiments determined that Uzbekistan's soil condition is not only good for G.glabra, but is also suitable for G.uralensis (Chinese traditional medicinal herb). Second, the production cost in Uzbekistan is competitive against the major exporter of liquorice roots – China. For instance, in Chinese currency, labor cost in Uzbekistan is about 15 RMB per day while it is over 150 RMB per day in China, which means that Uzbek labor cost is 10 times cheaper than the Chinese one, thus the production cost is cheaper as well (Chen, Kevin Z., Hu Song, and Chen Ruyu, 2015).

The liquorice production has many perspectives in Uzbekistan. Liquorice is expected to become one of the main exporting products for the Republic of Karakalpakstan.[10]

There was no foreign company involved in processing and producing value-added products from liquorice roots and extract before the 2000s in Karakalpakstan. However, liquorice planting and processing are undergoing

[9] Explanatory note on the liquorice production report of the Ministry of Foreign Trade of the Republic of Karakalpakstan, 2017 (not for public use)

[10] From the interview with the Minister of Foreign Trade of the Republic of Karakalpakstan, Ajiniyaz Seytakhov;

considerable changes. In 2015, the Chinese Kunming Pharmaceutical Corporation announced its plans to launch construction of the pharmaceutical plant in the region. The company is going to produce a unique drug – glycyrrhizic acid derived from the liquorice root.

The Uzbek people are optimistic about the undertaking of the Chinese company. The specialists in the Uzbek Scientific Research Institute of Chemistry and Pharmacy believe that the Uzbek pharmaceutical industry will be able to produce new Uzbek medicines on the basis of glycyrrhizic acid (Pharmaceutical Herald).

The liquorice production is continuously supported by the Uzbek government. The government has recently finished the draft of Decree of the Republic of Uzbekistan 'On measures to increase production and industrial processing of liquorice in the Republic of Uzbekistan' (SPISS. 2017), which provides:

Table 2. Provisions of the draft of Decree of the Republic of Uzbekistan 'On Measures to increase Production and Industrial Processing of Liquorice in the Republic of Uzbekistan'

1	2	3	4
Establishment of plantations for the production of liquorice in the Republic of Karakalpakstan for **2017-2021**;	Extension of plantations (more than 16.0 thousand hectares) and production of liquorice in the Republic of Karakalpakstan;	Approval of the Working Group responsible for the development of liquorice production and its industrial processing;	Exemption of farms creating industrial liquorice plantations, as well as enterprises processing liquorice root and producing finished products, from payment of various fees, taxes and customs payments from now till **January 1, 2022.**

Next is the list of exempted payments (SPISS. 2017):

Table 3 Payments Exempted

Period of exemption	Types of payment		
	Fees	**Taxes**	**Other payments**
2017~January, 2022 **Total 5 years**	- Fees for harvesting planting stock (seeds, cuttings) to create a plantation; - Customs fees (except for customs clearance fees) for equipment, raw materials, components carried for their own production needs, as well as construction materials not produced in Uzbekistan and carried in the framework of projects on the lists approved by the Cabinet of Ministers of the Republic of Uzbekistan;	- Land tax; - profit tax; - property tax of legal entities; - tax on improvement and development of social infrastructure; - a single tax payment for small enterprises;	- mandatory contributions to the Republican Road Fund and an extra-budgetary Fund for the reconstruction, overhaul and equipping of comprehensive schools, professional colleges, Academic lyceums and medical institutions under the Ministry of Finance of the Republic of Uzbekistan;

Furthermore, current president[11] of the Republic of Uzbekistan has assigned JSCB 'ASAKA' and other commercial banks to provide loans with a four-year grace period to:

1) business entities who want to create industrial plantations;
2) enterprises, engaged in the industrial processing of liquorice;

on terms in accordance with the Resolution of the President of the Republic of Uzbekistan dated September 16, 2016, No. PP-2595 'On the Program of measures for the further development of the Republic's pharmaceutical industry for 2016-2020s'.

These measures will henceforth facilitate the production of liquorice in the Republic the Republic of Uzbekistan, and bring the production of liquorice to a new level.

[11] Shavkat Mirziyoyev, the President of the Republic of Uzbekistan.

IV. Literature review

1. Previous Studies

Very little research is done on the economic, social and environmental impacts of liquorice production in general, and few are done on the economic and environmental impacts of the liquorice production in Uzbekistan.

Environmental impact

One of the first empirical studies conducted in Uzbekistan on the ecological impact of liquorice plant was made by a group of foreign and Uzbek scientists from Gulistan State University during 1999-2003 in the Hungary Steppes (Syr Darya region) in Uzbekistan. The study was undertaken on different types of saline soils to reveal the potential property of liquorice to restore soils. The liquorice was planted on abandoned soils with high levels of salinization and shallow groundwater as a phytoremediation crop (Kushiev et al. 2005).

The nearby field without any plant was also taken for comparative research. According to the results of the study, dry matter with a protein content immensely increased by 2003. That year the adjacent field and liquorice grown fields were prepared for wheat and cotton sowing. An increase in wheat and cotton yields showed that liquorice cultivation brought soil remediation effects. This amendment was possible thru liquorice properties to lower underground water table, to leach salts in soil, and to increase oil organic carbon content (Kushiev et al. 2005).

Another study was done between 2005-2008 by researchers from the International Water Management Institute (IWMI), who examined liquorice plants in the same Syr Darya region in a project funded by the Asian Development Bank. “IWMI’s research demonstrated that licorice cultivation is

an effective livelihood option in dry land and degraded areas with the high levels of soil salinity" (CGIAR. 2016).

IWMI in collaboration with local specialists spotted 700,000 ha abandoned and highly saline lands suitable for liquorice cultivation. The study highlighted that if liquorice is cultivated on a large-scale basis, it is possible to restore huge areas of dry and degraded soil into a fertile and productive land. In conclusion, the study suggested that it is expedient to release abandoned lands for 15 years and let farmers earn some money before exploiting the land for cotton and wheat production (Jeff Smith. 2013).

Above mentioned studies demonstrate that the liquorice plant can be not only a good alternative cash crop other than cotton, corn or sorghum, but also has the potential to improve soil productivity and to raise the income of farmers. This means a lot for farmers who are short of cropland, and who annually lose fertile soils to degradation and salinization.

Economic impact

According to the study by Qadir et al., restoring salt-affected lands is rather costly. In the study, they showed that it is more cost-effective to prevent land degradation. In their opinion, governments should invest in sustainable land management by taking 'action'. Qadir et al argue that 'no action' can lead to losses up to 69 per cent. Therefore, if land degradation is prevented and actions are taken to restore degraded lands, it would cost less than if land degradation is left on its own (Qadir et al. 2015).

The study by Qadir et al. is validated by the case study of Kappas, Martin et al. They demonstrated that development of liquorice plantations produces numerous financial, ecological benefits. The study was undertaken in the

Galaba collective farm in the period of 2005-2013. The authors of the case study had an objective to analyze the changes in soil conditions, together with the analysis of the profitability of liquorice cultivation under different prices, inflation rates, capital costs and yield scenarios (Kappas, Martin et al. 2016).

Kappas, Martin et al. used two different methodologies in their study. For the analysis of soil salinity, groundwater table and salinity, soil fertility, yields, an ANOVA test was conducted on three selected sites with representative soil physical properties. Besides, they made an economic cost-benefit analysis of on-farm enterprise budgets, proposing five scenarios.

According to the results of the cost-benefit analysis, cultivating liquorice on saline soils is rather profitable for farmers since it "offers additional income for individual farmers with relatively modest investments" (Kappas, Martin et al. 2016: 321). From the table below, it may be concluded that LC10yrs (Liquorice cultivated during 10 years) is economically more profitable than other cultivation cycles (See Table 4).

Table 4. Profitability of Liquorice Cultivation under Different Scenarios in the Syr Darya region

Indicators	LC5yrs	LC10yrs	LC5yrsCW5yrs	NO LC	No LC Only Cotton
Revenues	689	1,132	1,829	1,217	3,380
Costs	587	880	1,607	3,800	3,548
Net benefit	112	252	222	-2,583	169
BCR	1.2	1.3	1.1	negative	
Annual Net benefit	22	25	22	negative	17

- **LC5yrs** - Liquorice cultivated for 5 years;
- **LC10yrs** - Liquorice cultivated during 10 years;
- **LC5yrsCW5yrs** - Liquorice cultivated for 5 years, and after, the farmer switches to cotton-wheat rotation for the following 5 years;
- **No LC** - Cotton-wheat rotation is practiced in the high saline area, without rehabilitation of land using liquorice;
- **No LC Only Cotton** - Current average profitability of cotton cultivation in the Syr Darya province, all levels of salinity combined.

Source: Retrieved from Kappas, Martin et al. 2016. p. 319

The results of the cost-benefit analysis showed that "at 10 % of annual price growth both for liquorice roots and input costs, the final cost benefit ratio (BCR) for growing licorice would be 1.9 (See Table 5). That is, per each Uzbek sum invested in liquorice cultivation the farmer will be able to generate 1.9 sums in total revenues" (Kappas, Martin et al. 2016: 320).

Table 5. Estimated Cost-benefit Analysis of Liquorice Cultivation for 1 ha in UZS

Designation	**2006**	**2007**	**2008**	**2009**	**2010**
Yield licorice root, t/ha	0	0	0	0	10
Dried licorice weight	0	0	0	0	7
Price 1 t/root dried/uzs	120,000	132,000	145,200	1,597,200	175,692
Total sales	**0**	**0**	**0**	**0**	**1,229,844**
Net profit	**-173,000**	**-96,800**	**-106,480**	**-59,895**	**1,032,189**
Accumulated net profit	**-173,000**	**-269,800**	**-376,280**	**-436,175**	**596,014**
BCR at the end of the period					**1.9**
Discounted value of the net accumulated benefit					**139,349**

Source: Retrieved from Kappas, Martin et al. 2016. p. 320

2. Success story

The Kubuqi Desert[12] transformation is a great example of positive impacts of the liquorice production for farmers and the country as a whole. The Kubuqi Desert was called the 'Dune of Death' by local people because it brought sandstorms that made the roads impassable, irrigated lands unusable and negatively affected vegetation. Local households lacked access to basic public services, like schools, hospitals, electricity and roads. All of this resulted in aggravation of poverty in Kubuqi (UNCCD, Land for Life Program. 2015).

However, the situation has changed and in twenty years the desert has been transformed into a green oasis with trees, plants, and even provided habitat for wild animals, including swans, hares. All this was possible through a collective action led by the Chinese company - Elion Resources Group.

The Elion Resources Group was established in 1988 as a salt-producing plant. The company started land restoration simply by an action that indirectly launched the reaction chain. That time Elion Resources Group encountered a major problem to its business – sand dunes in the desert. To transport salt to other parts of Inner Mongolia, the company had to overcome continuous changes in road tracks due to sand drifting. It decided to invest in road construction. Though roads were constructed, they still needed protection from sand flooding. The management of the company adapted an effective course by planting liquorice and local trees along the road. The company also applied innovative new planting methods such as air and water jetting which ensured successful establishment of trees and plants. To stabilize sand dunes, the company implemented a sand barrier technology by adopting a grid pattern of

[12] A desert in the Inner Mongolia Autonomous Region, PRC

bundled Salix[13] tree stems. Then, the company has extended tree plantings over 10,000 square kilometers in the desert, additionally planting Chinese medical herbs along with liquorice (UNEP. 2015).

"The restoration project has benefited over 100,000 farmers and herdsmen, with annual local incomes increasing from 74 US dollars in 1988 to 4,500 US dollars today" (UNCCD and World Bank. 2016: 48). The Elion Group has been engaging with local people by hiring them on annual tree and grass planting seasons. The creation of jobs by the company was critical to stimulating economic growth in Kubuqi.

The Chinese government has been supporting the Elion Group all along from the very beginning. As the company had shown positive results of its activities, the Chinese government have prioritized ecological restoration at all levels. It has given incentives and support for this restoration project.

Nowadays, the Elion Group has expanded into a large multi-level business group. The company established the Elion Natural Pharmaceutical Group whose operations include 1) planting and processing of green Chinese herbal medicines, mainly liquorice, 2) research and development, production and sale, and 3) wholesale, retailing and delivery (UNEP. 2015).

The Elion Group's case indicates that rehabilitation of degraded lands is achieved through integrated collective action of farmers and local population. By growing trees and liquorice plants, people can stop deforestation and desertification. The leaders of the Elion Group showed that it is possible to solve ecological problems by using accumulated knowledge of local pastoralists and persistent effort.

[13] Willow tree

3. Methodology and Research Question

1-1. Methodology

Due to unavailability of relevant data on the production costs and prices of the liquorice roots, I could not implement my plan to show the positive production externality of the liquorice production through the externality model. Although it is impossible to conduct a real practical research, it is still plausible to estimate approximately economical, social and environmental impacts of the liquorice production by implementing an ***illustrative*** impact analysis. The data is obtained from a variety of published papers, factsheets, and publications of international organizations.

In the methodology, I attempted to synthesize the analytical framework from various works. The methodology combines mostly impact analysis' economic assessment structure and my own approaches.

An impact analysis is an assessment of positive and negative impacts of a proposed course of action (project) in consideration of its potential outcomes. An impact analysis assesses the ability of projects to address strategic policy goals of the government such as supporting regional growth, revitalizing distressed areas, reducing unemployment, generating higher paying jobs, increasing regional productivity and competitiveness.

Clarification of concepts

Let's assume that the liquorice production in the Republic of Karakalpakstan is a project. This project has impacts on the national level. So, there come the agents. Agents are interest groups who can benefit from the project. The economy, society and ecology of the Republic of Karakalpakstan will represent agents in our case.

Considering the fact that the impact analysis will address three different areas, there is a need to explain the following concepts:

- Economic impact analysis;
- Social impact analysis;
- Environmental impact analysis;

"An economic impact analysis is a way of demonstrating what kind of economic contribution an organization, industry, or investment makes to a region or a country" (Oxford Economics. 2017).

A social impact analysis is a way of analyzing, monitoring and managing the intended and unintended social changes, both positive and negative, which come out from a government's (or organization) policies, programs or projects (International Association for Impact Assessment. 2017).

An environmental impact analysis is a way of assessing the potential impact of a proposed development project on the natural and social environment. "This may include an assessment of both the short- and long-term effects on the physical environment, such as air, water and/or noise pollution; as well as effects on local services, living and health standards, and aesthetics" (The Environmental Literacy Council. 2017).

The current methodology will combine all three types of impact analysis.

Impacts are also categorized by types:

Direct impact – an impact generated directly by the project;

Indirect impact – an impact generated indirectly by the project via certain channels and chains (Oxford Economics. 2017).

The positive and negative impacts of a project can be viewed through the prism of benefits and costs. A cost is any item that makes an agent worse off (Renda, Andrea, et al. 2013). A benefit includes any item that makes any agent better off, regardless of whether it can be easily measured or quantified (Regulatory Review Department of Malaysia Productivity Corporation. 2013).

To figure out the positive impact of the project, the current methodology will follow several steps:

1) Identifying agents;
2) Identifying positive and negative impacts (benefits and costs);
3) Monetary valuation of impacts;

In the thesis paper, I could not show the cumulative increase or decrease in revenues or economic output over the period due to a lack of related data. I will not calculate net present values. The results of the impact analysis will be based on the semi-quantitative valuation of positive and negative impacts of the liquorice production in the Republic of Karakalpakstan.

The positive impact calculation methodology is illustrated in Table 6. It demonstrates how costs and benefits are shared out according to the types of agents. The benefit is signed as '+', and the cost as '-'.

Table 6. Model of Impact Analysis

	Name of agent	Impact+/ -	Monetary value
1	The economy of the Republic of Karakalpakstan	+/-	USD
2	The society of the Republic of Karakalpakstan	+/-	USD
3	The ecology of the Republic of Karakalpakstan	+/-	USD

1-2. Limitations of the methodology

I must admit that the methodology proposed by me has a lot of limitations as:

1) Primitiveness of the calculation;
2) Risk of overestimation of the impacts;
3) No distribution of effects over time (project lifetime);
4) No discount rate;
5) No calculation of net present values;
6) No sensitivity analysis.

From a policy maker's perspective, an impact analysis is of little use. The results of an impact analysis can be used by policy makers to choose whether maintain or raise the budget, though they cannot tell what the result of budget retention or raise might be. An impact analysis is much simpler than a cost-benefit analysis since it does not compare other available projects (ICOMOS. 1999).

1-3. Research Question/Hypothesis

Initially, in the early stages of writing my thesis paper, I intended to research the positive effect of the liquorice production in Karakalpakstan using externality model, and my research question sounded 'What effect does the liquorice production have on the economy of the Republic of Karakalpakstan'. However, the research question has been altered into the following version:

- How does the production of liquorice affect the agents in the Republic of Karakalpakstan?

In my hypothesis, I assume that the liquorice production has indirect positive impacts on the economy, society and ecology of the Republic of Karakalpakstan.

V. Impact Analysis of the liquorice production in the Republic of Karakalpakstan (Uzbekistan)

In this chapter, I will assess the economic, social and environmental impacts of the liquorice production in the Republic of Karakalpakstan using an impact analysis.

1. Step I. Identifying the Agents

Some guides to impact and cost-benefit analysis recommend using government, producers or organizations as the agents of the project. In my paper, I will have a different approach to determining the agents. The research question of my thesis paper considers the impact of the liquorice production on the general level rather than on regional or organizational level.

In this regard, three distinct agents are affected by the liquorice production. Those are:

1) The economy of the Republic of Karakalpakstan;
2) The society of the Republic of Karakalpakstan;
3) And the ecology of the Republic of Karakalpakstan;

2. Step II. Identifying Positive and Negative Impacts (Benefits and Costs) of the Liquorice Production in the Republic of Karakalpakstan

Further, I will identify positive and negative impacts of the liquorice production. In addition, I will simultaneously determine whether it is a direct or indirect impact.

Direct impacts

Direct impact refers to an impact that is generated directly by the project, in our case it is the liquorice production. So, the liquorice production induces the following direct impacts:

- Creates new job places in rural area;
- Attracts FDI and ODA in the sector;
- Increases revenues from export of the liquorice production in Republic of Karakalpakstan (Uzbekistan);
- Is hard to manage without the use of herbicides;
- Takes longer and larger investment than other cash crops and grains.

Indirect impacts

Indirect impact is defined as an impact that is generated indirectly by the project via certain channels and chains. The liquorice production in the Republic of Karakalpakstan has more indirect impacts than direct ones. This is explained by 1) the properties of the liquorice plant to revitalize barren fields, 2) promotion of job places by liquorice producing companies and 3) reduction of poverty rates in the region. So, the liquorice production brings about the following indirect impacts:

- Leads to the improvement of the regional infrastructure;
- Alleviates poverty in rural area;
- Contributes to sustainable development of the region in the long run;
- Lowers groundwater level;
- Decreases secondary soil salinization or to prevent its further accumulation;
- Improves soil fertility;
- There is a risk of exhaustion from excessive harvesting of wild liquorice.

Above mentioned impacts will be discussed in detail in the ‘Positive and Negative impacts’.

Positive impacts (benefits)

Positive impacts can be viewed as benefits of the project. A benefit is anything that makes an agent better off, that is, it puts an agent in a more advantageous position, regardless of whether it can be easily measured or quantified. The last notion is very important because the liquorice production has several positive impacts that cannot be computed. One of such impacts is the contribution to sustainable development of the region in the long run. Sustainable development is a very complex phenomenon. The extent of such impact cannot be accurately measured. Since it is not foreseeable to calculate this impact, I will leave it as a positive one, but still, put it as non-calculable impact.

Next, I will list up positive impacts and justify them by presenting supportive background.

1. *Creation of new job places in rural area;*

According to the estimates of the Cabinet of Ministers of the Republic of Uzbekistan, entities involved in liquorice production are expected to create more than 1000 job places within the period of 2015-2018 (See Appendix II).

2. *Attracts FDI and ODA in the sector;*

The liquorice production sector is already undergoing changes from an extractive industry into product manufacturing industry. It is gaining an image of a profitable business. The Uzbek government has already set up goals to subsidize[14] the liquorice production. There was also a report about the inflow of the Chinese investments into the pharmaceutical industry (the Kunming Pharmaceutical Corporation).

[14] See chapter 'Perspectives of the liquorice production in the Republic of Karakalpakstan'

3. *Increases revenues from export of the liquorice production in Republic of Karakalpakstan (Uzbekistan);*

Through the development of liquorice plantations, more and more companies will emerge and produce/process liquorice in Karakalpakstan. They will contribute to an increase of revenues by exporting high-quality liquorice products. As for the sum of revenues, the numbers will be reflected in Step III.

4. *Leads to the improvement of the regional infrastructure;*

To deliver a product to final consumers, producers need a connected network of transportation and delivery. With an increase in the liquorice production in Uzbekistan, the region will have an opportunity to develop road infrastructure. The positive impact of liquorice production on road infrastructure is explicitly shown in the case of the restoration of the Kubuqi desert[15].

5. *Alleviation of poverty in rural area;*

As mentioned before, the population of the northwest of Karakalpakstan is suffering from poverty. Even people employed in agriculture do not see means to increase their incomes by selling agricultural products. Thus, the liquorice production can be a solution for the local farmers since liquorice requires 'modest investments'[16] and can be exported for much higher price. An export of processed or unprocessed liquorice products will raise farmers' standard of living in the rural areas of Karakalpakstan.

6. *Liquorice plant helps to decrease secondary soil salinization or to prevent its further accumulation.*

Through full shading of the soil surface by its leaves, the liquorice plant reduces

[15] See chapter 'Success story'

[16] See 'Literature review'

the capillary rise of salts. An accumulation of glycyrrhizin acid in the liquorice roots prevents concentration of salts in the root zone. In addition, liquorice plant does not require much water and consequently, there is no excess of water in soil, which is the main cause of secondary soil salinization (CACILM. 2017);

7. *Liquorice plant improves soil fertility;*

It is possible to bring back soil fertility by growing liquorice. The liquorice plant enriches soil through nitrogen-fixing bacteria living in the rootstocks of the plant. In addition, high organic matter in the liquorice plant also facilitates improvements in the biological component of the soils promoting the overall health of the soil (CACILM. 2017);

8. *Liquorice plant lowers groundwater level;*

Through fast developing root system, the liquorice plant reaches groundwater level on the second or third year of cultivation and acts as a bio-drainage system. (CACILM. 2017);

9. *Contributes to sustainable development of the region in the long run;*

In overall, impacts associated with the economy, society and ecology lead to sustainable development. The example of Kubuqi desert restoration demonstrates that well-thought-out systematic investments in plant growing will result in sustainable development.

Negative impacts (costs)

Negative impact represents costs of the project.

Here are the negative impacts of the liquorice production in the Republic of Karakalpakstan:

1. *Hard to manage the cultivation without the use of herbicides;*

The liquorice plant is known as an invasive weedy species. Its extensive root system develops suckers that make the cultivation uncontrollable without the use of herbicides. Consequently, farmers have to bear additional cost of management of root extension (Qadir, Manzoor, et al. 2014);

2. *Cultivation of liquorice takes longer and larger investment than other cash crops and grains;*

To harvest marketable liquorice roots farmers should invest time and money for at least two years. During the period of 2 years, they do not get any revenue while corn growing covers expenses the same year. It is estimated that the investment per approximately 700 m^2 of liquorice is about 3.5 times higher than the investment for corn in the same period. But, the net profit gained from cultivating liquorice is lower than one gained from corn on an annual basis (Chen, Kevin Z., Hu Song, and Chen Ruyu, 2015).

3. *The risk of exhaustion from excessive harvesting of wild liquorice;*

Although the risk of exhaustion from excessive harvesting of wild liquorice is impossible to cipher out, it should not be underestimated. Uzbekistan might experience the same problem as China in the 2000s if it does not implement strict measures. The Chinese government had to impose a restriction on the collection of wild liquorice due to a speedy depletion of wild liquorice reserves (Chen, Kevin Z., Hu Song, and Chen Ruyu, 2015).

According to the Ministry of Foreign Trade of the Republic of Karakalpakstan, land plots with wild liquorice are gradually dwindling (See Appendix III). Although the Uzbek government maintains some regulations on harvesting, which are aimed at preventing the depletion of natural liquorice reserves, it is not enough to eliminate the risk. Therefore, it is essential to inculcate on the

farmers and producers the practice of sustainable collection of wild liquorice in the Republic of Karakalpakstan.

Table 7 summarizes all impacts. The impacts are listed randomly.

Table 7. Distribution of Positive and Negative Impacts

		Type of impact (Direct/ Indirect)	Positive impact (benefit)	Negative impact (cost)
1	Creation of new job places in rural area	direct	+	
2	Hard to manage the cultivation without the use of herbicides	direct		—
3	Cultivation of liquorice takes longer and larger investment than other cash crops and grains	direct		—
4	Alleviation of poverty in rural area	indirect	+	
5	Liquorice plants improve soil fertility by increasing organic matter	indirect	+	
6	Increases revenues from export of the liquorice production	direct	+	
7	Liquorice plants prevent further accumulation of salts	indirect	+	
8	The risk of exhaustion from excessive harvesting of wild liquorice	indirect		—
9	Attracts FDI and ODA in the sector	direct	+	
10	Contributes to sustainable development of the region in the long run	indirect	+	
11	Liquorice plants lower groundwater level, thus improve drainage system	indirect	+	
12	Leads to the improvement of the regional infrastructure;	indirect	+	
Total number of impacts			**9**	**3**

3. Step III. Monetary Valuation of Impacts

In this section, I will conduct the monetary valuation of all impacts. Given the implicit nature of monetary valuation procedure of the present methodology, clarifications should be made to avoid misinterpretation.

The costs of the liquorice production were obtained from different sources within the different time frame. For example, some costs and numbers are taken from earlier 2005 data, whereas others are from recent 2016 data. The costs were not corrected into present values by using a discount rate. While this method could have affected the accuracy of the monetary valuations, it is unlikely that the result of the impact analysis would be significantly distorted.

All values will be measured in US dollars to prevent inconsistencies in monetary values.

The valuation process will flow stepwise.

1. *Creation of new job places in rural area;*

For calculation of this impact, I have used the data from two resolutions adopted by the Uzbek government. According to the Resolution 'On the Comprehensive Program of Measures to mitigate the consequences of the Aral catastrophe, the restoration and socio-economic development of the Aral Sea region for 2015-2018', the government has proposed that total 1141 job places will be created by the liquorice production (See Appendix II). But there is no mention of costs of job creation. The information was found in another Resolution 'On measures to implement the agreements achieved within the framework of the International Conference on 'Development of cooperation to mitigate the consequences of the ecological catastrophe in the Aral Sea Basin region'. An estimated cost of job creation (20000 new job places) in rural areas

of the Republic of Karakalpakstan is equal to 85 mln US dollars (See Appendix V). Here, I divide 85 mln US dollars by 20000, and derive 4250. This is the cost of job creation per capita. Then I multiply the number of job places promoted by the liquorice production by the cost of job creation per capita, and derive the sum of the benefit (See Box 1):

Box 1. Benefit from Creation of New Job Places in Rural Area.

An estimated cost of job creation = 85 000 000 USD;
New job places = 20 000;
85 000 000 ÷ 20 000 = 4250
4250 USD is the cost of job creation per capita.
Number of job places promoted by the liquorice production = 1141;
4250 × 1141 = 4 849 250
Benefit from creation of new job places in rural area
= 4 849 250 USD

2. *Attracts FDI and ODA in the sector;*

The Uzbek government has allocated funds to support the liquorice production in the Resolution 'On the Comprehensive Program of Measures to mitigate the consequences of the Aral catastrophe, the restoration and socio-economic development of the Aral Sea region for 2015-2018'. According to the annexes of the Resolution, total 19.74 millions of US dollars should be channeled to support the liquorice production in the Republic of Karakalpakstan during the period of 2015-2018 (See Appendix II).

3. *Increases revenues from export of the liquorice production in Republic of Karakalpakstan (Uzbekistan);*

In the Resolution 'On the Comprehensive Program of Measures to mitigate the consequences of the Aral catastrophe, the restoration and socio-economic development of the Aral Sea region for 2015-2018', the volumes of liquorice

production in some regions of the Republic of Karakalpakstan are specified. The liquorice production was expected to increase up to 1600 tons. The numbers are proposed in the annex to the Resolution (See Appendix II).

As mentioned earlier, the average price of liquorice roots exported from Karakalpakstan comprised 729 US dollars in 2016[17]. So, I need to multiply the total volume of 1600 tons by 729 to find the benefit from an increase in revenues from the export of the liquorice roots:

Box 2. Benefit from Increased Exports of Liquorice Roots.

An average price of liquorice roots exported from Karakalpakstan = 729 USD;

The total volume of liquorice production = 1600 tons;

$1600 \times 729 = 1\ 166\ 400$;

Benefit from increased exports of liquorice roots = 1 166 400 USD.

4. *Leads to the improvement of the regional infrastructure;*

While transporting liquorice roots from plantations to processing plants, the producers will encounter problems related to poor road infrastructure. The roads in the rural area of the Republic of Karakalpakstan are in a terrible state, and the local authorities do not pay particular attention to its repairing. Obviously, the producers will have to act on their own to establish a good transport connection. Though the companies are not able to cover all costs of improvement of roads in the rural area, they can cooperate with the Uzbek government like in the case of the Elion Group. It would not be an exaggeration to contend that the liquorice production in Karakalpakstan will indirectly trigger the development of roads and network infrastructure.

[17] See chapter 'Liquorice production in Karakalpakstan'

The Uzbek government has allotted 158.73 million US dollars for repairing of certain rural roads of the Republic of Karakalpakstan for the period of 2015-2020 in the Resolution 'On the Comprehensive Program of Measures to mitigate the consequences of the Aral catastrophe, the restoration and socio-economic development of the Aral Sea region for 2015-2018' (See Appendix V). So, we might suppose that the liquorice production will bring about the equivalent benefit in the same period of time.

5. *Liquorice plant lowers groundwater level;*
6. *Liquorice plant helps to decrease secondary soil salinization or to prevent its further accumulation;*
7. *Liquorice plants improve soil fertility;*

I have merged the impacts related to the environment into one impact to make the calculation of impacts easier. The impacts *5, 6, 7* serve as means to protect land from degradation. Land degradation is caused by several factors. They are poor drainage system, elevated (ground) water tables, and secondary salinization. An improvement of drainage infrastructure can cost up to 2500 US dollars per ha in a year. In contrast, the liquorice plant can act as bio-drainage at a comparatively low cost – 50 US dollars per hectare (Kushiev at el. 2005).

As mentioned before, scientists from IWMI spotted 700,000 ha abandoned and highly saline lands suitable for liquorice cultivation[18]. The sum highly saline lands abandoned by farmers in the Aral Sea Basin region reaches 50,000 ha (New Agriculturist. 2008).

To find how much benefit is induced by the property of liquorice to revive degraded lands, I will follow the formula shown below (See Box. 3).

[18] See 'Literature Review'

Box 3. Benefit from the Positive Impact of Liquorice Planting on the Environment.

Cost of improvement of drainage infrastructure per ha = 2500 US dollars;

Cost of liquorice production = 50 US dollars;

Residual = 2500 – 50 = 2450;

Total amount of abandoned highly saline lands = 50 000 ha;

$2450 \times 50\,000 = 122\,500\,000$

Benefit from positive impact of liquorice planting on the environment = 122 500 000 USD.

8. *Alleviation of poverty in rural area;*

The per cent of the population living below poverty line (36.5%) in the Republic of Karakalpakstan is much higher compared to other regions (27.5%) of the Republic of Uzbekistan. The most vulnerable part of Karakalpak population lives in rural areas near The Aral Sea Basin. People in the rural areas are affected by unemployment (UNDP. 2014). Their only means of sustenance is agriculture. However, even farmers suffer from low income.

The liquorice cultivation could be a solution in alleviating poverty in rural areas. It must be noticed that the liquorice production itself cannot eradicate poverty, but it still can reduce poverty rates in the rural areas of Karakalpakstan.

The liquorice is a good cash-crop alternative for low-income farmers in Karakalpakstan for three reasons. First, by selling liquorice roots the farmers can earn more money than if they sell corn or wheat. Second, the farmers can sell not only roots but the liquorice biomass as well. Third, the farmers have an opportunity to work on improvement of liquorice seeds and sell high-quality seeds to other farmers in Uzbekistan or the Chinese importers.

A farmer, who has already had an experience of cultivating liquorice, reported that he could earn between 250 and 300 US dollars per ton of liquorice roots,

which accounted for 80 per cent of the farming profits (Jeff Smith. 2013). So, it can be concluded that net profit from the sale of liquorice roots amounts somewhere between 250 and 300 US dollars per ton.

It was proposed that 1600 tons of liquorice roots were produced by the companies in the Republic of Karakalpakstan in 2015-2016 (See Appendix II). Then, to find how much income the farmers could raise from producing liquorice, I will multiply net profit from the sale of liquorice roots (250 US dollars) by the volume of liquorice production (1600 tons). The benefit from the positive impact of the liquorice production on incomes of farmers in rural areas equals 400 000 US dollars (See Box 4).

Box 4. Increased Income of Farmers.

Net profit from sale of liquorice roots = 250 USD;
Volume of liquorice production = 1600 tons
$250 \times 1600 = 400\,000$
Increased income of farmers = 400 000 US dollars

9. *Cultivation of liquorice takes longer and larger investment than other cash crops and grains;*

One of the most profitable crops in Uzbekistan is cotton. Cotton has been the main agricultural product for several decades. Uzbekistan produced 3 million tons of raw cotton in 2016 (UzDaily. 2017). Uzbekistan is the world 5th largest cotton exporter. More than 160 thousand farms are involved in growing cotton (Cotton Outlook. 2016).

According to Kushiev et al., it is more profitable to grow cotton than liquorice in Mirzachul area (Jizzakh region) if the price of cotton reaches 500 US dollars per ton. The revenues from growing cotton comprised 3,548 USD per ha, while revenues from growing liquorice for 10 years were just 1,132 USD per ha

(Kushiev et al.2017). The difference between the revenues can be viewed as uncollected profit.

So, to calculate how much is the difference in the profitability of cotton and liquorice I will use the following formula (See Box 5).

Box 5. The Cost of Low Profitability of Liquorice Compared to Cotton.

Duration of cotton growth = one season;
Duration of liquorice growth = 3-5 years until first harvest;
Revenues from growing cotton per ha = 3548 USD;
Revenues from growing liquorice per ha = 1132 USD;
Residue = 3548 - 1132 = 2416 USD
Volume of liquorice production = 1600 tons
$2416 \times 1600 = 3\ 865\ 600$
Cost of low profitability of liquorice compared to cotton = 3 865 600 USD

10. Hard to manage the cultivation without the use of herbicides;

As mentioned above, liquorice requires modest cultivation cost – 50 US dollars per hectare. This price does not include export permit fee of 225 US dollars and other administrative costs. So, it may be concluded that this price incorporates herbicide costs.

Here is the cost of the difficulty of cultivation without the use of herbicides:

Box 6. The Cost of Difficulty of Cultivation without the Use of Herbicides.

Cost of liquorice production excluding administrative fees = 50 USD;
Volume of liquorice production = 1600 tons;
$50 \times 1600 = 80\ 000$
Cost of difficulty of cultivation without the use of herbicides = 80 000 USD

11. Contributes to sustainable development of the region in the long run;

12. The risk of exhaustion from excessive harvesting of wild liquorice;

The impacts *11* and *12* are non-calculable due to the complexity of their nature. Further studies are needed to find how much the liquorice production contributes to sustainable development of Uzbekistan, and what is the economic cost of excessive harvesting of wild liquorice in Uzbekistan.

Table 8 combines all monetary values of the impacts.

Table 8. Monetary Valuation of Impacts

		Calculable/ non-calculable	Monetary value
1	Creation of new job places in rural area	Calculable	4 849 250 USD
2	Hard to manage the cultivation without the use of herbicides	Calculable	80 000 USD
3	Cultivation of liquorice takes longer and larger investment than other cash crops and grains	Calculable	3 865 600 USD
4	Alleviation of poverty in rural area	Calculable	400 000 USD
5	Liquorice plants improve soil fertility by increasing organic matter	Calculable	122 500 000 USD
6	Liquorice plants lower groundwater level, thus improve drainage system	Calculable	
7	Liquorice plants prevent further accumulation of salts through full shading of the soil surface by foliage	Calculable	
8	The risk of exhaustion from excessive harvesting of wild liquorice	Non-calculable	
9	Attracts FDI and ODA in the sector	Calculable	19 740 000 USD
10	Increases revenues from export of the liquorice production	Calculable	1 166 400 USD
11	Contributes to sustainable development of the region in the long run	Non-calculable	
12	Leads to the improvement of the regional infrastructure	Calculable	158 730 000 USD

VI. Discussion

The result of the impact analysis has demonstrated that the liquorice production has many indirect positive impacts on the economy, society and ecology of the Republic of Karakalpakstan (See Table 9). However, the findings cannot be used or referred in other analytical papers due to significant limitations of the present methodology. There has been no discounting of the costs, and the data was taken from different sources and projects. The purpose of the methodology was to show that the liquorice production affects the economy, society and ecology and compute the impacts using available information on the topic.

Table 9. Summary of the impact analysis

		Type of impact	Monetary value
1	Creation of new job places in rural area	direct	4 849 250 USD
2	Hard to manage the cultivation without the use of herbicides	direct	80 000 USD
3	Cultivation of liquorice takes longer and larger investment than other cash crops and grains	direct	3 865 600 USD
4	Alleviation of poverty in rural area	indirect	400 000 USD
5	Liquorice plants improve soil fertility by increasing organic matter	indirect	122 500 000 USD
6	Liquorice plants lower groundwater level, thus improve drainage system	indirect	
7	Liquorice plants prevent further accumulation of salts through full shading of the soil surface by foliage	indirect	
8	The risk of exhaustion from excessive harvesting of wild liquorice	indirect	
9	Attracts FDI and ODA in the sector	direct	19 740 000 USD
10	Increases revenues from export of the liquorice production	direct	1 166 400 USD
11	Contributes to sustainable development of the region in the long run	indirect	
12	Leads to the improvement of the regional infrastructure	indirect	158 730 000 USD

VII. Conclusion

There is enough evidence that the liquorice production has a positive impact on the economy, society and environment of the Republic of Karakalpakstan. The liquorice plant has soil remediation properties. The lands freed from liquorice are considered rather fertile as the roots of the plant accumulate biologic nitrogen in the upper layer of the soil facilitating its restoration. Large-scale liquorice cultivation could become an important step in rehabilitating degraded lands in the Republic of Karakalpakstan while improving living standards of the rural population through the promotion of new job places and rise of farmers' incomes. Furthermore, the production of liquorice can result in the development of road infrastructure in the rural area of the Republic of Karakalpakstan.

Strengths of the thesis paper:

1. Pioneer at compiling three main impacts of the liquorice production in the Republic of Karakalpakstan;
2. Recent data on the export volumes of liquorice roots and extract from the Republic of Karakalpakstan;
3. Results of the interviews with relevant persons as the Minister of Foreign Trade of the Republic of Karakalpakstan, the Deputy Minister of Economy of the Republic of Karakalpakstan and the representatives of liquorice exporting companies;

Weaknesses of the thesis paper:

1. No rigorous analytical model or methodology;
2. Significant limitations of the current methodology;
3. No exact findings.

Recommendations for further research

For academia who wants to enrich and elaborate on the current thesis paper, I recommend 1) addressing main liquorice producers in the Republic of Karakalpakstan, and ask for data on production costs and product prices. Without data on liquorice production costs, prices, and volume of sales, it is impossible to conduct a decent research. 2) I recommend using a microeconomic model (externalities). The positive production externality model will graphically show the positive impact of the liquorice production. Furthermore, the monetary value of positive impact can be derived by calculation of triangles on the positive production externality graph. The results of such a research would be more reliable and scientifically sound.

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Appendices

1. Appendix I. Contacts of the interviewees*.

# of interviewees	Name of interviewee	Status of the interviewee	Contacts of the interviewee
1	Ajiniyaz Seytakhov	Minister of Foreign Trade of the Republic of Karakalpakstan	phone # **+99861 2225550** email address: **secrcetary.rk@umail.uz**
2	Dawletbay Urazimbetov	Deputy Minister of Economy of the Republic of Karakalpakstan	phone # +**99861 2261362** email address***:* n.kazakbaev@exat.uz**
3	Janabay ****	Representative of the FE **'Nukus Extract LTD'**	Cell phone # **+998933603971**

Source: Compiled by the author

* Notes: The content of the interviews are not placed here by the request of the interviewees

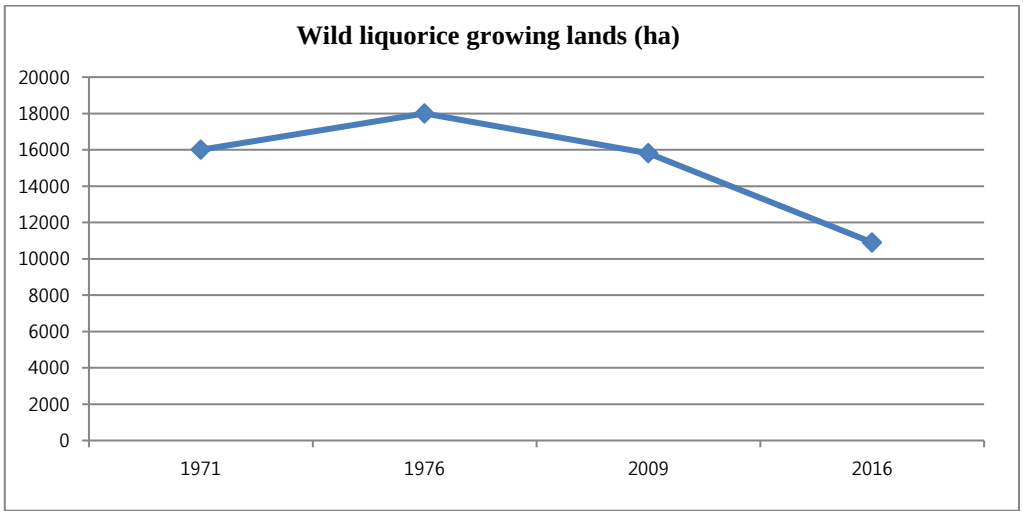
2. Appendix II. Part of the list of potential investment projects proposed for the Republic of Karakalpakstan in the Resolution 'On the Comprehensive Program of Measures to mitigate the consequences of the Aral catastrophe, the restoration and socio-economic development of the Aral Sea region for 2015-2018'.

Pharmaceutical Industry							
#	**Project name**	**Estimated cost, mln USD**	**Finance sources**		**Implementation terms**	**Executers/ Partners**	**Job creation**
			Internal funds	**Bank credits**			
9	Organization of production of pharmaceutical substances **(Glycyrrhetic acid)**	**4.00**		**4.00**	**2015-2016**	"Nukus KPC herbal technology", SJSC "Uzfarmsanoat", "Kunming Pharmaceuticals" China	**40**
10	Development of cultivated **liquorice** plantations in Nukus and Kegeyli region with subsequent non-waste processing of medicinal products, food, and livestock forages.	**12.00**	**2.50**	**9.50**	**2015-2018**	**Is determined by** SJSC "Uzfarmsanoat"	**700**

211	Organization of **liquorice root** production with processing capacity of 300 tons per year in Kegeyli region	**0.08**	**0.08**		**2015**	LLC "Boyan-Expo-Service", JSC "Halq Banki"	**30**
212	Organization of **liquorice root** production with processing capacity of 100 tons per year in Kegeyli region	**1.44**	**0.14**	**1.30**	**2015-2016**	LLC "Orion Tobon", JSC "Kapital Bank"	**200**
213	Organization of **liquorice root** production with processing capacity of 100 tons per year in Takhtakupir region	**0.06**	**0.04**	**0.02**	**2015**	LLC **"**Takhtakupir International", JSC "Halq Banki"	**25**
214	Organization of **liquorice root** production with processing capacity of 300 tons per year in Khojeyli region	**0.24**	**0.04**	**0.20**	**2015**	LLC "Promstroy servis", National Bank for Foreign Economic Activity of the Republic of Uzbekistan	**50**
215	Organization of **liquorice root** production with processing capacity of 700 tons per year in Qanlikul region	**0.40**	**0.40**		**2015**	JV LLC "Quality Licorice Root"	**70**
216	Organization of **liquorice root** production with processing capacity of 100 tons per year in Qanlikul region	**1.52**	**1.12**	**0.40**	**2015**	LLC "Kanlikul bio invest", JSCB "Asaka"	**26**
Total cost of potential investment projects		**19.74**	**Total volume of production of liquorice roots**		**1600 tons**	**Total number of created jobs**	**1141**

Source: National Database of Legislation of the Republic of Uzbekistan. 2017. Accessed March 30. http://www.lex.uz/pages/getpage.aspx?lact_id=2738680. Content translated from Russian

3. Appendix III. Reduction trend of the wild liquorice grown land plots in the Republic of Karakalpakstan.



Source: Retrieved from the presentation on the liquorice production by the Ministry of Foreign Trade of the Republic of Karakalpakstan (not for public use)

4. Appendix IV. Part of the list of national projects proposed for implementation in the Republic of Karakalpakstan in the Resolution from December 24, 2014 No. 363 "On measures to implement the agreements achieved within the framework of the international Conference on 'Development of cooperation to mitigate the consequences of the ecological catastrophe in the Aral Sea Basin region'".

No.	Project name	Executers/ Partners	Estimated cost, mln USD	Grants/ Bank credits	FGFO (Foreign government financial organizations that finance (co-finance) investment projects in the Republic of Uzbekistan)
1	Major overhaul of the motor road 4R173 Kungrad-Muynaq on the section 0-91 km.	Republican road Fund of the Republic of Uzbekistan	**139.0**	**100.0**	Asian Development Bank
2	**Increase of employment in rural areas**	Executive Committee of IFAS	**10.5**	**10.5**	FAO

Source: National Database of Legislation of the Republic of Uzbekistan. 2017. Accessed March 30. http://www.lex.uz/pages/getpage.aspx?lact_id=2528673. Content translated from Russian

5. Appendix V. Part of the list of potential investment projects proposed for the Republic of Karakalpakstan in the Resolution 'On the Comprehensive Program of Measures to mitigate the consequences of the Aral catastrophe, the restoration and socio-economic development of the Aral Sea region for 2015-2018'.

No.	Project name	Executers/ Partners	Estimated cost, mln USD	Implementation terms	Job creation
1	**Increase of employment of the rural population** of the Aral Sea Basin region through the allocation of micro credits provided by seven commercial banks for the development of small businesses engaged 1) in processing local raw materials, 2) in providing services, and 3) in construction.	Commercial banks, Regional khokimiyats [halls] of the Republic of Karakalpakstan and Khorezm region (within the framework of job creation program).	**85.0**	2015	20 000
Total sum of costs for promotion of employment in rural areas of the Republic of Karakalpakstan					**85.0**
2	Major overhaul of the motor road 4R173 Kungrad-Muynaq on the section 0-91 km.	Republican road Fund of the Republic of Uzbekistan	**139.00**	2016-2020	
3	Major and medium overhaul of 270 km long inter-farm rural roads	City and regional khokimiyats [halls]	**15.46**	2015-2019	
4	Major and medium overhaul of 67 km long city streets, rural settlements, region centers and towns.	City and regional khokimiyats [halls]	**4.27**	2015-2019	
Total sum of costs for road infrastructure development of the Republic of Karakalpakstan			**158.73**		

Source: National Database of Legislation of the Republic of Uzbekistan. 2017. Accessed March 30. http://www.lex.uz/pages/getpage.aspx?lact_id=2738680. Content translated from Russian

Abstract in Korean

초록

카라칼팍스탄 (우즈베키스탄) 공화국의 감초 생산의 경제적, 사회적 및 환경적 영향

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감초뿌리는 세계 시장에서 경쟁력 있는 상품이 되었다. 감초는 많은 영역에서 사용되며 또한 새로운 분야에서도 인기를 얻고 있다.

이는 식품생산, 화장품, 의약, 경중공업에서 널리 사용된다. 감초는 우즈베키스탄의 북서쪽에서 풍부하게 자란다. 우즈베키스탄에서는 농부들이 야생 감초를 수집하고 뿌리를 가공 회사에 판매한다. 감초의 잎과 줄기는 가축 사료로 이용된다.

감초 생산을 통해 우즈베키스탄에서의 생태계, 경제, 사회의 세 가지 방식으로 도움이 된다는 것이 입증되었다. 우즈베키스탄의 환경 문제를 고려해 감초를 생산하는 것은 아랄 해의 가뭄, 토양 염분, 기후 변화, 모래 폭풍 및 물 부족과 혹독한 생태계의 부작용을 완화하는 데 중요한 역할을 한다.

저비용 토지개간 사업이며. 감초는 시골 지역의 저소득 농가를 위한 좋은 대체 농작물이다. 감초 생산은 1000 개 이상의 새로운 일자리를 창출 할 수 있다. 장기적으로 본다면 감초재배는 지역의 발전에 기여될 것이다.

우즈베키스탄에는 감초 재배를 위한 전제조건이 갖추어져 있다. 감초 재배,

가공 및 수출에 유리한 조건이 있다. 감초 생산은 높은 전망을 가지고 있다. 카라칼팍스탄 공화국의 주요 수출품 중 하나가 될 것으로 예상된다.

우즈베키스탄 정부는 카라칼팍스탄 공화국에서의 감초 생산을 촉진하고 있으며 각료회의는 2017~2021년 감초 생산을 위한 재배지 설립과 개발을 제공하는 두 가지 결의안을 발표했다.

감초 재배에 종사하는 생산자는 수많은 수수료 및 세금을 5년간 면제 받는다. 게다가 산업 단지를 조성하고자 하는 자에게는 4년간 융자지원도 있다. 이러한 조치는 감초생산의 새로운 수준 향상으로 기대된다.

이 논문은 카라칼팍스탄 (우즈베키스탄) 공화국에서의 감초 생산이 사회적 경제적 및 환경에 줄 영향에 초점을 맞추고 있다. 감초재배로 인한 긍정적인 면이 있다.

첫째 카라칼팍스탄의 악화 된 토양과 전반적인 생태계를 복원 할 수 있다.

또한, 감초의 수요와 가격상승으로 인한 생산지 확대는 농부와 기업의 수익을 증가시킨다. 감초생산은 농촌의 도로 기반시설의 발전을 촉발시킬 것이다. 마지막으로 카라칼팍 주민의 실업률과 빈곤율도 감소할 것이다.

기준어 (키워드): 감초 생산, 감초 뿌리, 감초 추출물, 영향 분석, 긍정적인 영향.

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