**Czech University of Life Sciences Prague**

**Faculty of Economics and Management**

**Department of Economics**


**Bachelor Thesis**

# Evaluation of investment costs into greenhouse buildings

**Author: Vadym Pronin**

**Supervisor: Ing. Jiří Mach, Ph.D.**

# CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

# BACHELOR THESIS ASSIGNMENT

Vadym Pronin

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**Evaluation of investment costs into greenhouse buildings**

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**Objectives of thesis**

The objectives of thesis are to assess investment costs into greenhouse agribusiness in Ukraine and Czech Republic and to establish the most appropriate and profitable business project with considering all factors.

**Methodology**

The basis of work will be drawn from current publications of greenhouse agribusiness specialists. Data will be collected through a structured questionnaire sent to the representatives of companies such as: Bayer and Estem. Technique and method for evaluating investments which will be used, are dynamic evaluation method as NPV and IRR.

**The proposed extent of the thesis**

60 – 80 pages

**Keywords**

Greenhouse, technology, Ukraine, Czech Republic, investment cost, hotbed, net present value, payback period

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LOOMIS, R S. – CONNOR, D J. *Crop ecology : productivity and management in agricultural systems.* Cambridge [England] ; Cambridge University Press: Cambridge [England] ; Cambridge University Press, 1992. ISBN 052138379.

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**The Bachelor Thesis Supervisor**

Ing. Jiří Mach, Ph.D.

**Supervising department**

Department of Economics

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**prof. Ing. Miroslav Svatoš, CSc.**

Head of department

Electronic approval: 12. 11. 2018

**Ing. Martin Pelikán, Ph.D.**

Dean

Prague on 15. 03. 2019

**Declaration**

I declare that I have worked on my bachelor thesis titled " Evaluation of investment costs into greenhouse buildings" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break copyrights of any their person.

In Prague on 14 March 2019 _____

Vadym Pronin

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# Evaluation of investment costs into greenhouse buildings

**Abstract:** The purpose of this thesis was to test investment cost into greenhouse buildings through main dynamic evaluation methods as Net Present Value, Payback period, Internal Rate of Return. Data was collected from two countries Ukraine and Czech Republic as potential places for investment.

Investment cost applicable for quonset greenhouse 10x45, (450$m^2$). In Ukraine initial investment equals $10650 per one greenhouse. For Czech Republic price is $15860. According to calculation, Net Present Value for Ukrainian construction is: $5,001.5 with discount rate 18% and project life 10 years. Internal Rate of Return: almost 27% after taxes. Payback Period takes approximately 3 years.

Czech greenhouse has Net Present Value much higher than Ukrainian, $23,722.4 with discount rate 1% and the same project life. Internal Rate of Return is equal 16.51$. Payback Period correlate with: 3.7 years.

**Keywords:** Greenhouse, technology, Ukraine, Czech Republic, investment cost, hotbed, net present value, payback period, budgeting, internal rate of return.

# Vyhodnocení investičních nákladů na skleníkové hospodářství

**Abstrakt:** Cílem této práce bylo otestovat investiční náklady do skleníkových budov přes hlavní dynamické metody hodnocení jako: čistá současná hodnota, doba návratnosti, vnitřní výnosové procento. Data byla získána ze dvou zemí, na Ukrajině a České republiky jako potenciální místa pro investice.

Investiční náklady použitelné na obloukový skleníky 10x45 (450m2). Na Ukrajině počáteční investice se rovná 10650 dolarů za jeden skleník. Pro Českou republiku je cena 15860 dolarů. Podle výpočtu, Čistá současná hodnota pro ukrajinské stavbu je: 5,001,5 dolarů s diskontní sazbou 18% a životnost projektu 10 let. Vnitřní míra návratnosti: téměř 27% po zdanění. Doba návratnosti trvá přibližně 3 roky.

Český skleník má čistou současnou hodnotu mnohem vyšší než ukrajinská, $ 23,722.4 s diskontní sazbou 1% a stejným projektovým životem. Vnitřní míra návratnosti je 16,51 $. Doba návratnosti koreluje s: 3,7 roky.

**Klíčová slova:** Skleník, technologie, Ukrajina, Česká republika, investiční náklady, pařeniště, čistá současná hodnota, doba návratnosti, rozpočtování, vnitřní výnosové procento.

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## 1. Introduction

A very significant event in the world history of Agriculture is the domestication of plants by mankind. Instead of depending on wild growth, it was realized that the planting of seeds or cuttings allowed the propagation of the type of plants desired. Another important breakthrough resulted from the need to protect the domesticated plants from abiotic and biotic stress factors. Protected cultivation emerged as a way to protect crops from adverse weather conditions allowing year-round production and the application of an integrated crop production and protection management approach for better control over pests and diseases. One of the best decision is greenhouses and the concept of a sustainable greenhouse system. Farmers can control all factors and produce more standardized product.

Private investment in agriculture is crucial to tap into the enormous potential of agricultural sector and enhance economic growth and development. This review highlights key economic and political challenges to private investment in the sector. It provides economic recommendations to attract more and better investment. The third chapter examine specific technologies of greenhouses which can be classified based on their shape, utility, construction, and covering materials. Theoretical part consists of investment goals and agriculture development. The fourth chapter provide an overview of Ukraine's and Czech's brief political economic and legal analysis. The last chapter practical part where determines through calculations the most appropriate, profitable, environmentally-friendly investment way in agriculture.

## 2. Objectives and Methodology

### 2.1. Objectives

The objectives of thesis are to assess investment costs into greenhouse. agribusiness in Ukraine and Czech Republic and to establish the most appropriate and profitable business project with considering political economic and legal factors.

### 2.2. Methodology

The basis of work will be drawn from current publications of greenhouse agribusiness specialists. Data will be collected through a structured questionnaire sent to the representatives of companies such as Bayer and Estem. Technique and method for evaluating investments which will be used, are dynamic evaluation method as NPV, PP and IRR.

**Dynamic evaluation methods**

They consider the time and risk factor; the basis is discounting of input parameters.

- Net Present Value
- Internal Rate of Return
- Payback Period
- Budgeting

**Net Present Value:**

$$NPV = \frac{Cash\ Flow}{(1+i)^t} - initial\ investment$$

In this equation:

$R_t$ = net cash inflow-outflows during a single period t

i = discount rate or return that could be earned in alternative investments

t = number of time periods

**Internal Rate of Return:**

$$IRR = NPV = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} - C_0 = 0$$

Where:

- $C_t$ = net cash inflow during the period t
- $C_o$ = total initial investment costs
- r = the discount rate, and
- t = the number of time periods

**Payback period:**

$$DPP = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} \geq I_0$$

Where:

- $O_1$ = initial investment (outflow)
- r = rate
- CF = Periodic Cash Flow

The net profit has been calculated by subtracting total production costs from gross (total) revenue and expressed as:

$\pi i = TRi - TCi$

where,

| |
|---|
| $\pi$ = Net profit |
| TR = Total revenue |
| TC = Total cost |

The depreciation of fixed assets according to the formula for the write-off method according to the sum of the numbers of years of useful life is determined by the formula

$DE = IC \times N_1 / N$

Where

*DE* is the depreciation expense for a complete financial year.

IC is the initial cost of fixed assets

$N_1$ is the number of years that remained until the end of life,

N is the full useful life of fixed assets.

## 3. Literature review

### 3.1. Investments and the cost of investment.

An investment is an asset or item acquired with the goal of generating income or appreciation. In an economic sense, an investment is the purchase of goods that are not consumed today but are used in the future to create wealth. In finance, an investment is a monetary asset purchased with the idea that the asset will provide income in the future or will later be sold at a higher price for a profit[1].

In the theory of Keynes, investments were defined as part of the income that was not used for consumption in the current period. Investments are here as the back of the savings process. In his macroeconomic theory, investigated the mechanism of the investment process, paying particular attention to the relationship between investment and savings. Saving for the deposit on a new car or next year's holiday is different from investing to achieve a long-term goal, such as building up a retirement pot or paying school fees. Saving generally involves putting money into a bank or building society account or money market fund that is relatively safe and pays a fixed, although typically low rate of interest. However, a savings plan may not earn you wealth enhancing returns over the long term and taking into account the impact of inflation the real purchasing power of your money will likely decline. Investing, on the other hand, can help you to both create and preserve your wealth. By taking an appropriate level of risk you may have the the opportunity to earn potentially higher long-term returns. It is important to remember that the value of investments, and the income from them, may fall or rise and investors may get back less than they invested.

The system of market relations, the center of which is the mechanism of the investment process, is structured in a certain way. Among the diversity of economic relations, it is possible to single out those whose actions are aggregated into separate interrelated sectors (markets). In these markets, various actors enter into economic relations, which also form groups that differ in the same behavior in individual markets.

As a rule, there are four markets and four groups of economic entities that interact in a certain way with each other and form a market economy system. So distinguish:

- a commodity market in which all goods and services produced in the national economy are wrapped;
- labor market, covering the production factor of labor;

[1] investopedia.com, 2018

- money market, which includes issues of demand and supply of funds;
- financial market where securities are traded.[2]

### 3.1.1. Getting ready to invest – discipline and planning are key

Planning means thinking carefully about everything you need to consider when developing your investment plan, including:

1. Defining your goals and your investment time frame.
2. Understanding asset allocation.
3. Looking after your investments over time.

Discipline means keeping market movements into perspective, recognising the potential impact of risk and regularly rebalancing your portfolio. It is also important to live within your means and decide how much you will set aside for investing before you start to develop your plan. We look at each of these in more detail in the pages ahead.[3]

### 3.1.2. Understand the risks

A number of specific risks can affect your investments. As part of developing your investment plan you should understand the potential risks. One of the ways to define risk is the likelihood that an investment's actual return will differ from expectations.

- **Country risk.** The risk that domestic events – such as political upheaval, financial troubles, or natural disasters – will weaken a country's financial markets.
- **Currency risk.** The risk that changes in currency exchange rates cause the value of an investment to decline.
- **Inflation risk**. Inflation is a measure of the rate of increase in general prices for goods and services. The risk that inflation poses is that it can erode the value or purchasing power of your investments.
- **Liquidity risk**. The chance that an investment may be difficult to buy or sell.
- **Market risk**. There are risks associated with the majority of asset classes. This is what professionals call market risk. Market risk is the risk that investment returns will fluctuate across the market in which you are invested.
- **Short fall risk**. Short fall risk is a possibility that your portfolio will fail to meet your longer-term financial goals.[3]

[2] Leijonhufvud, 2006.
[3] Vanguard, 2015.

### 3.1.3. Diversify to minimise risk

Spreading your money across a range of investments is one of the best ways to reduce risk and protect against sudden falls in any particular market, sector, or individual investment. With a diversified portfolio of investments, returns from better performing investments can help offset those that under perform. Diversification alone does not ensure you will make a profit, nor protect you fully against losses in a declining market. But it can reduce the risk of experiencing a serious loss of wealth as the result of being over-committed to a single investment. With your financial adviser's help, you can spread your potential risk by investing in a mix of investments. That way, when some investments are under performing, other investments can carry the load and help to even out the ups and downs in your portfolio. [4]

### 3.1.4. Investments into agriculture

What is Agriculture? Like all sectors, agriculture is really a spectrum of activities that overlap with each other and even with other sectors. The simplified version is that producers grow crops and raise livestock to sell to processors, who prepare and package the product before it ends up on the grocery store shelves. Producers and processors are in the agriculture sector, while the retailers are part of the retail sector - nice and clean.

However, the reality is that the agriculture sector also holds agribusinesscompanies. There is no hard-and-fast rule on what constitutes an agribusiness, but if a company is pulling half of its revenue directly or indirectly from agriculture, then it is generally considered an agribusiness. To see how this can get confusing, consider a company like PotashCorp, which officially merged with Agrium to form Nutrien in early 2018. Potash was basically a mining company, pulling stuff out of the ground and selling it. The stuff it pulled out, however, was fertilizer, so the big buyers were farmers. Therefore, Potash was an agribusiness despite the fact that it looked suspiciously like a mining company.

The same is true for manufacturers like Deere & Company (tractors). At first glance, they don't have anything to do with growing corn or slaughtering pigs. On the plus side, the range of companies with interests in the ag sector can open up interesting plays on the "people gotta eat" theme that sometimes drives ag investment.

Agriculture is one of the oldest industries in the world, so it is not a big surprise that there are a number of different ways to approach investing in it. [5]

[4] Vanguard, 2015.
[5] investopedia.com, 2018

### 3.1.5. Investment opportunities

New technologies, product platforms and innovative business models in agriculture technology and food systems will drive the shift from a conventional, environmentally harmful and socially detrimental form of industrial agriculture to a more socially just and environmentally sustainable food production and distribution system.

The agricultural technology sector is large. In the US alone it comprises over 8,500 companies generating over $1.3 trillion of revenue per year. Moreover, the volume of transactions in the agricultural sector is greater than $15 billion per year, with an estimated peak of over $70 billion in 2007.

Agricultural supply is expected to fall far short of demand over the coming decades, particularly as developing and emerging economies develop further and consumption levels increase. McKinsey, for example, estimates that land supply would have to increase by 250% over the next two decades, compared with the rate at which supply expanded over the past two decades. There is, therefore, vast room for technological development in today's agricultural sector to boost productivity and efficiency and we expect a transition to "smart" agricultural technologies over the next decade and beyond. Agriculture is a vast and growing sector; as such, it presents massive investment opportunities.

Going into the future, "smart" (and "climate smart") agriculture will include advanced irrigation and precision technologies, benign environmental residues from chemicals, an efficient distribution and marketing system for producers and a consumer-led demand market for sustainably grown foods.[6]

## 3.2. Greenhouse and Open-field production

Farming nowadays faces challenges with quantity and quality at a grander scale than ever before. Farmers have to keep up with technology to make better produce. This, of course, requires more significant expenses and the implementation of new methods. Growing crops in the open field was prevalent before, if not the only option, but the risk of losing your harvest due to adverse weather conditions makes it more difficult to manage the risk of weaker yields. That's why farmers found another way of growing their plants - in a greenhouse. Let's see what is the difference between growing in a greenhouse and growing in an open field, and what are the risks associated with both methods.

Open field cultivation is the conventional method of farming dating back to the middle ages. When using the land like this, you have to take care of the soil, sow seeds or plant

[6] Dr. Irani, 2012

transplants yourself, and protect them from hazards until harvest. And the real world can be dangerous: fast changes in climate, disease or pest attacks, eroding soil, etc. This is a lot to put on your plate since you want to be competitive in the market. Fluctuations of the weather are becoming even more unpredictable recently so you have to be prepared with an appropriate reaction to the emerging problems.

If you choose to use a greenhouse, you will have more control over the environment where your crops grow. You can efficiently manage temperature, the irrigation process, the air humidity, the light. You may use different methods to control all of these factors, and you'll be able to protect crops from pest attacks. By having that much power over the development of your crops, you can keep them healthier and can predict how much you will harvest. The cost for setting up a greenhouse may correlate with the advantages that the greenhouse can give. This means that by having a greenhouse your yield can be 10-12 times higher, making crop results more reliable compared to open field cultivation.

Like an example consider greenhouse tomato growing: The tomato sub-sector is among the rapidly evolving sub-sectors worldwide, due to increasing population, decreasing land sizes and changing climatic conditions. Consequently, various tomato production technologies have been developed to ensure adequate supply, good quality and the achievement of various farmers' objectives. Growing of tomatoes in greenhouses is one such technology. Estimated tomato yields and corresponding costs of different sizes and types of greenhouses have been documented from 2010. The national average tomato yield in Ukraine is 90 mT/ha in 2016. One greenhouse plant has a potential of giving up to 45 kg at first harvest, going up to 160 kg by the time it has completed its full cycle mostly in 1 year. Farmers can get 10 times more yield with greenhouse production system than with the open-field system of production. [7]

### 3.2.1. Profitability and economic analysis of technologies

Profitability is the perception that a crop would reward the producer with surplus income and it is often considered as the basis for a viable business.[8] In economic analysis, profitability is a relative term derived from profit, where profit is total revenue minus total costs.[9] Total costs, can be classified into variable costs and fixed costs. Variable costs are those associated with production including all inputs like labour, fertilizer, pesticide, seed-seedling, transport, among others.[10] To determine variable costs, market input prices and labour costs

[7] Agrofusion, 2016
[8] Lukanu et al., 2009
[9] Lipsey, 1975
[10] Engindeniz, 2007

are used. Fixed costs are costs that don't vary with production and they include administrative costs, interest on total initial investment costs, annual initial investment costs, interest on total variable costs and land rent.[11] Administrative costs have been estimated to be 2-7% of total gross production value or 3-7% of total costs (Kiral et al., 1999). Besides, in their respective studies, Engindeniz (2002, 2007), Engindeniz and Tuzel (2006) and Engindeniz and Gül (2009) estimated administrative costs to be 3% of variable costs. According to Chaudhary (2006), interest is defined as a sum paid for the use of capital and is calculated in terms of a rate or percentage. Various interest rates have been used in past economic analysis studies to calculate interest as a component of fixed costs. For example, Engindeniz (2007) used 6%, Engindeniz (2002) used 14%, Engindeniz and Gül (2009) used 12%, while Engindeniz and Tuzel (2006) used 11% as the interest rate charged on total variable costs and total initial investment costs. These interest rates were justified by the annual saving deposits interest rates on US$. Depreciation, also considered as a fixed cost, is defined as the loss in value of an asset over time, mainly as a result of obsolescence. In computing depreciation, a 10% allowance or salvage value is deducted from the purchase price of assets before dividing by their estimated economic life in years. [12]

Although gross margin has been used as a proxy for profitability in many studies, because it provides an estimate of the returns of a particular enterprise, it however, has the weakness of using only the variable costs, thus not including fixed costs and capital costs like equipments and buildings, capital interests and depreciation.[13] To calculate profitability and productivity of greenhouse tomato production, Bayramoglu et al. (2010) used Gross margins per hectare combined with Net Incomes in a comparative analysis between certified and uncertified greenhouse tomato producers. In their study, the gross margin was calculated as Gross Product Value (GPV) minus Variable Costs. The Farm Net Income from tomato production was calculated as Gross Product Value (GPV) minus production costs. The t-test was used to determine significant differences in mean values of variables across the producer groups. Their findings showed that certified tomato producers had a higher net income per unit area compared to uncertified tomato producers.[14]

[11] Engindeniz and Gül, 2009
[12] Chaudhary, 2006
[13] Sullivan and Greer, 2002
[14] Chaudhary, 2006

### 3.2.2. Analysis of agribusiness

In recent decades, greenhouse area has risen worldwide including Ukraine and Czech Republic, due mainly to the increased use of plastic greenhouses for growing plants. Site selection is a key factor for profitable and sustainable greenhouse production. The main factors determining location and site selection of a greenhouse production area are: cost of production, quality of produced yield, and transportation cost to markets. Obviously, cost and quality of production depend on the local climate and the greenhouse growing conditions. The level of investment in technology (simple or sophisticated greenhouses and equipment), as well as management, depends primarily on the local climate. Nowadays, long distance transportation means that production areas may be located far from major consumption centres, enabling the development of greenhouse industries in many climatically favourable areas around the world. In addition to transportation, marketing (standardization, packing etc.) also affects the overall cost of the products; they tend to be similar for different commodities coming from different geographical origins, but which compete in the same markets.

- When planning the installation of a greenhouse, two main questions must be answered:[15]
- Where will the production be marketed (domestic or export markets or both)?
- What type of commodities will be produced (edible or ornamentals)?

In general, optimum climatic conditions and low production costs (with good quality) are key to the selection of a location; transportation costs are also an important consideration when markets are far away. Other technical and socio-economic aspects (water and electricity supply, labour availability etc.) also influence production costs and competitiveness.[16]

### 3.3. Greenhouse technique, types and subspecies

The greenhouse is now better understood as a system of controlled environment agriculture (CEA), with a precise control of air, temperature, humidity, light, carbon dioxide, water and plant nutrition. The main purpose of greenhouse technology is to provide a good growing environment for successfully growing high quality plants round the year.[17]

Greenhouses can be classified based on their shape, utility, construction, and covering materials.

**Based on shape**

[15] Jensen and Malter, 1995
[16] Food and agriculture organization of the united nations, 2013
[17] Tiwari**,** 2013

Lean-to greenhouse is a greenhouse placed against the side an existing building except the northern side (in northern hemisphere). This lean-to-design makes the best use of natural sunlight and minimizes the requirement for roof supports. The roof of the existing building is extended with appropriate covering material and the greenhouse is properly enclosed. Figure 1 illustrates a side view of a lean-to greenhouse.

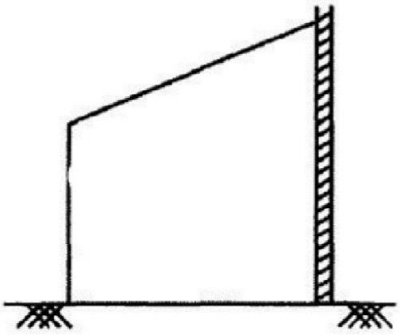


*Figure 1: Lean-to greenhouse*

Greenhouse of small size and is constructed on a levelled ground can use the Even span greenhouse design which has two roof slopes with equal pitch ad width. For single span type, the span generally varies from 5 to 9 m, whereas the length is around 24 m. The height usually varies from 2.5 to 4.3 m.

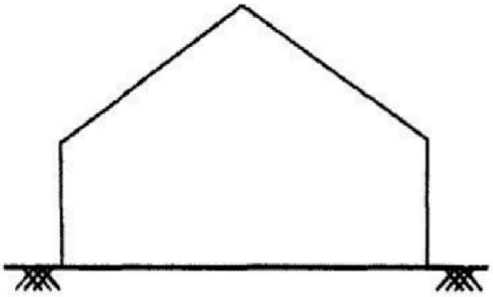


*Figure 2: Even span greenhouse*

On hilly terrain, uneven span greenhouse is constructed with the roofs of unequal width which make the structure more adaptable and durable to the side slopes of the hill. This type of greenhouses is no longer adaptable due to nowadays automation. Figure 3 illustrates the side view of an uneven span greenhouse.

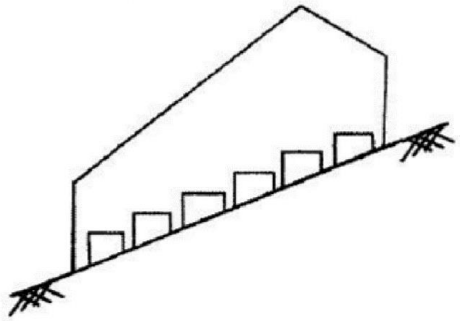


*Figure 3: Uneven span greenhouse*

Ridge and furrow greenhouse uses two or more A-frame greenhouses and it is connected to one another along the length of the eave. The eave serves as a furrow or gutter to carry rain and melted snow away. The walls inside the greenhouses are taken away, which makes the greenhouses into a structure with a single large interior. Combining of interior space reduces labour, lowers the cost of automation, improves personal management and reduces fuel consumption, as there is less exposed wall area through which heat escapes. The snow loads must be taken into consideration in northern countries since the snow cannot slide off the roofs as in case of the single greenhouses. The snow can even collapse the whole structure.

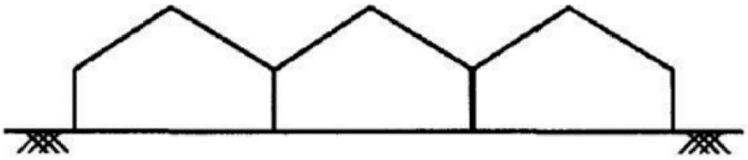


*Figure 4: Ridge and furrow greenhouse*

Saw tooth greenhouse is somewhat similar to the Ridge and furrow greenhouse but with natural ventilation system mechanism. Specific natural ventilation flow path develops in a saw tooth type greenhouse. Figure 5 illustrates the side view of a saw tooth greenhouse.

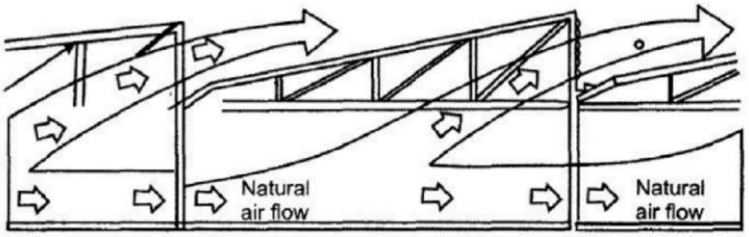



*Figure 5: Saw tooth greenhouse*

In quonset greenhouse, the pipe arches or trusses are supported by pipe purlins running along the length of the greenhouse. The covering material generally used for this type of greenhouses is polyethylene (plastic). This type of greenhouse is slightly less expensive than the gutter connected greenhouses and are useful when a small isolated cultural area is required.

These greenhouses are connected either in free standing style or arranged in an interlocking ridge and furrow. In the interlocking ridge and furrow type of greenhouses, truss members overlap sufficiently to allow a bed of plants to grow between the overlapping portions of adjacent houses. A single large cultural space thus exists for a set of houses in this type, an arrangement that is better adapted to the automation and movement of laborers. Figure 6 illustrates the side view of an interlock Quonset greenhouse. [18]

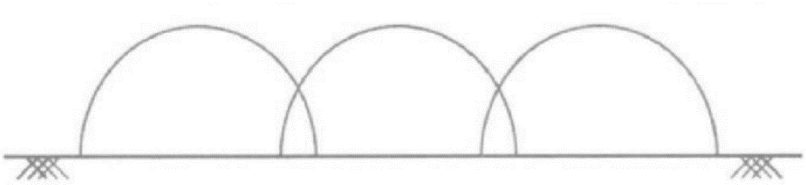


*Figure 6: Interlock quonset greenhouse*

**Based on Construction**

Structural materials predominantly influence the type of construction, although the covering materials is also influence the type. Span of the greenhouse dictates the selection of structural members and their construction. The higher the span, the stronger the material should, and the more structural members are used in order to make a sturdy truss frame. Simpler design can be used for smaller spans. Hence based on the construction, greenhouse can be classified as wooden framed, pipe framed and truss framed structures.

Greenhouses with span less than 6m, only wooden framed structures are used. Side posts and columns are made of wood without the use of a truss. Most commonly used are pine wood for it is inexpensive and possesses the required strength. Timber is also a good material with good strength, durability and machinability, though it is available locally.

If the greenhouse structure span is around 12m, pipes are used for the construction of greenhouses. Side posts, columns, cross-ties and purlins are constructed using pipes. Trusses are also not used in pipe framed type of greenhouse. The pipe components are not interconnected but depend on the attachment to the sash bars for support. Figure 7 illustrates a greenhouse with pipe framed structures.

[18] Le Khang, 2016

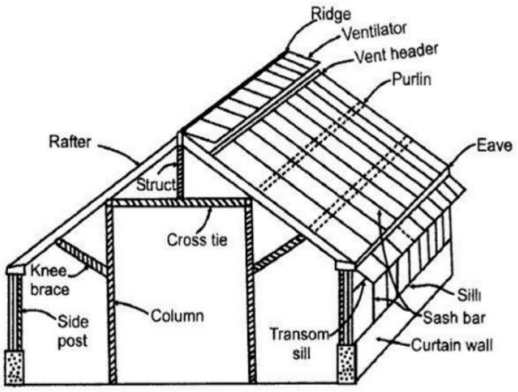



*Figure 7: Pipe Framed Structures*

If the greenhouse span is greater than or equal to 15m, truss frames are used. Flat steel, tubular steel or angle iron is welded together to form a truss enclosing rafters, chords and struts. Struts are support members under compression and chords are support members under tension. Angle iron purlins running throughout the length of greenhouse are bolted to each truss. Columns are used only in very wide truss frame houses of 21.3m or more. Most of the glass houses are truss frame type. Figure 8 illustrates a greenhouse with truss framed structures. [19]

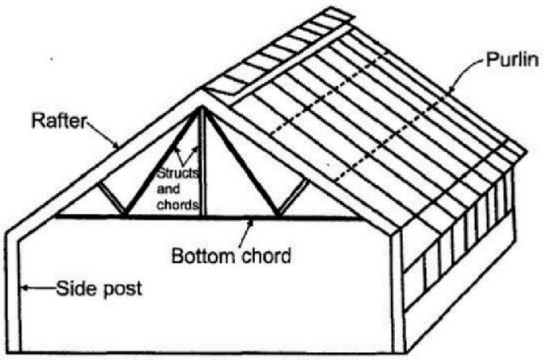



*Figure 8: Truss Framed Structures*

**Based on covering materials**

Covering materials are the prime and most significant component of the greenhouse structure. Covering materials have the direct influence on the greenhouse effect inside the structure, and they modify the air temperature inside the greenhouse. Based on the type of covering materials the greenhouses are classified as glass, plastic, plastic film and ridge panel greenhouses.

Prior to 1950 only greenhouse with glass as covering material existed. Glass greenhouse has the advantage of greater interior light intensity. These greenhouses have higher air

[19] Le Khang, 2016

infiltration rate which leads to lower interior humidity and better disease prevention. Lean-to, even span, ridge and furrow type of designs are used as the construction of glass greenhouse.

Flexible plastic films including polyethylene, polyester and polyvinyl chloride are used as covering material for plastic film greenhouse. Covering material made of plastics for greenhouse has become increasingly popular as they are affordable, and the cost of heating is less comparing to glass greenhouse. The main disadvantage of plastic film for covering material is its short lifespan. For example, the best quality ultraviolet (UV) stabilized film can last for four years only. Quonset design as well as gutter-connected design is suitable for using this covering material.

Polyvinyl chloride rigid panels, fiber glass-reinforced plastic, acrylic and polycarbonate rigid panels are employed as the covering material for ridge panel greenhouse. These panels can be used in the quonset type frames or ridge and furrow type frames. This sort of material is more proof against breakage and the light intensity is consistent throughout the greenhouse comparing to glass or plastic film. High grade panels have long life even up to 20 years. The main disadvantage is that these panels tend to collect dust as well as to harbour algae, which results in darkening of the panels and subsequent reduction in the light transmission. There is significant danger of fire hazard.

Traditional greenhouses are classified based on its shape, utility, construction, and covering materials. And that concludes all the basic types of traditional greenhouses.[20]

[20] Le Khang, 2016

## 4. Practical part

### 3.1. Ukraine analysis

Ukraine has everything to be a successful investment place. Moreover, in the coming years it has a clear and distinct potential to become a new growth space for Europe as a whole. Ukraine offers the best agricultural soils in the world, a sophisticated industrial infrastructure (for instance, the country is a renowned producer of space carriers), a well-educated, hard-working population that feels culturally and historically bound to Europe, and a good climate. Additionally, it has great connections and proximity to the EU as well as rivers and sea ports. What it had been missing, was an effective government doing its job dutifully and – a framework of security for each and every investor. The idea behind all the reforms in the last years has been to give Ukraine this kind of a government and this kind of a framework. This makes it worthwhile to look twice at Ukraine as an investment destination. This makes it worthwhile to look twice at Ukraine as an investment destination.

#### 3.1.1. Political analysis

The dominant and decisive feature of Ukraine political culture is distrust of the authorities and state institutions. This has manifested itself since the first years of independence of the Ukrainian state and was with all presidents and governments. Unfortunately, this also applies to the attitude to the law. Significant legal nihilism is inherent in our politicians and ordinary citizens. Where is this distrust? In my opinion, this is due to two factors. The first reason - the Ukrainian nation was formed in the absence of its own state, as part of other states. And this laid the foundations of our mass political consciousness for the attitude towards the state and its institutions as a foreign and hostile force. The reason for the second - during the formation of his own state did not happen its "appropriation" of citizens, society. The new state, its property and resources have been assigned to the most active strata of the political, administrative and economic elite of society. That is why the restored Ukrainian state has not become fully its own for most ordinary Ukrainian citizens.

But the critical attitude to the external power institutions also formed a feature of political culture as a rejection of authoritarian forms of government, which is inherent to most of our fellow citizens. And this essentially distinguishes us from the Russians, who are prone to the "autocratic" form of government, even if the president acts as the "king", who is elected by direct elections. According to a survey by the Razumkov Center in September 2017, 56.3% of Ukrainians consider democracy the most desirable type of arrangement for their country.

The negative attitude of most Ukrainian citizens towards authoritarianism is confirmed by political practice, including two revolutions (in 2004 and 2013-2014).

Negatively affect the political life of the country is the low political activity of citizens. As a result, it provokes the appearance of falsifications and illegal manipulations of votes.

| |
|---|
| *November 14, 1999 - Leonid Kuchma scored 56.25% of the vote in the second round. The turnout was 74.87%.* |
| *July 10, 1994 - Leonid Kuchma scored 52.58% of the vote in the second round. The turnout was 71.6%.* |
| *December 26, 2004 - Viktor Yushchenko won 51.99% of the vote on the second round. The turnout was 77.28%.* |
| *February 7, 2010 - Viktor Yanukovych gained 48.95% of the votes. The turnout was 69.70%.* |
| *May 25, 2014 – Petr Poroshenko won 54.70% of the vote in the first round. The turnout was 59.48%* |

Source: *http://www.cvk.gov.ua/*

According to this data, in average turnout in Ukraine takes 72.82%, which is not so good. During all elections there were violations of the electoral process. This was especially clear in November 21, 2004 - Viktor Yanukovych gained 49.46% of the vote. (This result provoked in Ukraine the so-called "orange revolution", the results of the elections were invalidated and the re-vote of the second round was assigned). The voter turnout was 81.12%. Political live in Ukraine critically unstable, it causes difficulties for all spheres, especially investments (national and foreign).

### 3.1.2. Economic analysis

Ukraine offers an enormous agricultural potential, particularly due to its vast and fertile arable land, part of which is currently idle, and its comparative advantage in production owing to low production costs and a strategic location. As the global demand for food increases driven by growing populations, higher incomes, and changing diets, Ukraine’s agricultural potential attracts a rising number of investors, both foreign and domestic. Indeed, private investment has increased over the last decade and Ukraine has now some of the largest farms on earth. Large multinational agri-food companies are planning to invest heavily in the sector in the coming years. However, several policy issues should be addressed to attract further domestic and

foreign investment, channel it to the areas where it is most needed, and maximise its positive impact.

The Ukrainian economy is showing signs of stabilisation after years of political and economic tensions (see Table 1). According to the IMF, in 2017 the country recorded a 2% GDP growth and a 12% annual inflation rate. Estimates for 2018 forecast a 3.2% growth and a 10% inflation. However, since 2014 and the conflict with Russia over Crimea, the country has suffered from territorial division. In 2017, Ukraine cut trade relations with two eastern regions (Donetsk and Lugansk) which are controlled by Russian-backed forces. The conflict in the eastern part of Ukraine - and more generally the souring of relations with Russia - is impairing the economy. Nevertheless, in 2017, the government has passed several reforms in order to foster household consumption and fiscal consolidation. The minimum wage was doubled last year and inflation was better controlled.

Financial aid from the IMF, the EU and the World Bank has helped the country address economic difficulties. In exchange, Ukraine has agreed to pass numerous reforms towards fiscal consolidation, economic stability, social inclusion, fight against corruption and poor governance. Ukraine's unemployment amounted to 9.7% of the active population in 2017 and is expected to decrease to 9.3% in 2018. It is estimated that the informal sector in Ukraine represents a third of the country's GDP. For today the discount rate in country equal to 18%.

*Table 1: Overview of GDP and other indicators of UA*

| ***Main Indicators*** | **2016** | **2017** | **2018** | **2019** | **2020 (e)** |
|---|---|---|---|---|---|
| ***GDP** (billions USD)* | 93.35 | 112.13e | 126.39 | 132.93 | 141.82 |
| ***GDP** (Constant Prices, Annual % Change)* | 2.4 | 2.5e | 3.5 | 2.7 | 3.0 |
| ***GDP per Capita** (USD)* | 2,201e | 2,656e | 2,964 | 3,133 | 3,361 |
| ***General Government Balance** (in % of GDP)* | -1.9 | -2.0e | -2.6 | -2.5 | -2.3 |
| ***General Government Gross Debt** (in % of GDP)* | 81.2 | 71.0e | 70.5 | 68.8 | 64.4 |
| ***Inflation Rate** (%)* | 13.9 | 14.4 | 10.9 | 7.3 | 6.0 |
| ***Unemployment Rate** (% of the Labour Force)* | 9.3 | 9.2e | 9.4 | 9.2 | 8.9 |
| ***Current Account** (billions USD)* | -1.39 | -2.09e | -3.92 | -5.17 | -4.97 |
| ***Current Account** (in % of GDP)* | -1.5 | -1.9e | -3.1 | -3.9 | -3.5 |

Source: *Source: IMF – World Economic Outlook Database, October 2018*

Agricultural yields in Ukraine are relatively low, (means fruits and vegetables). They are lower than in Western Europe and estimated at 40% of their potential. This may be due to the lack of technologies and knowledge, water mismanagement, land degradation, and the low use and misuse of fertilisers and plant protection products. According to official statistics, the actual use of arable land is 29.5 million ha against 32 million ha available. At least 1.5 million ha is either abandoned or used unofficially (UCAB, 2014a), which allows for significant expansion of arable land.

### 3.1.3. Legal analysis

Secure land rights are a necessary condition of any investment in agricultural production. They are critical to ease the process of land acquisition, incentivise long-term investment in land and sustainable land management, and facilitate access to credit by allowing land to be used as collateral. Similarly, secure and well-defined water rights encourage new agricultural investment and the upkeep of existing investments.

According to the World Bank Doing Business index, Ukraine has made excellent strides in improving its ranking under the indicator 'registering property' from 88 in 2014 to 59 in 2015, out of 189 economies. While the number of procedures for registering property remains higher than elsewhere in Eastern Europe and Central Asia (7 in Ukraine versus 5.4 on average in the region) and time spent is also higher (27 days against 23.1 in the region), Ukraine's improvement in both of these metrics is impressive. In 2012-13, Ukraine introduced an effective time limit for processing transfer applications at the land cadastre in Kyiv and made transferring property easier by streamlining procedures. Despite of progress in land policy, Ukraine still stuck with land-sales moratorium. For the past 15 years, the moratorium extension was a given. Most parliamentarians didn't even give it a second thought. Corruption and populism, which peaks during election years, are the reason why Ukraine has no functioning land market like most democratic nations.

However, securing land tenure rights encompasses not only registering but also protecting these rights. In property rights protection, Ukraine falls far short of Finland, one of the world's highest-ranked countries for protecting property rights, and lags Bulgaria, Hungary, and Czech Republic (Figure 1). Similarly, the Heritage Foundation notes that property rights protection in Ukraine is only slightly above Russia and far behind most Central and Eastern European transition economies. As described below, this may be due to several restrictions on

land rights and a weak formal judicial system, making the exercise of property rights difficult. [21]

### 3.1.4. Investment cost

To make the most accurate calculation, the data were taken from survey of the existing farmer. The example was carried out in Kakchovka town. It is one of the districts that make up Cherson region the southern part of the country, near the Black and Azov Sea (Picture 1).

**Area output**


*Picture 1, Estem*

| |
|---|
| 71232.939 m² |
| 0.071 km² |
| 17.602 Acres |
| 7.123 Hectares |
| 766744.981 Feet² |

**Cost**

First, for the evaluation of investments it is necessary to derive all the indicators (the cost of materials, labour, overheads, and target profit, Table 2). Data is suitable for quonset greenhouse 10x45 = 450m$^2$ (Picture 2).

*Table 2: Budgeting (UA)*

| **Sales** | | |
|---|---|---|
| *Price* | $/unit | 10,650 |
| **Direct costs** | | |
| *Material - pipes* | $/unit | 2,700 |
| *Material - film* | $/unit | 520 |
| *Material - paint* | $/unit | 260 |
| *Direct labor* | $/unit | 1,300 |

[21] Review of Agricultural Investment Policies of Ukraine, 2015

**Manufacturing overheads**

| | | |
|---|---|---|
| Variable overheads | | |
| *Indirect materials:* | $/unit | 185 |
| *Generator* | $/unit | 800 |
| *Water well* | $/m (usualy needed 15m) | 555 |
| *Pump* | $/unit | 370 |
| *Other variable overheads (second roof, third roof)* | $/unit | 650 |
| Fixed overheads | | |
| *Interest (rent)* | $ per Ha (10 year) | 500 |
| *Depreciation* | $ (10 years) | 2,210 |
| *Other fixed overheads:* | $ | - |

Source: *Own calculations*

The depreciation of fixed assets according to the formula for the write-off method according to the sum of the numbers of years of useful life (Table 3):

*Table 3: Depreciation (UA)*

| ***Year*** | **Amount** |
|---|---|
| *1* | 2210×10/ (10+9+8+7+6+5+4+3+2+1) = 401.8 |
| *2* | 2210×9/ (10+9+8+7+6+5+4+3+2+1) = 361.6 |
| *3* | 2210×8/ (10+9+8+7+6+5+4+3+2+1) = 321.4 |
| *4* | 2210×7/ (10+9+8+7+6+5+4+3+2+1) = 281.2 |
| *5* | 2210×6/ (10+9+8+7+6+5+4+3+2+1) = 241 |
| *6* | 2210×5/ (10+9+8+7+6+5+4+3+2+1) = 200.9 |
| *7* | 2210×4/ (10+9+8+7+6+5+4+3+2+1) = 160.7 |
| *8* | 2210×3/ (10+9+8+7+6+5+4+3+2+1) = 120.5 |
| *9* | 2210×2/ (10+9+8+7+6+5+4+3+2+1) = 80.3 |
| *10* | 2210×1/ (10+9+8+7+6+5+4+3+2+1) = 40.1 |

Source: *Own calculations*

**Capital Budgeting Techniques**

Net present value (NPV) is the difference between the present value of cash inflows and the present value of cash outflows over a period of time. NPV is used in capital budgeting and investment planning to analyze the profitability of a projected investment or project.

To calculate NPV, I must consider Cash flow during the project period. As an example, was taken following plants:

1) Cucumber (gherkin type), Table 4.

*Table 4: Cost of production 1*

| Culture | Cucumber Cormonous type | | |
|---|---|---|---|
| Hybrid | DIRECTOR F1 | | |
| Seasonality | Seasonality 1 | | |
| Planned cultivating area | m2 | 450 | |
| Article | Unit of measurement | Material requirements | Cost of materials |
| Seeds | seeds | 1350 | 64.08 |
| Mineral fertilizers | kg | | 63.3 |
| PPT | m2 | | 16.6 |
| Mulch p.m. | m2 | 450 | 7.5 |
| Tube of drip irrigation p.m. | m2 | 450 | 8.3 |
| Watering water | m3 | 180 | 3.3 |
| Rope p.m. | m2 | 4500 | 6.6 |
| Soil uplift | m2 | | 2.5 |
| Cost of land (rent) | m2 | | 0.83 |
| The cost of used vehicles | m2 | | 8.33 |
| Cost of labour hour | h | 344.3 | 127.5 |
| Total cost | | | 308.84 |

| Planned yield | 9000.0 kg |
|---|---|
| Revenue | $ 2333.3 |
| Profit | $ 2024.2 |

Source: *http://www.nunhems.com/*

2) Indeterminate Red-billed Tomato, Table 5.

*Table 5: Cost of prodaction 2*

| Culture | Indeterminate Red-billed Tomato | | |
|---|---|---|---|
| Hybrid | ASTONA F1 | | |
| Seasonality | Seasonality 2 | | |
| Planned cultivating area | m2 | 450 | |
| Article | Unit of measurement | Material requirements | Cost of materials |
| Seeds | seeds | 1350 | 129.37 |

| | | | |
|---|---|---|---|
| Mineral fertilizers | kg | | 35.41 |
| PPT | m2 | | 10 |
| Mulch p.m. | m2 | 450 | 7.5 |
| Tube of drip irrigation p.m. | m2 | 450 | 8.33 |
| Watering water | m3 | 180 | 1.66 |
| Rope p.m. | m2 | 4500 | 6.6 |
| Soil uplift | m2 | | 2.5 |
| Cost of land (rent) | m2 | | 0.83 |
| The cost of used vehicles | m2 | | 8.3 |
| Cost of labour hour | h | 344.3 | 80.94 |
| Total cost | | | 291.44 |

| | |
|---|---|
| Planned yield | 6750.0 kg |
| Revenue | $1750 |
| Profit | $1458.5 |

Source: *http://www.nunhems.com/*

According to this data NPV equal: (Table 6)

*Table 6: NPV (UA)*

| | | | |
|---|---|---|---|
| Discount Rate: | 18% | | |
| Life of Project: | 10 years | | |
| Initial Cost: | -10650 | PV | |
| Cash flow 1: | 3482.7 | 2951.4 | per year |
| Cash flow 2: | 3482.7 | 2501.2 | per year |
| Cash flow 3: | 3482.7 | 2119.6 | per year |
| Cash flow 4: | 3482.7 | 1796.3 | per year |
| Cash flow 5: | 3482.7 | 1522.3 | per year |
| Cash flow 6: | 3482.7 | 1290.1 | per year |
| Cash flow 7: | 3482.7 | 1093.3 | per year |
| Cash flow 8: | 3482.7 | 926.5 | per year |
| Cash flow 9: | 3482.7 | 785.1 | per year |
| Cash flow 10: | 3482.7 | 665.4 | per year |

| |
|---|
| $PV_n$ = 15651.5 |
| NPV = $PV_n$ – Initial investments |
| NPV = 15651.5 – 10650= 5001.5 |

Source: *Own calculations*

Net Present Value:

**$5,001.5**

PV of Expected Cash flows:

**$15,651.5**

With a discount rate of 18.00% and a span of 10 years, your projected cash flows are worth $15,651.5 today, which is greater than the initial $10,650 paid. The resulting positive NPV of the above project is $5,001.5 which indicates that pursuing the above project may be optimal. A positive net present value indicates that the projected earnings generated by a project or investment - in present dollars - exceeds the anticipated costs, also in present dollars. It is assumed that an investment with a positive NPV will be profitable.

**Internal Rate of Return**

The internal rate of return (IRR) is a metric used in capital budgeting to estimate the profitability of potential investments. The internal rate of return is a discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero. IRR calculations rely on the same formula as NPV does.

For comparison of calculated IRR (Table 7) we have to know Weighted Average Cost of Capital (WACC). A company's weighted average cost of capital is the average interest rate it must pay to finance its assets, growth and working capital. The WACC is also the minimum average rate of return it must earn on its current assets to satisfy its shareholders or owners, its investors, and its creditors. Due to no existing company I decided to take as WACC - discount rate (Bank is the main creditor for as in this situation).

*Table 7: IRR (UA)*

| Year | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|
| Initial Outlay | -10650 | | | | | |
| After-Tax Cash Flow | | 3134.4 | 3134.4 | 3134.4 | 3134.4 | 3134.4 |
| PV | 14086.4 | 2656.3 | 2251.1 | 1907.7 | 1616.7 | 1370.1 |
| Discount rate | 18% | | | | | |
| | | 2025 | 2026 | 2027 | 2028 | 2029 |
| | | | | | | |
| | | 3134.4 | 3134.4 | 3134.4 | 3134.4 | 3134.4 |
| | | 1161.1 | 984 | 833.9 | 706.7 | 598.9 |
| | | | | | IRR | 26.66% |

Source: *Own calculations*

Finally, we have results. IRR positive number which means the project is profitable.

**Payback Period**

In Table 8 we can see the results of PP calculation. Regular cash flow, and progressive profit over the time.

*Table 8: PP (UA)*

| | Cash Flow | Net Cash Flow | Discounted Cash Flow | Net Discounted Cash Flow |
|---|---|---|---|---|
| *Year 0* | $-10,650.00 | $-10,650.00 | $-10,650.00 | $-10,650.00 |
| *Year 1* | $3,482.70 | $-7,167.30 | $2,951.44 | $-7,698.56 |
| *Year 2* | $3,482.70 | $-3,684.60 | $2,501.22 | $-5,197.34 |
| *Year 3* | $3,482.70 | $-201.90 | $2,119.68 | $-3,077.66 |
| *Year 4* | $3,482.70 | $3,280.80 | $1,796.34 | $-1,281.32 |
| *Year 5* | $3,482.70 | $6,763.50 | $1,522.32 | $241.00 |
| *Year 6* | $3,482.70 | $10,246.20 | $1,290.10 | $1,531.10 |
| *Year 7* | $3,482.70 | $13,728.90 | $1,093.31 | $2,624.41 |
| *Year 8* | $3,482.70 | $17,211.60 | $926.53 | $3,550.94 |
| *Year 9* | $3,482.70 | $20,694.30 | $785.20 | $4,336.13 |
| *Year 10* | $3,482.70 | $24,177.00 | $665.42 | $5,001.55 |

Source: *Own calculations*

Payback Period: **3.0 years**

Discounted Payback Period: **4.8 years**

Cash Flow Return Rate: **30.4% per year**

### 3.2. Czech Republic analysis

The Czech Republic has been a popular destination for foreign capital and has attracted high volumes of foreign direct investment, since the 1990s. Membership in the European Union quickly became significant to postcommunist countries, including the Czech Republic. To post communist Europe, membership in the EU meant a consolidation of democracy and the market economy in these transition countries, and it meant security for all European nations. In an abstract sense, a reunification of Europe meant creating a new European citizenship: no longer should there be an iron curtain dividing Europe, but Europe would now be a continent of diversity and democracy, composed of citizens from many different “nations” under one European Union. The Czech Republic is home to many advantageous conditions – from its geographical location combined with a reliable infrastructure, availability of suppliers and specialized inputs needed by foreign investors, to quality of life and social stability, cost competitiveness, financial stability and availability of financing, investment incentives as well as a skilled workforce and a high educational level, all making it an attractive location for all types of investors and companies.

#### 3.2.1. Political analysis

The Czech Republic is a parliamentary, democratic and pluralist republic. The President is the chief of the State and is elected by direct public vote for a five-year term. The legislature is bicameral. The parliament consists of: Senate (the upper house), its 81 members elected by

popular vote to serve six-year terms and the Chamber of Deputies (the lower house) with its 200 members elected by popular vote to serve four-year terms. Parties need to secure 5% of the vote in order to obtain parliamentary representation. The ruling Government is comprised of a combination of centre-left and centre-right forces.

The current President is Miloš Zeman. A former member of the Communist Party of Czechoslovakia, the politician who – almost entirely by himself – made the Social Democrats (ČSSD) a force to be reckoned with and ultimately led them to a victory in the 1998 House1 election and was the Prime Minister for a full term (which is quite a feat in Czech politics). In the 1990s, he was known for his great oratory skills and for a no-holds-barred approach to his public speeches; he would never shy away from dirty language or outright threats. It was his government that joined NATO in 1999 and did most of the work on aligning Czech law with EU law in the so-called "legislative typhoon."

In Czech Republic the turnout the same as Ukraine on unsatisfactory level. Which says about low political activity of citizens.

*Election of the President of the Czech Republic held on 11 – 12 January 2013 - Zeman Milos Ing. Scored 24.21% of the vote in the first round. And 54.80% during the second. Turnout was 59.11%*

*Election of the President of the Czech Republic held on 12–13 January 2018 - Zeman Milos Ing. Scored 38.56% of the vote in the first round. And 51.36% during the second. Turnout was 66.0%*

Source*: https://www.volby.cz/index_en.htm*

Milos Zeman, the longest-standing figure in Czech post-communist politics, won a second term as president in January 2018, showing off his strong political instincts.

The current government is led by Andrej Babiš, The Eurosceptic, billionaire businessman Andrej Babis was sworn in as prime minister in June 2018 for a second attempt at forming a stable government.

Quite a controversial politician in the Czech Republic. General elections that took place at the end of 2017 led to the defeat of Social Democrats, which was only able to finish sixth after ruling the government with the centre-right ANO 2011 between 2013 and 2017. ANO, on the other hand, won 31 seats and its leader Andrej Babis became the Prime Minister. One of the richest people eastern Europe (almost 4 billion USD, wealthier than Donald Trump).

### 3.2.2. Economic analysis

The Czech economy had one of the strongest performances in the EU in 2017 as growth reached a level above expectations: +4.5% as opposed to an initial projection of 3.5% by the IMF. Inflation was at target level and unemployment hit the lowest level among 28-member

states (2.4% at the end of the year and during the first quarter of 2018). Labour shortages may contain growth to about 2.5% over the medium-term. Coupled with a strong aggregate demand, they could also push the inflation over the 2-percent target. Nonetheless, inflation rate is currently on par with the EU28 average (1.6% y-o-y increase as opposed to an initial projection of 2.3% by the IMF). Czech monetary policy has also been accommodative as the Central Bank decided to remove the cap on koruna-euro exchange rate, which resulted in the appreciation of the local currency. In fact, koruna was one of the strongest currencies in the world in 2017, appreciating nearly 16% relative to the US dollar. Lower capital spending and higher fiscal revenues have led to a surplus of 0.6% of GPD (see Table 9) while government debt dropped below 37% of GDP, one of the lowest levels in the EU. Solid economic performance and increasing wages (at about 5% on average) resulted in a surge in mortgages, however the indebtedness of Czech households still remains below EU average. In the long term, the government's objective is to make the Czech Republic one of the 20 most competitive economies in the world by 2020, developing infrastructure, strengthening institutions and governance, reforming the education sector, increasing the flexibility of the labour market and improving the business climate. Diversification of exports is also part of the strategy.

The economy of the Czech Republic is one of the most developed in Central and Eastern Europe, but remains vulnerable to external shocks due to its dependence on exports and inflows of foreign direct investment. For today the discount rate in country equal to 1%.

*Table 9: Overview of GDP and other economic indicators of CZ*

| ***Main Indicators*** | **2016** | **2017** | **2018** | **2019** | **2020 (e)** |
|---|---|---|---|---|---|
| ***GDP*** *(billions USD)* | 195.09 | 215.83e | 244.54 | 264.50 | 285.81 |
| ***GDP*** *(Constant Prices, Annual % Change)* | 2.5 | 4.3e | 3.1 | 3.0 | 2.5 |
| ***GDP per Capita*** *(USD)* | 18,485 | 20,402e | 23,085 | 24,938 | 26,916 |
| ***General Government Balance*** *(in % of GDP)* | 0.9 | 1.3e | 1.2 | 0.8 | 0.7 |
| ***General Government Gross Debt*** *(in % of GDP)* | 36.8 | 34.7e | 33.2 | 31.9 | 31.1 |
| ***Inflation Rate*** *(%)* | 0.7 | 2.4 | 2.3 | 2.3 | 2.0 |
| ***Unemployment Rate*** *(% of the Labour Force)* | 3.9 | 2.9 | 2.5 | 3.0 | 3.2 |
| ***Current Account*** *(billions USD)* | 3.04 | 2.32 | -0.88 | -2.43 | -3.34 |

| | | | | | |
|---|---|---|---|---|---|
| ***Current Account*** *(in % of GDP)* | 1.6 | 1.1 | -0.4 | -0.9 | -1.2 |

Source: *Source: IMF – World Economic Outlook Database, October 2018*

### 3.2.3. Legal analysis

Since the Czech Republic entered the European Union in 2004, the overall frame, philosophy, level of support, and level of regulation in agriculture and the agrarian sector have basically conformed to the rules and limitations of the EU Common Agricultural Policy. [22]

Agricultural entrepreneurs now farm around 4264 thousand hectares of agricultural land in the Czech Republic, around half (54 %) of the total area of the country. There is 0.42 hectares of agricultural land per one member of the population of the country, 0.30 hectares of this being arable land (roughly the European average). More than one-third of the land fund of the Czech Republic consists of forest land. There has been a decline in agricultural land of 15 thousand hectares and a rise of 16 thousand hectares of woodland since 1995. Whereas the area of arable land has continued to decline in recent decades, the area of land registered in the real estate cadastre as permanent grass land has risen by 71 thousand hectares. Half of the agricultural land fund is located in areas which are less favourable for farming (so-called LFA areas) and these are the very areas which support the creation and maintenance of meadows and pastures.

Most agricultural land is now owned by natural persons and legal entities. Some 599.7 thousand hectares of land were owned by the state on 31 December 2004 and rented out by the Land Fund of the Czech Republic. Czech and Moravian agriculture can be characterised by the serious fragmentation of land ownership and the large percentage of leased land (90 %) from the large number of lessors. The size structure of businesses differs greatly from the structure of businesses in the 25 member states of the European Union. Businesses with more than 50 hectares of agricultural land occupy 92.2 % of the total area of the agricultural land farmed. [23]

### 3.2.4. Investment cost

Firstly, the purchase of agricultural land is a long-term investment with a horizon of at least 5-7 years. However, there are cases (for example, the planting of new forests), when the return on investment starts in 80-100 years.

Its obvious advantage (unlike other investment tools and unlike other types of real estate) is that it practically does not imply maintenance costs. The only expense is the annual

[22] Bečvářová 2008
[23] The Ministry of Agriculture of the Czech Republic © 2009-2019

property tax, which is also the minimum for agricultural land (land tax rates are 0.20-0.25% of the "assessed value" per year.)

The advantages of low maintenance cost allow to invest into greenhouse buildings and get great revenue after. My goal is evaluate average investment cost according current data (Table 10). The profit from selling agricultural commodity in average approximately higher on 20% than in Ukraine. The information about materials and additional components are taken from HCV group, (Picture 5).

**Budgeting**

*Table 10: Budgeting (CZ)*

| **Sales** | | |
|---|---|---|
| *Price* | $/unit | 15860 |
| **Direct costs** | | |
| *Material - pipes* | $/unit | 3700 |
| *Material - film* | $/unit | 620 |
| *Material - paint* | $/unit | 280 |
| *Direct labor* | $/unit | 3770 |
| **Manufacturing overheads** | | |
| Variable overheads | | |
| *Indirect materials:* | $/unit | 200 |
| *Generator* | $/unit | 800 |
| *Water well* | $/m (15m) | 685 |
| *Pump* | $/unit | 370 |
| *Other variable overheads (second roof, third roof)* | $/unit | 750 |
| Fixed overheads | | |
| *Interest (rent)* | $ per Ha (10 year) | 1000 |
| *Depreciation* | $ (10 years) | 3685 |
| *Other fixed overheads:* | $ | - |

Source: *Own calculations*

### The depreciation

*Table 11: Depreciation (CZ)*

| *Year* | **Amount** |
|---|---|
| *1* | 3685×10/ (10+9+8+7+6+5+4+3+2+1) = 670 |
| *2* | 3685×9/ (10+9+8+7+6+5+4+3+2+1) = 603 |
| *3* | 3685×8/ (10+9+8+7+6+5+4+3+2+1) = 536 |
| *4* | 3685×7/ (10+9+8+7+6+5+4+3+2+1) = 469 |
| *5* | 3685×6/ (10+9+8+7+6+5+4+3+2+1) = 402 |
| *6* | 3685×5/ (10+9+8+7+6+5+4+3+2+1) = 335 |
| *7* | 3685×4/ (10+9+8+7+6+5+4+3+2+1) = 268 |
| *8* | 3685×3/ (10+9+8+7+6+5+4+3+2+1) = 201 |
| *9* | 3685×2/ (10+9+8+7+6+5+4+3+2+1) = 134 |
| *10* | 3685×1/ (10+9+8+7+6+5+4+3+2+1) = 67 |

Source: *Own calculations*

### Capital Budgeting Techniques

Net present Value (NPV) Method. This is one of the widely used methods for evaluating capital investment proposals. In this technique the cash inflow that is expected at different periods of time is discounted at a particular rate. The present values of the cash inflow are compared to the original investment. If the difference between them is positive (+) then it is accepted or otherwise rejected. The discount rate is 1% according CNB (Table 12).

*Table 12: NPV (CZ)*

| | | | |
|---|---|---|---|
| Discount Rate: | 1% | | |
| Life of Project: | 10 years | | |
| Initial Cost: | -15860 | PV | |
| Cash flow 1: | 4179.2 | 4137.8 | per year |
| Cash flow 2: | 4179.2 | 4096.8 | per year |
| Cash flow 3: | 4179.2 | 4056.2 | per year |
| Cash flow 4: | 4179.2 | 4016.1 | per year |
| Cash flow 5: | 4179.2 | 3976.3 | per year |
| Cash flow 6: | 4179.2 | 3936.9 | per year |
| Cash flow 7: | 4179.2 | 3898 | per year |
| Cash flow 8: | 4179.2 | 3859.4 | per year |
| Cash flow 9: | 4179.2 | 3821.2 | per year |
| Cash flow 10: | 4179.2 | 3783.3 | per year |

| |
|---|
| $PV_n$ = 39582.4 |
| NPV = $PV_n$ – Initial investments |
| NPV = 39582.4 – 15860 = 23722.4 |

Source: *Own calculations*

Net Present Value:

**$23,722.4**

PV of Expected Cash flows:

**$39,582.4**

With a discount rate of 1.00% and a span of 10 years, your projected cash flows are worth $39,582.4 today, which is greater than the initial $15860 paid. The resulting positive NPV of the above project is $23,722.4, which indicates that pursuing the above project may be optimal.

**Internal Rate of Return**

Calculation are based on future profit from one greenhouse. Initial Outlay stay the same, but revenue changed according the tax rate. In Czech Republic Income tax varies according to the taxpayer's status. A natural person has a rate of 15%, a legal person has a rate of 19%. I want to distinguish fact, that Cash Flow is taken after tax (Table 13).

*Table 13: IRR (CZ)*

| ***Year*** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** |
|---|---|---|---|---|---|---|
| *Initial Outlay* | -15860 | | | | | |
| *After-Tax Cash Flow* | | 3343.4 | 3343.4 | 3343.4 | 3343.4 | 3343.4 |
| *PV* | 15025.5 | 2656.3 | 2251.1 | 1907.7 | 1616.7 | 1370.1 |
| *Discount rate* | 1% | | | | | |
| | | 2025 | 2026 | 2027 | 2028 | 2029 |
| | | | | | | |
| | | 3343.4 | 3343.4 | 3343.4 | 3343.4 | 3343.4 |
| | | 1161.1 | 984 | 833.9 | 706.7 | 598.9 |
| | | | | | IRR | 16.51% |

Source: *Own calculations*

**Payback Period**

Payback period important technic which is use in evaluation of investment cost (Table 14). According PP investor can make a view about future businesses and projects. In our case initial investments equal to 15,860; that's why during the 0 year we have negative number.

*Table 14: PP (CZ)*

| | Cash Flow | Net Cash Flow | Discounted Cash Flow | Net Discounted Cash Flow |
|---|---|---|---|---|
| *Year 0* | $-15,860.00 | $-15,860.00 | $-15,860.00 | $-15,860.00 |
| *Year 1* | $4,179.20 | $-11,680.80 | $4,137.82 | $-11,722.18 |
| *Year 2* | $4,179.20 | $-7,501.60 | $4,096.85 | $-7,625.32 |

| | | | | |
|---|---|---|---|---|
| *Year 3* | $4,179.20 | $-3,322.40 | $4,056.29 | $-3,569.03 |
| *Year 4* | $4,179.20 | $856.80 | $4,016.13 | $447.09 |
| *Year 5* | $4,179.20 | $5,036.00 | $3,976.37 | $4,423.46 |
| *Year 6* | $4,179.20 | $9,215.20 | $3,937.00 | $8,360.46 |
| *Year 7* | $4,179.20 | $13,394.40 | $3,898.02 | $12,258.47 |
| *Year 8* | $4,179.20 | $17,573.60 | $3,859.42 | $16,117.89 |
| *Year 9* | $4,179.20 | $21,752.80 | $3,821.21 | $19,939.10 |
| *Year 10* | $4,179.20 | $25,932.00 | $3,783.38 | $23,722.48 |

Source: *Own calculations*

Payback Period: **3.7 years**

Discounted Payback Period: **3.8 years**

Cash Flow Return Rate: **23.0% per year**

## 5. Comparison of results for the Czech Republic and Ukraine

The main goal of the work was to evaluate investments into greenhouse facilities. The data were taken from existing experts in the field of agriculture relevant for today. I want to emphasize the fact that this work is not a business project or a direct investment plan. My task is to show which numbers the investor will have to face if he decides to engage in greenhouse agribusiness. With the help of certain indices, such as NPV, PP, IRR, I tried to show the effectiveness, profitability, and prospects of this field of investment.

The analysis was carried out for two countries: Ukraine and the Czech Republic. Given that the Czech Republic is a member of the European Union and its legal, economic and political position is extremely different from Ukraine. The differences are noticeable at all stages without exception. Because of the Czech Republic is a country related to the developed, the cost of investments is logically higher than in Ukraine, a developing country. However, if we are talking about guarantees of protection of property rights, law and order, the Czech Republic is coming forward with a significant margin. Specifically, about the results of the study, we can see the following indicators:

The investment value of a Quonset greenhouse type 450m2 greenhouse is on average $10,650. The key components of the budget you could see in section: Investment cost. The same layout of greenhouse in the Czech Republic will be equal to $15,860. But do not forget that despite the high cost of construction, your investment will be guaranteed protected, due to stronger the power of law in state. Also, by a more stable and forceful economy, the discount rate in Czech Republic is 1% instead of 18% in Ukraine. This directly affects the value of investments and their payback. You can see the result of the discount rate in the main indicators of return on investment, namely:

**Net Present Value (Ukraine):**

| | | |
|---|---|---|
| Discount rate | % | 18 |
| Life of Project | years | 10 |
| Initial Cost | $ | -10650 |
| NPV | $ | 5,001.50 |
| PV of Expected Cash flows | $ | 15,651.50 |

Source: *Own calculations*

Discount rate is taken from Nationla Bank of Ukraine (2019). Of course commercial discount rate higher than NBU, aproximatly on 7%.

**Net Present Value (Czech Republic):**

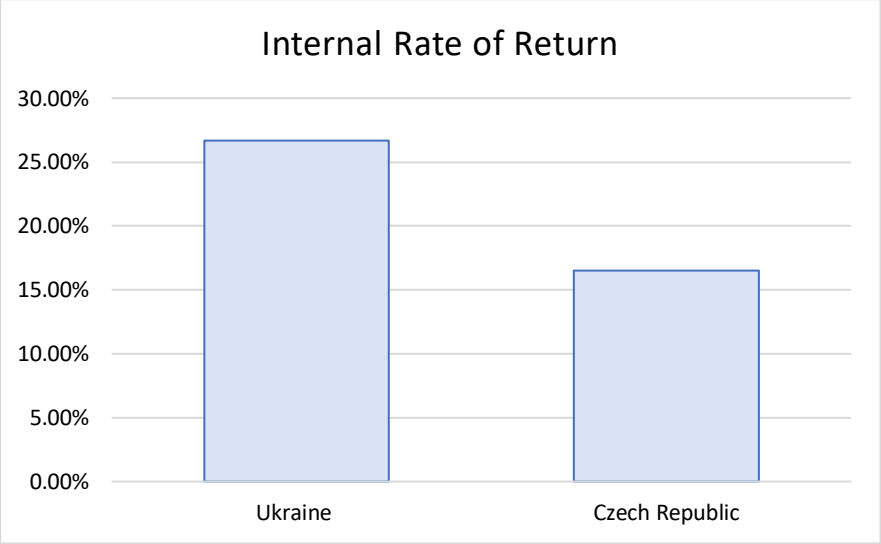
| | | |
|---|---|---|
| Discount rate | % | 1 |
| Life of Project | years | 10 |
| Initial Cost | $ | -15860 |
| NPV | $ | 23,722.4 |
| PV of Expected Cash flows | $ | 39,582.4 |

Source: *Own calculations*

Discount rate is equal 1% (CNB) instead of 8% (Commercial banks). According these tables discount rate has huge influences on NPV. If we will take 8% for example, the NPV stayed positive and profitable.

The difference between expected cash flows is equal almost $24,000 and the difference between NPV is nearly $19,000.

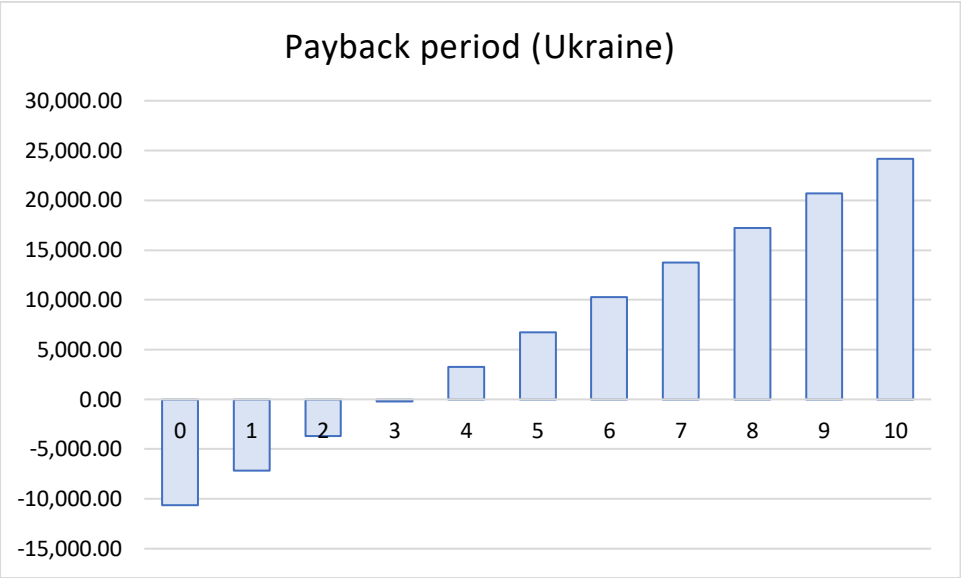
**Internal Rate of Return**




Source: *Own calculations*

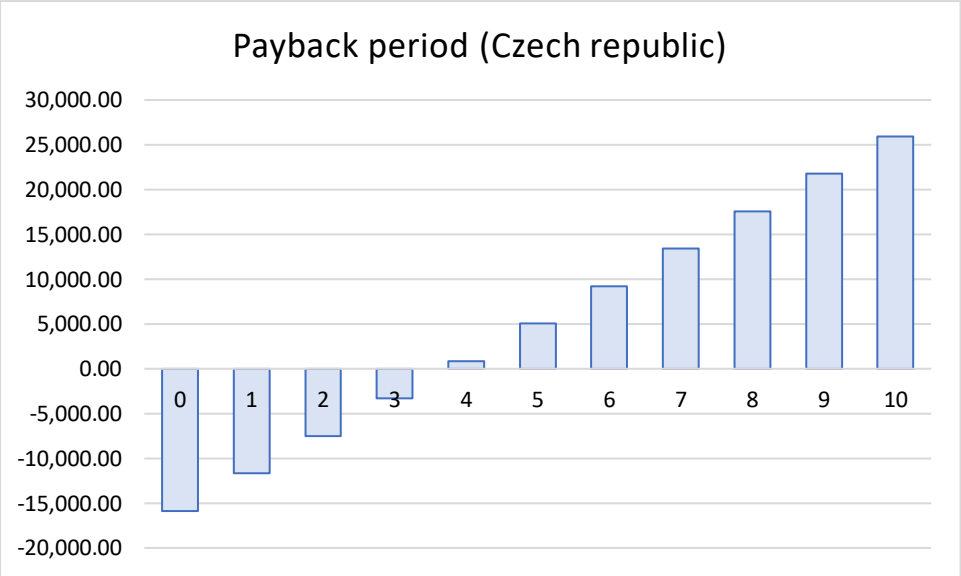
IRR in Ukraine higher due to low investment cost and mainly because 10% of tax rate instead of 19% in Czech Republic.

**Payback period**




Source: *Own calculations*

Initial investment – 10650$. We will return this amount for 3 years.




Source: *Own calculations*

Initial investment – 15860$. We will return outlay during almost 4 years.

## 6. Discussion and conclusion

### 6.1. Discussion

The paper presents data that meet the current situation in greenhouse construction. An analysis of the overall picture of the two states as potential investment places was also carried out. There is no doubt that information regarding political and legal analysis is subjective. Each individual investor relies on different facts and indicators and decides.

The main purpose of greenhouse technology is to provide a good growing environment for successfully growing high quality plants round the year (Tiwari, 2013). I totally agree with Mr. Tiwari. But he spoke about full controlled greenhouse with microclimate inside. The expenses on this construction will take vast amount. Such a project will have Payback period during many years. Nowadays exist a lot of ways how to make profit quickly without huge costs of investment. In my work you can see example of simple quonset greenhouse.

The above will give the reader only a superficial idea of the possibilities of greenhouse management. But based on these data, it possible to see that covered ground is profitable, albeit with a risk. The great importance is the level of bureaucracy and legality in the country in which the business is planned. Land issues are often not resolved quickly, but, on the other hand, you end up with an investment tool that is not expensive in terms of maintenance.

### 6.2. Conclusion

Modern agriculture is the science of the most rational, economic, environmental and technological way to use land, the formation of highly fertile soil, with optimal parameters (conditions) for cultivation plants. Must adhere to environmental principles. Under certain conditions, it is impossible to transform more than 40% of the territory, this leads to an ecological catastrophe. For agriculture, it is necessary to know the prospects for expanding the land fund for agricultural crops. needs. The land area on Earth is 14.9 billion hectares, but the area suitable for agricultural production is only 64% or 9.5 billion hectares.

I believe that the future lies in the efficient and rational use of land resources. For today, there are many different modern ways of growing agricultural products. From standard greenhouses to high-tech hydroponics equipment. Agricultural business is quite a risky field to invest. It is not enough just to establish cyclical production, satisfying your needs and the lenders. The difficulty lies in the fact that agriculture is very dependent on weather, environmental conditions. Like any other business, agriculture requires development and expansion. There are various ways, but in general they can be divided into two mains: extensive and intensive. The extensive method implies a method of increasing production volumes due

to quantitative factors of economic growth: additional attraction of labour, expansion of acreage. Intensive type of economic growth is characterized by an increase in the scale of production, which is based on the wide use of more efficient and qualitatively advanced production factors. The growth of production, as a rule, is achieved using more advanced technology, advanced technologies, scientific achievements, more economical resources, and advanced training of workers. Due to these factors, improved product quality, productivity growth, resource saving, etc. are achieved.

The second option for my opinion the priority option! Why choose greenhouse agribusiness? Because of intensive method of production. Minimization of risks using coating materials such as film, glass, polycarbonate, etc. Protection against insects and external environmental factors (strong wind, acid rain, hail, ultraviolet, etc.). At the same time, there is saving of land resources and space.

To use precisely the intensive way of production, investor must have higher capital than the traditional methods of farming. Therefore, it is necessary to provide analysis of payback and investment efficiency. In a capitalist economic model, only a profitable and rational business has a future.

If we compare Ukraine and the Czech Republic as a place for investment, we can draw such a parallel. In the world of finance, there are risky stocks and more reliable. The difference is that the final profit from risky stocks will be much higher than from reliable ones. However, the chance of losing everything is also high. Each investor determines the risk and makes a certain decision. Czech Republic right now it’s more safety choice, for investors. The rule of law outweighs the scales. Ukraine still has not land market, confusion with land question. But a huge potential does not leave investor’s enthusiasm.

There is a phrase: Man is what he eats (Ludwig Feuerbach). Modern agriculture can help to answer, who we are.

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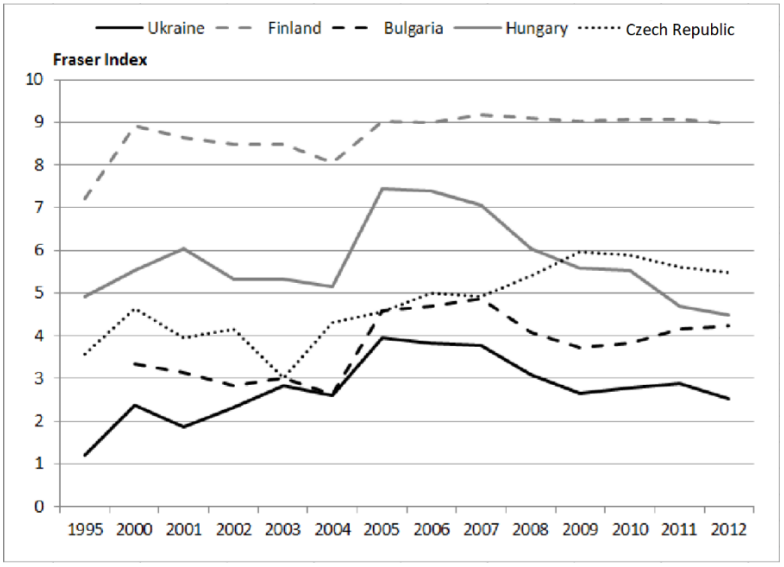
# 8. Appendix


*Picture 2: Tavrijsk, Kherson region, Ukraine, 46.762028,33.436117*




*Picture 3: Fraser index*

*Picture 4: Quonset greenhouse*

*Picture 5: HCV group a.s. Polní 780, Brno-střed*

**Interview**

1. Why you decided run greenhouse sustainable business rather open field production?

-At the beginning of my career, I started with 2 hectares not suitable for growing land. During the years from 2004 to 2005, was carried out comprehensive sweep, and starts the process of preparing the land for planting crops.

By 2014, the territory has increased to 30 hectares. The volume of grown vegetables scored a large-scale. Because of this, labour costs have become too high, people simply could not cope. I decided to sub-lease half of the territory to another farmer and start building up my plot with greenhouse facilities. This was done to create a compact complex without reducing production.

2. How long you run this business?

-I have been working with greenhouses for more than 4 years.

3. Can you measure territory which covered for today?

-For today, more than 7 hectares are under the film.

4. Do you have the standard size of greenhouses?

-We have different size greenhouses at the enterprise, but mostly it is 6x30$m^2$

5. Which technology do you use?

-We mainly use arched greenhouses with film without heating. But I must say that in the last 2 years heating has been actively used in parts of greenhouses.

6. Your main production plants?

-Production occurs depending on the market situation. Part of the product goes to regular customers under contracts. The other part is grown according to sales prospects. Often it is a cucumber, tomato, onion, or radish.

7. Due to which factors, you can make a profit?

-The main income comes from the early entry into the market.

8. In the percentage ratio, what's the different between investments and profit?

-The average payback is 2 - 3 years (depending on the type and size). Of course, this is without heating.

9. How government stimulates farmers to produce more? State and local level.

-In 2008 there was a special state program, according to which the farmer's expenses for develop their business were partly offset. The list included: fertilizers, seeds, small equipment, tools. I do not remember, unfortunately, its official name, but it helped a lot. To my regret, the program has been closed.

10. Land question. Privet ownership, collective ownership, and public.

-Today in Ukraine there are 3 types of agricultural land ownership. Private, collective, and state. Most of the land is leased from the municipal, regional or district government.

11. For your opinion, cancel of moratorium (selling land), will affect positive or negative on agriculture, and greenhouse business?

-Absolutely negative. Do not misunderstand me. I am in favour of opening a land market in Ukraine. This will give land owners more money from rent or selling their land. The cost of land comes close to the real value. But this cannot be done now. Ukraine is not ready for such a decision due to weak power of law in the country. Reform will not be carried out with the law. Because of corruption of the executive power, and the puppet justice, the reform is transformed into a monopolization of land resources.

*Andrey Komarov, CEO 'Olimp Agro'*