Kingdom of the Netherlands

Report on glasshouse technology in Poland with focus on energy deficiency

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I.

Introduction

This report focuses on the analysis, structure and potential of glasshouses and greenhouses industry in Poland. This type of agricultural production plays a significant role in the year-round production and supply of vegetables. This report presents the current situation, trends, future growth, and development opportunities.

II.

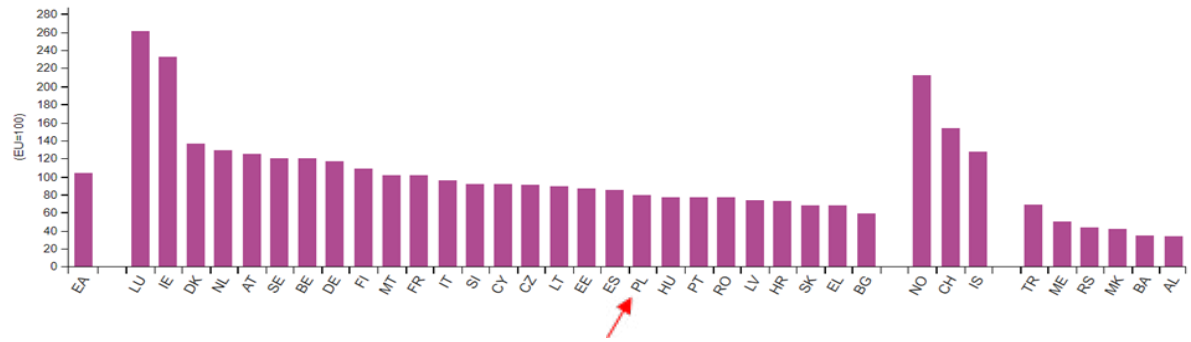
2023 market situation

1. Macroeconomic data and forecasts

Population – 37 million people plus in the last year, due to the war, an additional 2 million refugees from Ukraine found a home.

Poland is an economically stable country, although it has been slowing down since the outbreak of war in Ukraine with inflation eating away at a nominal wage growth, thus inhibiting consumption. However, the economy appears to be strong again. The Polish Ministry of Finance expects GDP growth in Poland in 2023 at the level of 0.3%. According to the fund's forecasts, economic growth is expected to accelerate to 2.4% in 2024 and 3.7 per cent in 2025. At the same time, the Ministry forecasts a decrease in inflation in Poland to 7.2% at the end of 2023. Inflation is expected to fall to 5% at the end of 2024 and to 3.6% at the end of 2025.

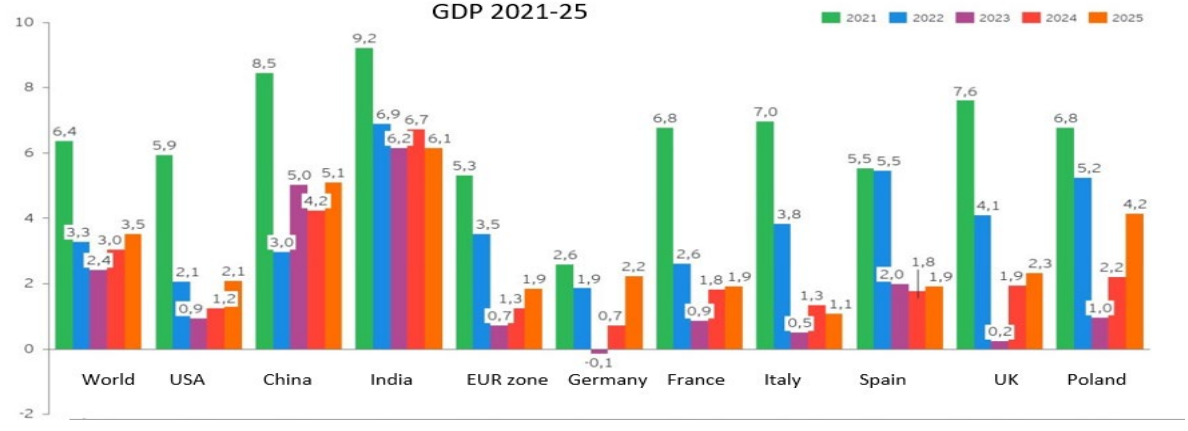
Volume of indices of GDP per capita, 2022



Note: countries are sorted according to their 2022 volume index per capita for GDP.
Source: Eurostat (online data code: prc_ppp_ind)

eurostat

growth
GDP 2021-25



Źródło: Oxford Economics, prognoza EY EAT (scenariusz bazowy). Wzrost PKB w ujęciu łańcuchowym i odsezonowanym.

2. Protected cultivation - area and harvesting

According to IERiGŻ (The Institute of Agriculture and Food Economics), vegetables in glasshouses and greenhouses were grown in 2022 on the area of 5220 ha. Tomatoes, grown on the area of 1750 ha, had the largest share. The area of cucumbers was 970 ha. The group of species referred to in the statistical statements of IERiGŻ as "other" vegetables – including peppers, eggplants, radish and lettuce – was cultivated last year on the area of 2500 ha (IERiGŻ Fruit and Vegetable Market). "Other" are greenhouse crops.

Harvests protected 2022 (thousand tons), according to the Central Statistical Office

Total	tomato	cucumber	Other
1,457.6	615.7	327.7	514.2

3. Greenhouses vs. glasshouses
The above data includes glasshouses and greenhouses

Greenhouses – polytunnels

There is no reliable data on the size of this market due to simple, easy to remove constructions. Is known that it is declining every year. An average grower is small with less than 1 ha. Exceptions constitue stronger, traditional regions – near Radom with pepper and cucumbers, Sandomierz and Kalisz with cucumbers and tomatoes. Tunnels are often not heated, not advanced, simply equipped, for short cultivation cycle.

Photo: different types of greenhouses

Glasshouses

Glasshouses represent professional, high tech vegetable production. The market size is well recorded as the sector is stable, consisting of large companies and focuses on this sector.

The glasshouse market in Poland has been stable for many years. The planted area in 2023 is ~1300 ha and within 100-200 ha there are small fragmentated farms.

In the Polish glasshouse industry consolidation trends are noticeable, the same throughout Europe – the number of growers is decreasing while their area is increasing.

Currently, it can be assumed that 50% of glasshouses are companies above 10 ha and the remaining 50% lower.

There are about 20 of the largest glasshouse companies, representing half of the market. These are almost only family businesses. The exeption is the largest company in Poland, which is a typical business venture.

Glasshouse companies in Poland are rather not associated and act as individual enterprises. There are several growers' groups but in practice the only to run common sales policy.

Photo: Glasshouses

After the energy crisis in 2021/22, a decrease in vegetable production in glasshouses was recorded by about 50 ha. This acreage either closed permanently or changed its profile to less energy-demanding soft fruits (strawberries, raspberries). This concerns older constructions, and it is a way of looking for other solutions for less efficient facilities.

4. Crops and fruit types

In terms of crops tomatoes prevail. The second crop is cucumber.

Greenhouses

In greenhouses, however, cucumbers dominate, and their popularity is increasing. It is mainly a PSP type (short, spine) for fresh consumption and for processing – pickling or self-fermentation, planted 1-3 times/season. Greenhouse tomatoes are for a short cycle, not grafted, for 6-8 trusses, beef varieties – pink and red ones. The third crop is pepper, which, in Poland, is produced only in greenhouses (partly heated or not heated), planted late with harvests in the months of summer and early autumn.

Glasshouses

In glasshouses tomatoes predominate, cultivated in year-round cycle. 70% of tomato type is pink beef with an upcoming trend over the last 10 years. Red varieties have 20% of market share and are declining. The remaining ones do not constitute a large part due to the frequent negative correlation of production costs and the price achieved.

The cucumber is grown by smaller growers or is an additional crop for those who need a larger range of products. The most common type is medium-length smooth, but more and more often a short spine type is grown. Planting occurs in 2-3 cycles. The long Dutch type is not cultivated in Poland.

The timing of planting for tomatoes and cucumbers is similar to BX.

LIT production (winter, with artificial light) covers about 100 ha; 99% tomato pink beefs for local retailers. The leading company is Citronex (78 ha).

5. Geographical characteristic

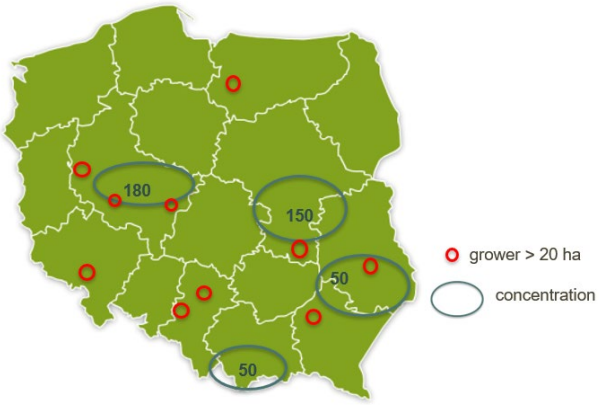
The area of Poland is almost 8 times larger than NL. With a large population, this gives Polish growers great opportunities.

The regions of the country differ slightly in climatic conditions. Light is the most important factor for cultivation, and western areas have a higher average light than eastern areas.

Glasshouse growers are dispersed throughout the country.

There are no clear discrepancies in the level of access to energy or water. However, more densely populated areas, the vicinity of large cities, have problems with workers in greenhouses.

On the map below, large growers >20 ha and more are marked in red. The map also indicates concentrations of smaller growers with an estimated total number of hectares. The largest concentration regions are close to Warsaw and Kalisz.



Greenhouses/polytunnels are even more dispersed with the several regions indicated. The largest are in the central part and the estimated size is 100 ha each.

III.

Sales of vegetables; retail structure

Retailers, the biggest ones of which are Biedronka, Lidl, Dino play the main role in the supply chain. Large growers are direct suppliers, smaller ones deliver to wholesalers and traders that supply to chains. Another distribution channels are local wholesale markets, purchase places for groceries, HoReCa, etc.

Vegetable consumption and awareness of healthy eating is like in other EU countries.

The tomato, most of which is the pink type, is a product for the domestic market. Only a small number is exported, while red varieties are more suitable and are often shipped to southern countries in summer, when prices fall. The popularity of the pink beef varieties deserves attention and is completely unique. Outside Poland, such varieties are cultivated on a larger scale in Asia – China, Korea, Japan. More than 95% of Polish consumers prefer this type. The reason is the sweetish taste and softer skin compared to the red ones.

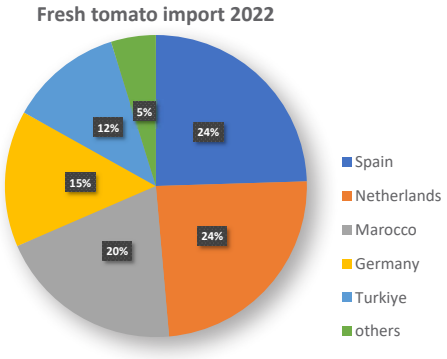
The cucumber in Poland is sold very fresh because the consumer is unlikely to buy foil-wrapped vegetables. Short, spine type is for fresh consumption, and processing – pickling or self-fermentative.

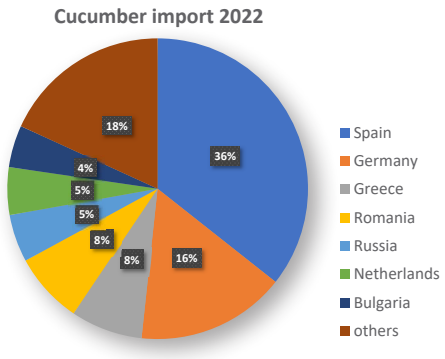
Big companies create their own brands around the products with special labeling, packaging, and positioning which guarantees them a stronger place on the market.

Although the Polish consumer is still price driven, it is important that they also prefer the Polish products, such as the unique pink tomato, which gives more protection to the local production.

Import and export 2021-22

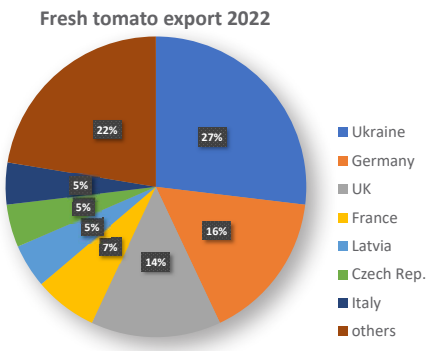
Vegetable	IMPORT			
	Value (k EUR)		Volume (T)	
	2021	2022	2021	2022
Tomatoes (fresh)	269176	312852	173640	180796
Cucumber (fresh and processed)	79432	97198	73145	79435

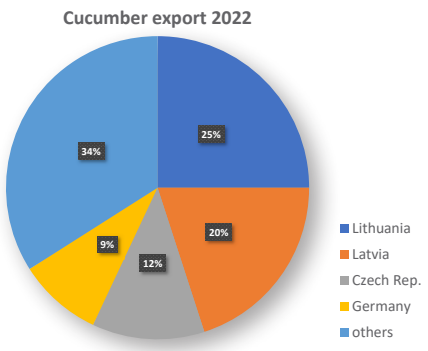




Vegetable	EXPORT			
	Value (k EUR)		Volume (T)	
	2021	2022	2021	2022
Tomatoes (fresh)	75431	99239	67427	82464
Cucumber (fresh and processed)	188809	23202	20080	19554

(European Fund for the Development of Polish Villages, *GUS)





IV.

Technologies

1. Types of buildings

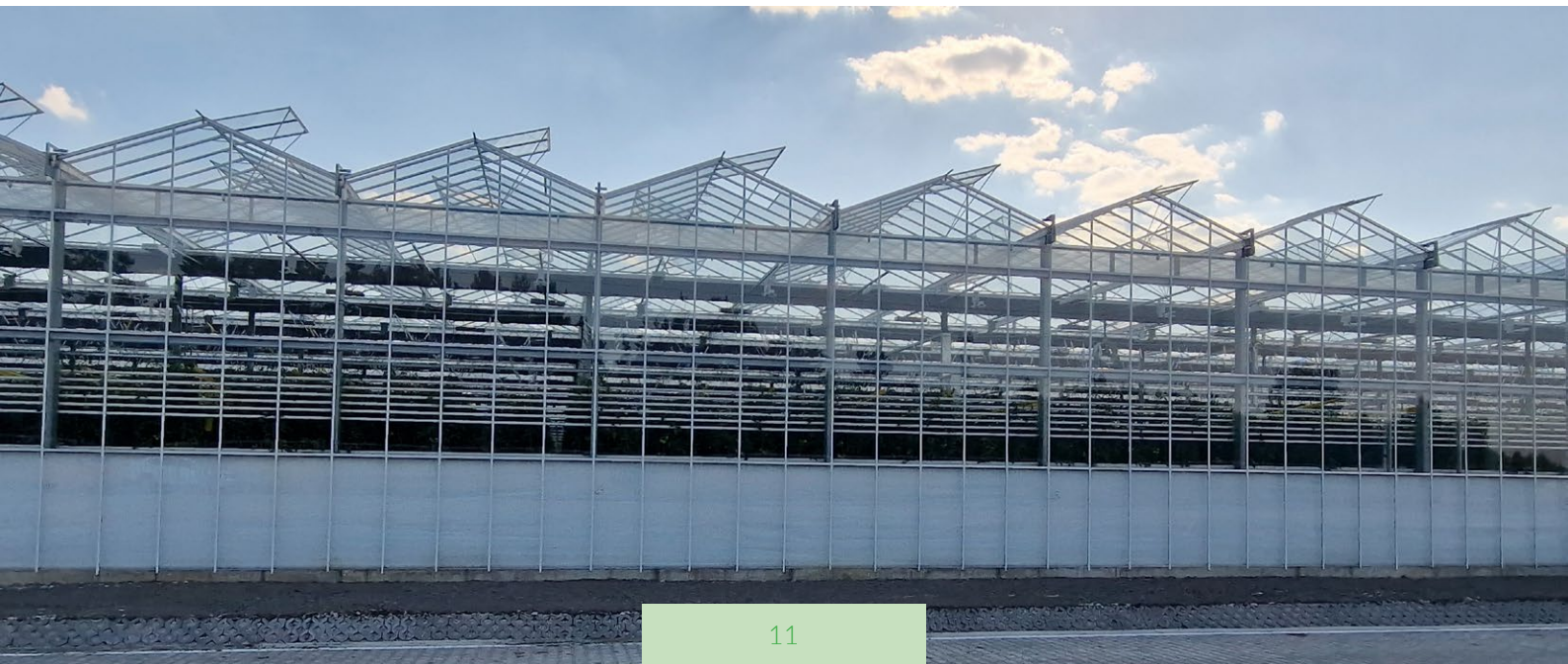
Greenhouses represent many different types, sizes and solutions of a local origin. Usually, these are simple constructions, sometimes old and low and small. The equipment is often only drip irrigation, connected to fertilizer tanks and heating boiler. Substrates used are peat, coco peat slabs or reused rockwool from glasshouses.

Glasshouse production is modern, Venlo type constructions, 100% soilless technology, equipped by global technology providers, such as Priva, Sercom, Hoogendoorn. Many of them were built between 2004 and 2013 when the market boomed. These older houses, 4-6 m high with a lower number of compartments, are still in the Kalisz region and the south of Poland. The new ones, up to 10 years old, are higher (7m), with compartments on several hectares. It can be assumed that 40% of glasshouses are new, not older than 10 years.

There are no geographical differences in advancement among growers.

2. Types of glass

The glass is tempered, float type. 20% buildings have diffused glass, but this glass is reducing some amount of light to be transmitted inside, which is disadvantage during dark Polish winters.



3. Production means, irrigation, and equipment

As the market is mature, there are many suppliers on the Polish market, mainly Dutch. The names of the major ones are mentioned in the following part. Not all are listed.

- **Substrate**

Cultivation in glasshouses is soilless, on soilless substrates and mineral wool (Grodan, Cultilene) plays the main role with others constituting only 5%.

- **Irrigation**

Drip irrigation with computer steering is in common use. The reuse of the nutrient solution (recirculation), popular in many countries, is working in a very small number of growers as it is not mandatory yet. It may be due to the high prices of fertilizers, recirculation will be used more often in the coming years.

- **Water**

Water is from deep boreholes or, rarely, ground level water. Thanks to own water intakes, there are no strict limitations on its use.

- **Fertilizers**

Single nutrient fertilizers are used to prepare irrigation solution in a majority of cases. Single elements are more flexible and cheaper components than ready mixed ones.

- **CO_2**

The pure gas from tanks is dosed, supplied by gas providers like Linde, Messer, Air Liquide. Extra CO_2 is commonly used and automatically fed.

- **Climate steering**

Climate computers are in almost all glasshouses with additional sensors to measure drain, moisture of substrate, steer temperature, vents, RH, screens, CO_2, fans, fog.

- **Shadowing**

Single or double curtains are the norm, in LIT production blackout curtains are often required by local environmental reasons.

- **Digital plant steering tools**

Advanced sensors to monitor plant growth parameters, such as: speed, fruit load, consumption, are installed at high tech growers. Such growing tools measure 250-300ha of protected vegetables production and help growers to take the right crop decisions. Technology providers are: Gremon Systems, Priva, Sors.

- **Pest control**

Bio control only, based on natural enemies and bumble bees for pollination (Koppert, Biobest, Brinkman); chemicals are used rarely and only when necessary, limited to a low number allowed. Chemicals negatively impact plant growth and, therefore, retailers and food chains carefully examine the fruit supplied against residues.

- **Harvest and sorting**

Manual harvest. Sorting machines become less popular with an increase of popularity of pink tomatoes, relatively soft and harvest with calyx harvested directly into boxes in the glasshouse. Other types of tomatoes and cucumbers are mechanically sorted.

Packaging depends on the requirements of a retailer. Tomato – carton boxes, flow pack and various types of trays. Cucumber to boxes, not wrapped.

- **Light**

LIT growers (winter production with lamps) and young plant risers are equipped with gas congenators and very few is still dependent of power station. Light sources are LED (85%) or sodium lamps (declining). Suppliers: Signify, Luminance.

- **Robotics**

These would be probably the most sought-after tools, but not present on the market yet. Induction carts from Bogaerts working at modern houses constitute the first step.

4. Heating and electricity

Polish glasshouses need to be heated during the entire production cycle.

Heating is the highest cost of glasshouse production (30-35%). 95% of the facilities are heated by a small fraction of coal. The common use of coal is the result of the state's economy, which supports fossil fuels and the lack of a solid long-term energy policy. Gas heating is not popular due to high costs, but it is often a local community environmental requirement. Now, changes from coal to other sources are not noticeable. Investments related to heating are rather directed towards additional, supporting methods.

There are glasshouses connected to a power station/public heating station and heating prices are slightly lower for them, but with the risk of dependency on an external supplier.

20% of glasshouses have a buffer tank installed.

Growers are increasingly using cogeneration. In Poland, unlike in NL the energy generated is in practice for own, internal use, not to be taken over by power stations.

A few percent of the greenhouse area use heat from biogas plants. Investing in biogas plants is necessary to meet the EU's 2030 targets whereby at least 60% of the municipal waste produced annually by all EU countries and reducing non-recyclable waste by 50%. The 2030 scenario, including new investments in electricity production foresee biogas to supply 2% of energy. At the end of last year, there were 378 biogas installations operating in Poland with a total capacity of 271.1 MW. Poland has a sufficient reservoir of substrates to ensure the economic existence of such installations. Agriculture and the agri-food industry have the greatest potential amounting to be approximately 120-150 million tons of useful biogas waste. 98% of biogas mass is still left to be used (Biomass „Biogas in Poland" warehouse). The investment in biogas plants is financed from the project supporting the implementation of the European Green Deal strategy.

Another energy solution based on organic fuels is biomass boilers. They are successfully used in several farms. The calorific value of biomass burned is not sufficient for full heating and has a secondary role.

European funds support recycling processes, aligned with the long-term reaching implications, causing that, in the next few decades, heat generation for heating systems based on the combustion of coal, oil and natural gas will disappear in favor of the use of renewable sources, such as wind, solar or biogas.

Investment in photovoltaic panels is also supported by the state and European subsidies and can complement the needs of the farm.

Considering limitations of the existing Polish energy network and regulations mentioned, the problem excess energy may constitute a problem as surplus buy-back systems do not work as well as in other countries. Selling is not clear and not easy. The solution may be energy storage which is also subsidized.

Although Poland is a large country with various local resources, there is no dependency between the area of Poland and energy source or preferences concerning the supplier.

V.

Investments

Glasshouse horticulture is becoming more and more capital-intensive due to the need of technical advancement.

The 2022 energy crisis has shown that the biggest limiting factor is energy.

The recipe for combating energy problems is to improve energy efficiency, i.e., all actions and solutions that will serve to reduce the amount of energy consumed in relation to the effect obtained.

Projects involving the construction of glasshouses with facilities can be financed by banks. For several years, a slowdown in investment in expansion has been noticed, which is caused by the increase in steel and other building costs and lower availability of external financing. It is also often a problem of the lack of willingness to continue by the young generation.

Over the recent years fewer than ten growers have decided to enlarge the area.

Since the pandemic, Polish companies have been most troubled by the uncertainty of the economic situation. The common shortage of workers, with rising labor costs, were ranked second among the factors that negatively affected the functioning of enterprises. Unemployment in Poland has a downward trend, and in May 2023 it amounted to only 5.1%. For a glasshouse owner, the entire labor costs are 21% of the total costs and are second after heating. Lack of people to work is currently the first limiting factor in the industry.

Most of the employees in glasshouses are foreigners from the East, Asian countries, or Latin America. The war in Ukraine has even increased the problem with workers.

In Poland, like in in other countries, robotization is the future. Growers would gladly invest in harvesting or plant maintenance robots if they were available. As yet, there are no such commercial devices yet. Transport, sorting, packaging, climate control and fertigation are automatically steered, but manual work is still a must.

Polish growers follow news, ideas, and improvements. The Netherlands is the leader in technology, genetics, varieties, and know-how. Many global providers and industry leaders are present on the market. Consulting companies are also active, helping to apply the best practices of the latest technology. Polish growers are always present in large numbers at fairs and conferences in BX, e.g., GreenTech, Global Tomato Congress, Fruitlogistica in Berlin, Fruit Atraction in Madrid. They are keen to visit demo places and research centers to keep up to date, they are open for any novelties in products, ideas, and solutions.

VI.

The future according to the Polish glasshouse owner

Protected vegetable is part of food production. Despite obstacles and various difficulties, people must eat.

Until recently, there have been only typical growers on the market, now there are big Polish companies which play a large role in the production and trade of fruit and vegetables on the local or global scale.

Large growers are well prepared for market dynamics challenges. They have a stable situation with a stronger market position. Companies with an established position on the market are expanding, sometimes diversifying their assets. Family businesses are taken over by the next generations.

The global trend is noticeable – the big companies are getting bigger by new investments or acquiring smaller ones.

Large growers consider investments aimed at increasing the acreage or further modernization. Polish growers, except for Citronex, do not consider expansion beyond borders. Perhaps it is a time of temporary stagnation on the market, verification of strength and quality.

ToBRFV (Tomato Brown Rugose Fruit Virus)

ToBRFV is the most dangerous disease of tomato today. In Poland, the first infection was reported in 2021. So far, the virus has been detected in several places and it has led 2 growers to change the crop. This new disease is the biggest treat, dangerous for the production economy, directly eliminating companies. The task is to find methods against it – hygiene, vaccines, new resistant varieties. 99% of growers have installed disinfectant stations and entrance mats. Disposable clothing, gloves become a standard. ToBRFV is a new, top priority challenge for growers and suppliers.

VII.

SWOT analysis of the Polish glasshouse zoomed on future dynamics, energy transformation and investments

Strengths:

- Modern technologies in a majority of companies
- Strong market position of large growers
- Easy to invest, adopt and transform
- Ability to rapidly implement new solutions
- Market knowledge
- Well-trained and experienced management
- Access and openness to news and best practices
- Year-round production; reliable and stabile suppliers
- Labor costs still lower than in many EU countries
- High quality products to offer
- Healthy foods thanks to use of biological control
- Product marketing awareness; brands and positioning/specialization (by type of varieties, type of consumer, etc.)
- Relatively cheap and available land

Weaknesses:

- Coal dependency
- Shortage of employees
- Limited access to reusable raw materials and biomass
- Limitation of land for photovoltaics and windmills
- Dependence on energy suppliers
- Small capacity of existing energy net to resale surplus; low motivation to invest in green energy
- Still small caloric efficiency of new, modern methods
- No partnership between growers, no strong growers' group
- No long-term state policy for the industry; glasshouse production is marginal compared to orchards or agricultural production; no specific state support
- Very unstable income and costs
- Increasing number of certificates and procedures; bureaucracy
- Lack of synergy between local authorities or state organizations
- Glasshouse products are still perceived as "artificial"
- Lower light conditions versus BX

Opportunities:

- The size of the market and the country still creates investment opportunities
- Space to develop energy efficiency with new technologies
- A lot of waste material to reuse (energy, CO_2)
- Potential in reuse (e.g., irrigation) to reduce costs
- Access to international nets (Kaufland, Lidl, Netto, etc.)
- Consumers' awareness of the importance of vegetables consumption in the diet
- Polish origin is locally prioritized
- Constantly emerging new product opportunities caused by environmental changes (e.g., water restrictions and salinity in North Africa, increasing number of emigrants in Poland)
- big country, smaller concentration of growers, lower risk of disease transmission

Threats:

- Unstable situation in Eastern Europe
- Strong competition from Turkey, Morocco and NL
- Lower yield performance vs. NL
- New diseases (ToBRFV, CGMMV)
- CO_2 emission fee and regulations
- Volatile prices of energy, coal, fertilizers, and other products
- Banks are more unlikely to invest (higher cost of invested capital)
- Decreasing profitability forcing growth in volumes

VIII.

Conclusion

Despite the energy crisis and the war in Ukraine, glasshouse production in Poland is stable.

The role model of the modern grower is business oriented manager, often seen in larger companies.

Polish growers are open to new technologies, innovations, and cost optimization to increase economics. Coal heating, old fashioned and consuming the largest share of costs, needs to be changed in the long-term period, and it must follow the state direction, which is still not clearly regulated.

The industry is closely dependent on energy. Innovations in energy, energy-saving solutions are particularly needed.

Another challenge is to optimize labor costs and mitigate the impact of lack of people through robotization, which might to be the next step.

The increase in output prices will not be compensated by an increase in sales prices. Increasing productivity is also possible, although it is threatened by new diseases, which can lead to a significant decrease in production, change of profile, etc.

Poland applies the same technologies, it has similar limitations and opportunities as other EU countries. Although the Polish grower does slightly differently, the interests remain the same as those of the Dutch. Both countries are a short distance away and in a similar climatic zone.

Polish growers follow prices and trends on the Dutch market. Due to large imports, local supply fluctuations are largely dependent on the harvest and price in BX. Even though Polish growers grow different varieties, the crop remains the crop and this dissimilarity gives only partial protection of local prices and demands.

Poland is the follower and the sentence frequently heard in the industry is “what happened in Netherlands yesterday, will happen in Poland tomorrow”.

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