



Circular Czechia – for a sustainable bioeconomy in the landscape

Barriers and incentives for the transition to sustainability

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About Four Leaves Finance

We are a team of professionals with a wide range of experience in various fields, which combines a passion for change, for a new model of agriculture and related industries. We want to support the transformation of small and medium-sized enterprises (SMEs) from linear to circular production.

Our goal is to move from commodities to products with higher added value. Farmers are partners for us in achieving these goals. Together we strive to improve the quality of food and soil:

Sustainability will no longer be an added value, it will become a prerequisite for business.

“The change towards sustainable agriculture and food in the Czech Republic will be possible depending on our ability to work together as a society. In keeping the traditions that connect us to food, but also to have a closer relationship between who produces the food, and who eats the food. In other words, we must do alternative food networks” – Juan Martin ESPINOSA MENDOZA

O Four Leaves Finance

Jsme tým profesionálů se širokou škálou zkušeností z různých oborů, které spojuje vašeš pro změnu modelu zemědělství a souvisejících průmyslových odvětví. Chceme podpořit transformaci malých a středních podniků z lineární na cyklickou výrobu.

Naším cílem je přejít od komodit k produktům s vyšší přidanou hodnotou. Zemědělci jsou pro nás partnery při dosahování těchto cílů. Společně se snažíme zlepšovat kvalitu potravin a půdy:

“Proměna zemědělství a potravinářství v České republice směrem k udržitelnému modelu je možná díky naší schopnosti spolupracovat jako společnost - udržování tradic spojených s jídlem,

i užší vztah mezi tím, kdo jídlo vyrábí a kdo jídlo jí. Jinými slovy, musíme vytvořit alternativní potravinový network”

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Coming from the part of Mexico where the desert and the jungle split- The land where humans are made from corn, at least is what Mayans say. Studied a bachelor in Environmental Engineering, discovering a passion towards the environmental & social issues of agriculture. Making research in soil pollution, and in the environmental impacts of GMOs usage. Went to Toulouse, France to study a master in Agroecology of the Food Systems. Specializing on how to make the transition towards alternative food systems, through innovation based on Agroecology principles.

Martin is a cultural promoter, which has organized exhibitions, festivals, concerts and debates in Prague. Interested in politics, feminism, and the integration of foreigners in the Czech Republic.



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Summary

The circular economy is a concept getting more recognition and applied more and more in different sectors. It is usually referred to as the model that will bring sustainability in our societies. It seems that it will keep gaining relevance with the rising issues by the dominant linear economy, plus the demand for more resources by the growing population. For instance, the current drought and forestry crisis in the country affects nature, the landscape and us humans as well. People in the countryside are the first to be hit: farmers, forest managers, fishers, food & wood processors.

The Czech Republic is facing several constraints due to the current economic model which favors big players, the economy of scale, specialization, and the extensive use of agrochemicals. The main causes are monocultures, use of agrochemicals, power concentration, aging of farmers, and land access. Leading to soil deterioration, water pollution, governance by a handful of enterprises, dependence on external inputs, and reduced food sovereignty.

However, in the current context, there are opportunities for positive change in the bioeconomy sectors. For example, EU policy instruments such as the "green agreement", raising awareness towards the environmental crisis, traditional practices of peasant and indigenous cultures, and rejecting current "conflicts of interest" related to the national government.

In this paper we provide insights on the barriers and incentives for a circular economy in the bioeconomy sectors: agriculture, forestry, aquaculture, and related industries. With a SWOT analysis we aim to highlight how to make this transition to sustainability possible in the Czech Republic.

Souhrn

Cirkulární ekonomika je koncept, který je více uznáván a je více využíván v různých odvětvích. Obvykle se označuje jako model, který přinese udržitelnost do našich společností: přechod z lineárních na cirkulární systémy. Zdá se, že s rostoucími problémy dominující lineární ekonomiky bude stále nabývat na důležitosti a navíc s rostoucí populací bude poptávka po dalších zdrojích. Například současná krize sucha a lesnictví v zemi, která ovlivňuje přírodu, krajinu i nás lidi. V první řadě ovlivňuje lidi na venkově: farmáře, lesní hospodáři, rybáři, zpracovatelé potravin a dřeva.

Česká republika čelí několika omezením kvůli současnému ekonomickému modelu, který upřednostňuje velké hráče, úsporám z rozsahu, specializaci a rozsáhlému používání agrochemikálií. Hlavními příčinami jsou monokultury, využívání agrochemikálií, stárnutí zemědělců a přístup k půdě. Vede ke zhoršení stavu půdy, znečištění vody, správě několika podniků, závislosti na vnějších vstupech a snížení potravinové soběstačnosti.

V současné situaci však existují příležitosti pro pozitivní změnu v odvětvích biohospodářství. Například politické nástroje EU, jako je „green deal“, zvyšování povědomí o ekologické krizi, tradiční postupy rolnických a domorodých kultur a odmítání současných „střetů zájmů“ souvisejících s národní vládou. V tomto článku poskytujeme přehled udržitelnosti odvětví biohospodářství: zemědělství, lesnictví, akvakultura a související průmyslová odvětví. Pomocí SWOT analýzy zdůraznit, v jaké fázi se nacházíme a jaké jsou podmínky pro změnu udržitelných systémů.

V tomto příspěvku uvádíme přehled udržitelnosti odvětví biohospodářství: zemědělství, lesnictví, akvakultury a souvisejících průmyslových odvětví. Pomocí SWOT analýzy zdůraznit, v jaké fázi se nacházíme a jaké jsou podmínky pro přechod na cirkulární systém



Basic concepts: linear, circular and bio economy

Linear economy traditionally follows the “take-make-dispose” step-by-step process, meaning that raw materials are collected, then transformed into products that are used until they are finally discarded as waste. Value is created in this economic system by producing and selling as many products as possible (Het Lectorenplatform, 2021).

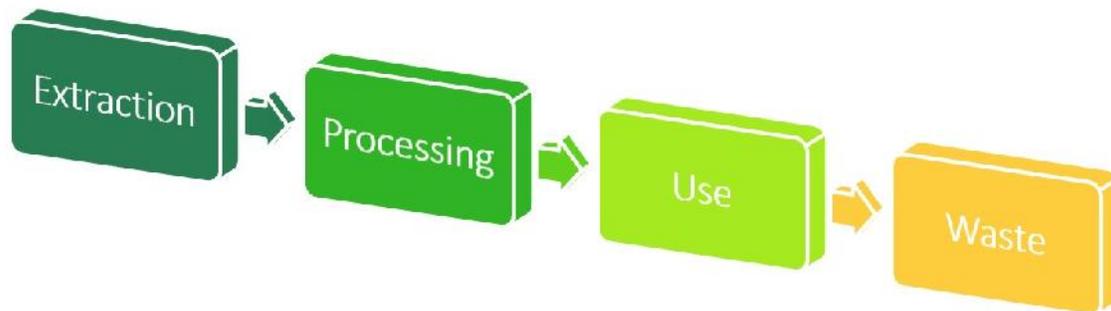


Fig. 1 Linear economy model
Source: Author

Circular economy is a sustainable development concept, which enables a functional and prosperous relationship between nature and human society, by closing the loops of materials in perpetual cycles (INCIEN, 2021).



Fig. 2 Circular economy model
Source: (INCIEN, 2021)

Bioeconomy is a concept referring to all sectors and activities that rely on biological resources (animals, plants, micro-organisms, and derived biomass, including bio waste), their functions, and principles. It includes and interlinks with: land and water ecosystems and the services they provide;



all primary production sectors that use and produce biological resources (agriculture, forestry, and aquaculture); and all economic and industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services (European Commission, 2018).



Fig. 3 European Commission bioeconomy scheme
Source: (European Commission, 2018)

In this article we will present a reflection on how we can make the transition from a linear to a circular bioeconomy in the Czech Republic.

Context of the Czech bioeconomy

Some data on the country

The Czech Republic is the most industrialized country in the Central-Eastern European region. The country's economy depends primarily on heavy industry sectors, like the manufacturing of motor vehicles, metal structures, electrical equipment, and chemical products.

However, it is a predominantly a rural country, with an agricultural area of 3.5 million ha and a forest area (43%) of 2.67 million ha (33%) of the total 8 million ha of the country's total area. Approximately 40% of the population lives in rural areas and rely on good roads and rail network. The Gross Value Added (GVA) of the bioeconomy sectors is higher than the European average 2.2% CZ > 1.6% EU.

Agriculture and food

The Czech Republic is known to have an industrialized agriculture sector, with a high average farm size (130 ha) that rather supports extensive monoculture practices. The land is dominated by big players, as large farms (11% of total) manage 70% of the agricultural land. On the other hand, small to medium size farms (89%) manage the remaining 30% of the agricultural area (fi-compass, 2020). In total, there are 26,530 farms.

The situation was inherited from the communist regime, which adopted the Green Revolution practices. After communism, land management changed from state cooperatives to private firms. So, the only change has been in the ownership, with economic benefits for a handful of enterprises, which even today is directly linked with the government at national level.



Such farming has led to improvement in the crop yields, thus economic productivity, but at the expense of the so called “externalities”: soil depletion, erosion, loss of nutrients, loss of organic matter and pollution from the use agrochemicals. On the bright side, the Ministry of Agriculture is applying a measure starting in 2020, limiting monoculture to 30 ha per single crop.

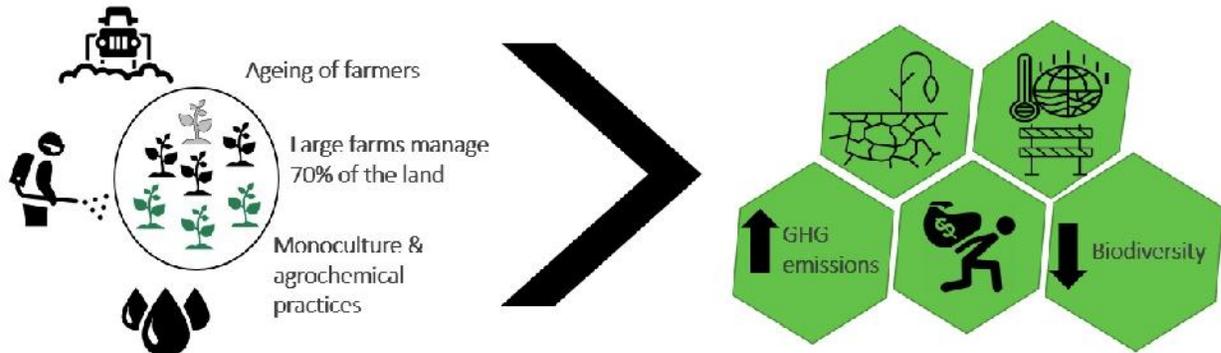


Fig. 4 Externalities of agriculture in the Czech Republic
Source: (CZSO, 2020; Ministry of Agriculture of the Czech Republic, 2018)

In summary, the way of practicing agriculture today has been developed from the communist regime into **monoculture**, high **agrochemical** inputs, and **large-scale** farms, managed by a handful of enterprises which have strong link to the government at the highest levels.

The organic sector is rather small when compared with conventional production, with a total of 5815 “ecological entities” from which 4669 are organic farmers, 865 organic food producers, 227 farm processors, 1051 distributors, and 208 other ecological entities. These manage 508 thousand ha of land, which is 12% of the total agricultural area in the country (Ministry of Agriculture of the Czech Republic, 2021), representing 0.9% of the commercialized food.

The main products of agriculture by value are cereals (23.4%), industrial crops (14.9%), forage plants (10.3%), milk & livestock (36%), with dependency on imports for key products like poultry, pork, fruits, and vegetables within the EU28 (European Commission, 2020).

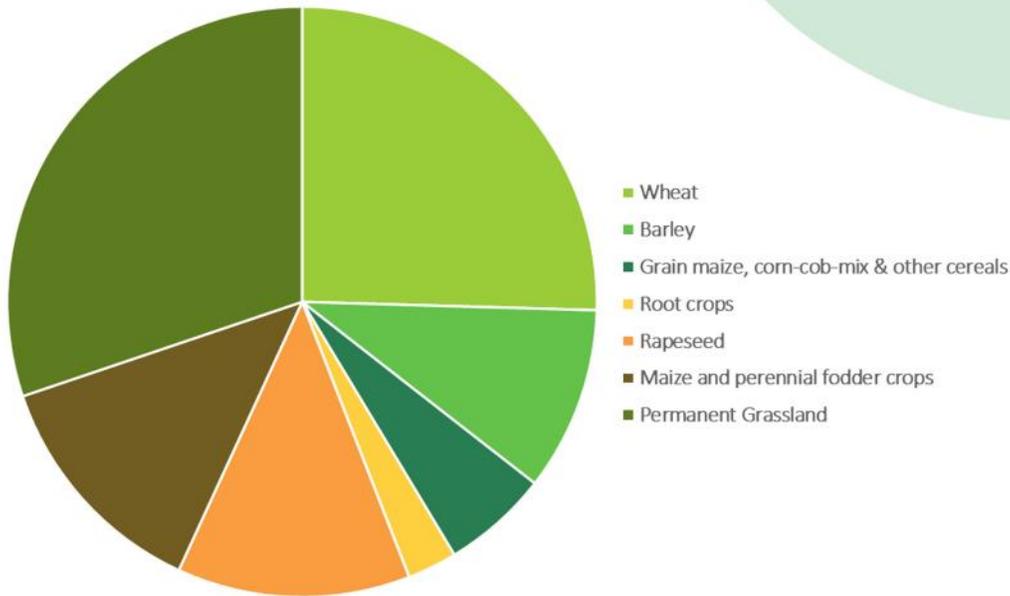


Fig. 5 Main crops by surface in CZ
Source: Zednicek et al., (2020)

The livestock sector is oriented toward the export of meat and dairy, thus the high level of permanent grassland and fodder crop production, with the exception of pigs, since 50% of the national demand is imported.

Regarding the social structure, as in other European countries, the Czech Republic suffers from the ageing of farmers, since 59% of them are >55 years old and only 10% are below 40 years old (European Commission, 2020). This is mainly due to low wages and the lack of “interesting” activities compared to those offered by cities.

The agri-food sector is as well dominated by large international corporations. In terms of revenue share, large enterprises generate 39%, medium enterprises 42%, and small enterprises 19% of total food manufacturing. In the beverage industry, the revenue share is 57% for large, 19% for medium, 11% for small, and 13% for micro-enterprises (fi-compass, 2020,).

The main industries are in the meat, dairy and beer sectors. Related to the latter, it is not a secret that the Czech nation has a strong beer culture. Being world leaders in beer consumption per capita, beer is part of the everyday life. Thus naturally, the Czech Republic is one of the major barley and hop producers in Europe.

Other relevant food sectors are the processing of potatoes, production of flour and starch products, wine & liquor making, and the production of mineral water & soft drinks.

The agri-food industry is strong in specific sectors (dairy, meat, and beer), however other products are exported as raw materials. Plus, the Czech Republic is dependent on imports to satisfy its consumption.



Lastly the problem of food waste makes it clear that the current linear economy does not meet the demand for sustainable food from farm to fork. It is not possible to do business as usual without having a cycle of energy, nutrients, and matter.

Forestry

Forestry is a sector with a tradition in the Czech Republic. It covers a large area of the national land, 2,670 thousand hectares (33% of the territory) (Hájek et al., 2021), thus, a high tree stock and related ecosystem services are relied upon. But, it is not economically strong, as it contributes only 2% of the national GVA (Ministry of Agriculture, 2017).

The reason for this is that forestry is highly oriented toward the production and export of raw wood from coniferous trees (mainly Norway spruce), but there is low processing capacity, and low consumption in the Czech market. So, the farmers & forest managers get only a small share of the wood value. Plus, the existing wood industry is strongly dependent on foreign investments, producing semi-finished products that are then exported to the investor's countries of origin.

Forests represent a fundamental part of the biodiversity and the ecosystem values, such as: water & nutrient cycling, biodiversity, soil erosion control, CO₂ fixation, and recreational space (sports, mushroom picking, etc.).

Currently there are 3 factors severely affecting Czech forests: workforce reduction, drought, and the bark beetle. This situation has put the forest into a vicious cycle:



Fig. 6 Locked forestry crisis in the Czech Republic
Source: (Dobor et al., 2020; Ministerstvo zemědělství, 2020)

This crisis in the forestry sector suggests a need for a different way of doing business, as well as more sustainable management with a clear strategy for the future, especially to develop the economic engine that can trigger Czech forests into a backbone of sustainability.

The bark beetle outbreak

The bark beetle (*Ips typographus*) is a natural inhabitant of forests in Europe, usually feeding from dead Norway spruce (*Picea abies*) trees, but under special conditions they can overpopulate and become a pest. In 2018 there was a bark beetle outbreak due to the high quantity of wind-fallen trees; the population of bark beetles grew so much that they started to infest healthy trees as well. The reason it hit Czech forests particularly hard was firstly that there was not enough removal of fallen trees, and secondly because of the high Norway spruce population. It is in fact a monoculture type of forestry, as 72% of the forests consist of coniferous trees, from which half are the Norway spruce (Ministerstvo zemědělství, 2020; Ministry of Agriculture, 2017).

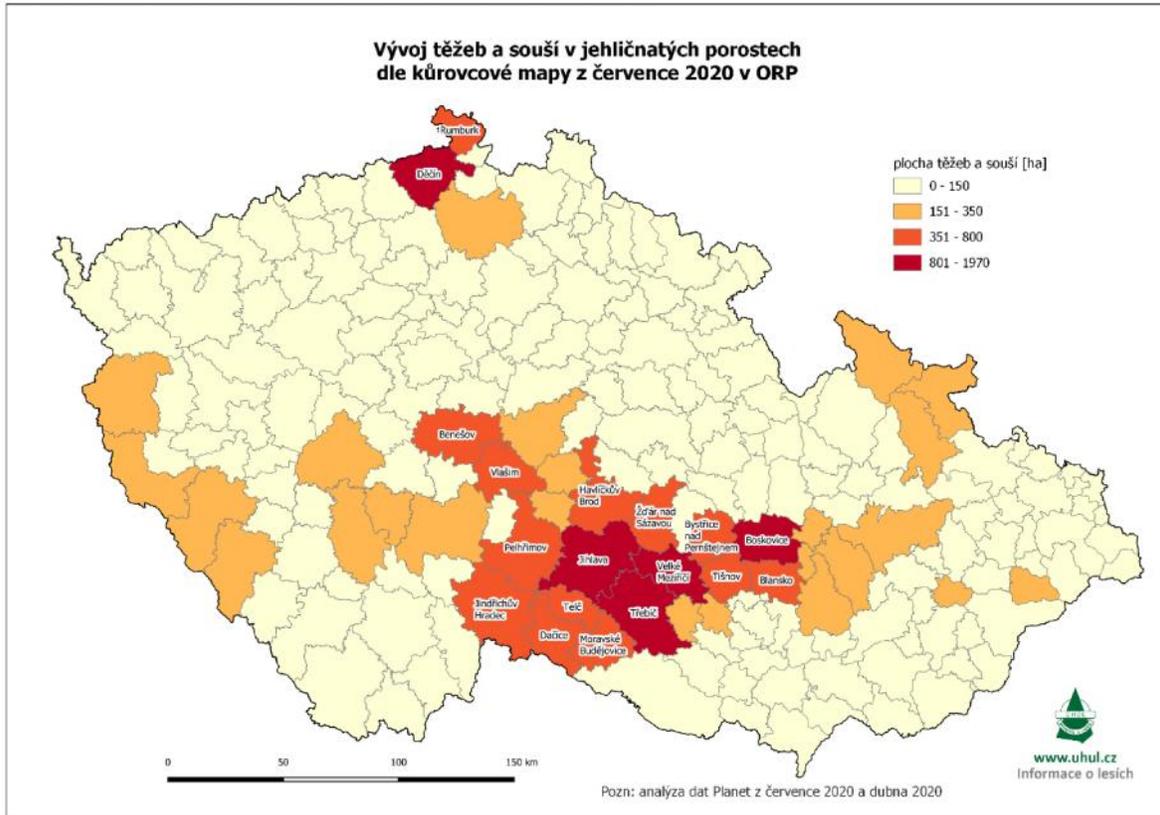


Fig. 7 Bark beetle spread in 2020

Source: (UHUL, 2020)

The most affected regions in 2020 were Jihlava (approx. 1,550 ha), Děčín (approx. 1,550 ha), Třebíč, Boskovice, Velké Meziříčí, Pelhřimov, and Havlíčkův Brod (ÚHÚL, 2020).

This left an estimated 30 million m³ of timber cut from infested trees in 2019, followed by a drop in the price of round timber, simply because of the supply-demand logic. Besides, forest managers have to log the infested parcels before the wood become unviable for sale. Nevertheless, ecologists suggest leaving some parcels with infested trees in place, as the natural recycling processes will take charge and return nutrients to the forest.



The delicate forest situation is attracting the attention of a variety of people, from government, organizations, universities, and businesses. In an ideal world, the development of projects with farmers + partner ecosystem would be at the core of the transition to a circular economy.

The National Forestry Program is promoting the development of forest-based bioenergy, but it does not emphasize it at the greater level, i.e., taking the whole landscape into account, which means the Czech Republic is in the process of developing a sustainable forestry model.

In any case, increasing economic activity and attracting younger generations to work in forestry seem to be the most urgent challenges. Increasing milling activities can incentivize higher income to farmers, thus higher interest in investment in the management of their forest parcels, and the capacity to increase the wages of workers.

Plus, a nationwide survey showed that the 46.3% of respondents preferred wood over other building construction materials – trend showing a slow increase, but still indicating that Czech consumers offer the potential for the development of a domestic wood market.

Aquaculture

Aquaculture is one of the activities with the greatest tradition in the country, having accumulated know-how from the Middle Ages combined with efficient best practices of fish farming. Fish is produced mainly in artificial ponds (42,000 ha), accounting for almost the 80% of national fish production (20,986 tons in 2019) (Rybářské sdružení ČR, 2020).

The common carp is the main farmed fish, representing 85.5% of total fish production in 2019 and includes 2 protected designation of origin labels “Třeboňský kapr” and “Pohořelický kapr” (Czech Agriculture and Food Inspection Authority, 2021, Rybářské sdružení ČR, 2020).



Fig. 8 Carp harvest at the Rožmberk pond, the biggest in the Czech Republic
Source : (trebonsko.cz, 2020)



The consumption of carp is strongly linked to the Czech traditional Christmas meal (80% of the annual carp consumption) (Nebeský et al., 2016). However, the rest of the year it is not eaten, as Czech consumers prefer imported sea-food products. Carp are negatively perceived as “water pigs”, and are difficult to eat because of the small bones.

But in other countries like Germany, the Czech carp is valued, and thus half of the total production is exported, but as unprocessed fresh fish (Rybářské sdružení ČR, 2020).

The fish market in the Czech Republic is getting more sea-food options, such as imported sutchi catfish from Vietnam and salmon from Norway. There is always the option of having different farmed fish instead of just carp.

In addition to fish production, fishponds provide significant **ecological functions**:

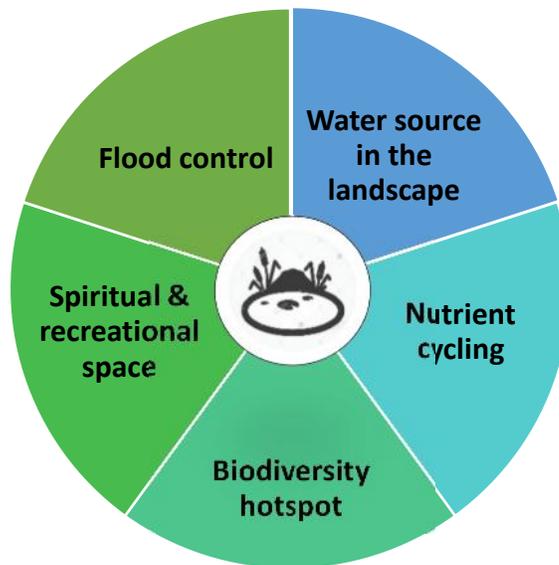


Fig. 9 Ecosystem services of fishponds

Source: (Adámek et al., 2012; Pokorný & Květ, 2016; Rybářské sdružení ČR, 2020)

When looking at the ecological & social functions of fishponds we can quickly understand why they are so important for the landscape, both as a strategic component of the natural ecosystems, plus for human settlements. This was very evident in the 2002 flood, when the fishponds in South Bohemia delayed the strength of Vltava river before arriving in Prague, not to mention their contribution in terms of biodiversity, as the “eco-tones”, or the areas of transition between aquatic and terrestrial ecosystems.

SWOT analysis of the Czech Bioeconomy

The bioeconomy sector is on its way to re-shaping the Czech Republic from the top-down. The environmental treaties that the EU has comprised is putting pressure on all the member states. Of



course, it is very debatable if this is enough for the change needed towards sustainability, but if society does not engage it will certainly not.

Currently, the production model in bioeconomy follows the same path as in other Western countries, which spread after the WWII, i.e., the “Green Revolution” that applied chemical inputs, monoculture practices, heavy mechanization, specialization, and economy of scale. Its main focus was increasing the yields and producing enough food to feed the world after the effects of the war. Nowadays, there is consensus that this model has huge environmental and social costs.

The SWOT analysis in Fig. 8 considers the big picture of bioeconomy in the Czech Republic. Although every sector requires its own development strategy, they must be interconnected, simply because the different elements of the landscape (low-land, forest, and fishponds) are interconnected. In the sense that, the strengths of aquaculture can alleviate the weaknesses of agriculture, and vice-versa. For instance, fishponds as a back-up source of water during the drought periods.

These are the main strengths when integrating the whole bioeconomy:

- Land availability
- Traditional know-how in aquaculture and forestry
- Well-developed transport infrastructure
- Raising environmental awareness

Main weaknesses

- Monoculture practices: rapeseed & cereals in agriculture, the Norway spruce in forestry and the common carp in aquaculture.
- Economic & power concentration of a handful of companies
- Ageing of farmers and lack of interest from the younger generations
- Climate Change raising temperatures, strengthening drought
- Financial gap for small-and medium sized farms & enterprises, new entrants and young farmers.

Opportunities

- European and national funds available for the transition
- Rising trend of environmentalism, veganism, localism, and slow consumption.
- Successful examples of circular initiatives & businesses: ČZU (smart countryside, Bioeconomy Platform), INCIEN, CELEBIO, Cyrkl.com, among others
- Czech Republic is a hub for digital technologies in Europe

Threats

- Climate Change to worsen the drought periods
- Lack of integrated bioeconomy policy
- Dominant players (multi-nationals) will oppose sustainability
- Lack of take-over by younger generations



Strengths

1. Land availability for agriculture and forestry activities, as well as the main activities for the rural population.
2. Advanced know-how based on traditional best practices in fishpond management. Strong tradition in forest management.
3. Well-developed dairy, meat and beer industry sectors.
4. Modern transport infrastructure.
5. High online consumption, with a share of 16% of the total retail sales in 2020.
6. Advanced digital technology industries.
7. Forests and fishponds non-production ecosystem services: biodiversity hotspots, soil erosion control, regulation (climate, nutrients and water), and aesthetics.
8. Rising initiatives in the private and non-profit sector towards a Circular Economy (INCIEN, Impact Hub, Bioeconomy Platform CZ, Cyrkl.com,).

Opportunities

1. European funds supporting a transition to circular bioeconomy.
2. New national law favoring diversification of crop production.
3. Increasing demand for organic products in CZ and the EU. Supported by trends in environmentalism, veganism, slow consumption, and waste management.
4. Diversification of activities towards services: tourism, cultural events, education & research. To have multi-purpose farms, forests and fishponds.
5. Utilization of digital solutions, for example a marketplace for secondary-raw materials like Cyrkl.com. Blockchain as promising technology for traceability, digital transactions, others.
6. Having “nature-like” production systems to increase resilience. Reforesting bark-beetle affected areas with mixed-tree forests. (e.g., Kuojtakiloyan)
7. Development of equity-based financial instruments: Four Leaves Finance circular bank & partner ecosystem.
8. Relatively open market for the development of the wood industry with innovative products.
9. Generation of new systems of food and sludge recycling, just one option to return nutrients to the soil.

Weaknesses

1. Power and economic concentration of big international players in all the supply chains. Government with link to these dominant production spheres.
2. Very large farms (average of 130 ha) supporting monoculture production (wheat & rapeseed), use of agrochemicals, imported feed (GM soya), and poor soil management.
3. Environmental crisis: drought, groundwater depletion, loss of soil, rising temperatures and the bark beetle calamity.
4. Labor crisis: ageing of farmers (59% of them are >55 years), and low wages.
5. Poorly developed domestic wood and fish processing.
6. Big financing gap for young & small farmers and entrepreneurs
7. Net food imports (mainly vegetables, chicken and pork), processed fish (salmon and sutchi catfish), and processed wood products.
8. Export-driven low value-added products in forestry (raw timber to China and Austria), and aquaculture (Germany).
9. No processing of food waste, especially in the cities.

Threats

1. Rising temperatures can worsen both the bark beetle outbreak and the consequences of drought.
2. National policies in agriculture, forestry, aquaculture and related industry sectors are still not integrated in a circular bioeconomy framework.
3. The dominant players will pose resistance to change, namely, the cash crops, meat and dairy sectors.
4. Low political action to have mechanisms of waste management in cities and municipalities
5. Lack of generational take over can lead to loss of know-how, detachment from the land, and weaken the cultural values around farming & forestry life-styles.
6. Expected return on investment the same as conventional loans.

Fig. 10 SWOT diagram of the bioeconomy activities in the Czech Republic

Reflections for a Circular Bioeconomy

The transition from a linear to a circular economy is the challenge of the 21st century. As we know that human activities have accelerated Global Warming, and have polluted water, air, soil, and living organisms. Thus, there is no escape from the search for sustainability, as life on earth depends on it.

Scholars of transition studies suggest that economic systems have “lock-ins” or “brakes” that will oppose changes to the way of doing business as usual. Such “lock-ins” refer to technological, scientific, cultural, industrial, political, or market related structures. For instance, to have mixed crops and polycultures, a technological lock-in would be to have machines that can harvest different crops at the same time. It is thus important to understand that the transition to sustainability is a gradual process, non-linear, and that it will highly depend on the number and quality of the players involved.

The Czech political context is the main barrier to the transition, due to the linkage between the government and the dominant conglomerate of Agrofert, concentrating power over the food supply chain, regulatory bodies, and farmers.

Even with this adverse scenario, there are promising indicators showing that the change is imminent: rising vegetarian/vegan/organic trends, rising environmental awareness, and the rejection of the government by a large part of the Czech population.

The key players to push for the transition would have to be those producing the food/wood, and those consuming it, in order to increase farmers’ capacity not only to grow food & wood, but to grow it in circular systems, as well as to motivate society to change consumption habits, and demand different policies that will incentive best practices.

We propose here actions that can materialize the transition:

- Generate financial alternatives for young & small producers, that would also consider sustainability KPIs: soil formation, increase of biodiversity, water retention in soil, and carbon fixation.
- Develop new farms along with a synergic multi-stakeholders ecosystem (farmers + companies + academia + governments + NGOs + consumers). To build farms with diversification:
 1. Polyculture systems in agriculture, forestry and aquaculture.
 2. Generate capacities to process raw materials into high added value products
 3. Adding other activities within the farm (tourism, cultural events, education, co-working places on farms). To make rural areas attractive for the younger generations.
- Create extensive awareness campaigns for different audiences, from schools, media, influencers, farmers associations, and industry clusters. To create a brand of “modern countryside”.
- Integrate more fishponds next to the farming plots that can work as water storage for agriculture but also for the surrounding biodiversity.

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