

FUTURE IN HEMP

INDUSTRIAL HEMP PRODUCT CHAIN OVERVIEW

Future in Hemp

Industrial hemp product chain overview

2023

Nemzetstratégiai
Kutatóintézet

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Dear Reader!

One of the most important experiences of the ten years of the Research Institute for National Strategy is that the practical implementation of the reunification of the nation is a real Sisyphean task.

This task can - and must - be interpreted as the meticulous, often tiring, but always tenaciously restarted activities of the weekdays that give meaning to the holidays.

Seven years ago, we held our first conference on industrial hemp at the House of the Nation, and since then we have developed a comprehensive, complex industrial hemp economy development program for the entire Carpathian basin, which includes various product paths, from production to processing to sales.

Once the Hungarian industrial hemp varieties were the best, in the nineteenth century we were a hemp superpower. At that time the plant was cultivated on eighty thousand hectares in Hungary, today it is cultivated on sixty thousand hectares in the whole world. In addition to its economic benefits, the plant also played a significant community-building role in the life of Hungarians, it is enough to mention the spinning mills, which were also the scene of social relations and cultural life.

The Carpathian basin has particularly good properties for the cultivation of industrial hemp, the producers and processors can count on versatile possibilities in terms of all parts of the plant, such as the seed, the fiber, the pods, the inflorescence and the foliage.

In August 2019, we launched a cross-border INTERREG program in Alsó- and Felső-Bodrogköz, Szatmár and Bereg. The results speak for themselves. Using the example of hemp, it is possible to perceive how our cultural and community values and traditions can become an economic force and a guarantee of staying in the homeland.

In the hope that the good example will be contagious, circulate the publication for profit.

Jenő Szász,
President of the Research Institute for National Strategy

The role, importance and history of the initiative

The health and environmental benefits of products made from industrial crops that provide natural raw materials, such as flax and hemp, have long been recognised, but their cultivation and processing almost ceased decades ago. All over the world, including in Hungary and the Carpathian Basin, these natural raw materials have been replaced by cheap plastics that are harmful to health and the environment. However, in recent years, as consumer awareness of health and environmental protection has increased, there has been a growing international demand for a return to natural materials.

In 2015, the Research Institute for National Strategy launched a knowledge gathering and partnership building process to develop a national programme for the development of the hemp economy (the successive development projects are illustrated in the figure below). As a result, a comprehensive, complex development programme entitled **"Building a coherent industrial hemp economy zone in the Carpathian Basin through the cooperation of economic development zones"** was drawn up and presented to the relevant government decision-makers.

An animated short film illustrating the programme, which has been put together over the years with the help of nearly a hundred skilled and dedicated experts and market stakeholders, can be viewed here:

Products made from parts of industrial hemp as a natural raw material - in the form of clothing, food, cosmetics, buildings, furniture, stationery, vehicles, medicinal products, various utensils and tools - have a direct health-protective and environmentally regenerative effect. The **aim of** this development programme, which spans industries, disciplines and geographical areas, **is to build a new national economic driver**. As a newly rejuvenated industry, its role in protecting health, the environment and the climate will not only help to overcome the current economic situation, but will also help to build a new era of quality of life. **A well-planned, coordinated national hemp economy on the scale of the Carpathian Basin is one of the most important economic, social, environmental and national strategic resources of the coming decades**. It will increase the profitability of agriculture, help to further

develop the structure of agriculture, further promote organic farming, boost rural development with modern, new jobs, replace plastic and substitute wood. It contributes to a change in the competitiveness model and to sustainable growth. It is a sustainable, carbon-negative, circular economy sector that can simultaneously strengthen and connect communities in the Carpathian Basin: **the first complex, cross-border economic development programme capable of pooling our resources for a large, common development goal, and therefore of particular importance in strengthening and integrating cooperation.**

The Interreg project " Future in Hemp", coordinated by the Research Institute for National Strategy, is an important step in the preparation of this large-scale development programme in the north-eastern region of the Hungarian-Slovak border region, which is the **first cross-border cooperation in the development of hemp economy in the Carpathian Basin supported by EU development funds.** The Institute's dedicated and well-prepared working group, composed of Levente Barkaszi, Attiláné Beszédes Nimród, Anna Ivanics and Zsolt Pásztor, played a key role in the development of the project's content and its continuous professional support.



Handover celebration in Barabás (János Vincze, Jenő Szász, István Nagy)

The place of the project and its importance in the preparation of the national hemp economy development programme

Compiling a comprehensive, complex development programme
the creation of a coherent Carpathian Basin hemp farming zone

2020 - 2023

- **Hungarian-Slovak cross-border project** for the coordinated processing of industrial hemp (INTERREG)

2018 - 2019
EU projects hemp farming for sub-targets

- Series of workshops to **develop a concept for the development of crafts based on industrial hemp** for the Government's Creative Industries Strategy (EFOP)
- **Establishing a new creative visual culture for the hemp economy** (EFOP)
- **Development of commuter employment models** for the Southern Great Plain and Northern Hungary (EFOP)

2017
Coordinated by sample projects

- Methodological underpinning of **folk crafts** and community building **based on industrial hemp**
- Hemp fibre **textile processing pilot project**
- Industrial hemp **cultivation and processing pilot project** in Northern Hungary and Szeklerland

2016
A Development Process initiative

"The potential of the development programme of the industrial hemp-based economy in Hungary and the Carpathian Basin" **conference in the Hungarian Parliament**

Adoption of a **final declaration on** areas of public engagement

Békés county hemp seed production public employment programme from 2015

(Békés County Government Office and 25 municipalities)

Project summary

Objective

The mission of the Research Institute for National Strategy is to create a **complex, cross-border economic development programme** that **contributes to the integration of Hungarians living in the Carpathian Basin, promotes rural development and contributes to the expansion of the green sector through the establishment and operation of a national economic driving force** based on industrial hemp.

The objectives of the 6 closely interrelated projects of the Territorial Action Plan (TAPE) were thus determined by the definition and systematic implementation of the activities necessary for the development of a unified Carpathian Basin economic space, modelling the construction of an industrial hemp-based economy.

The general objective of the TAPE was to reduce and reverse the negative demographic trends by developing businesses and increasing employment. The immediate objective of the project is to develop and market competitive products in the area of intervention. A further objective is to develop an economy based on local assets, increasing added value and the level of processing in industry. The objectives included the sharing of competitive knowledge with local economic operators. The synthesis of theoretical knowledge and practical experience has contributed to the realisation of local economic development aspirations.

One of the basic prerequisites for the future competitiveness of the national spandex economy is the provision of adequate human resources, the targeted establishment and maintenance of a modern, innovative training and employment system, the development and operation of a modular training programme and curriculum system based on job analysis. The knowledge collection, content development, knowledge sharing and the creation of a professional support network within the project system have served to lay the foundations for this.

The implementation process

The Research Institute for National Strategy was the lead partner of TAPE, with the main tasks of coordinating activities, communicating results and implementing the knowledge sharing programme. The number of other partners participating in TAPE was 8, with 4 partners from Slovakia and 4 partners from Hungary.

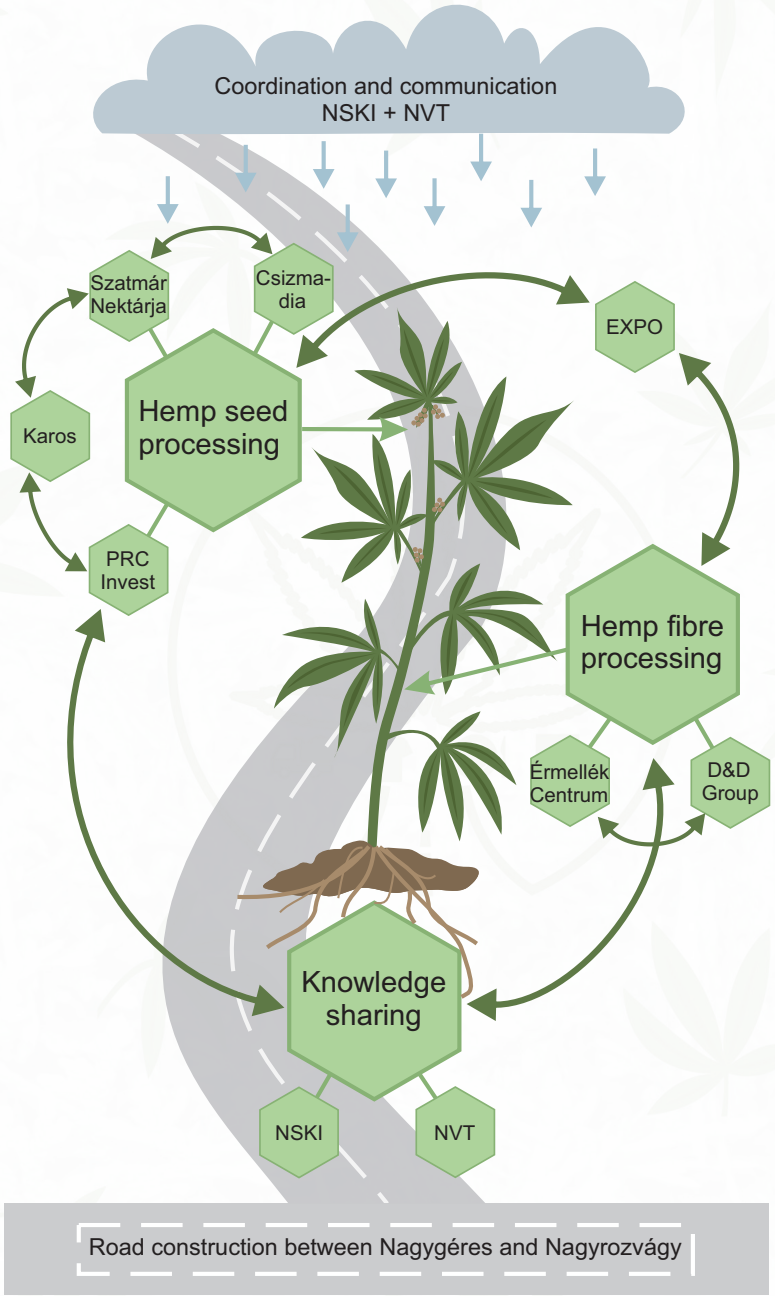
Partners in Hungary:

- Szatmár Nektárja Nonprofit Ltd., Géberjén
- PRC Invest Ltd, Karos
- Municipality of Karos
- Érmellék Centrum Community Nonprofit Ltd., Barabás

Partners in Slovakia:

- Tímea Csizmadia-Júlia self-employed, Nagygéres
- Municipality of Nagygéres (ObecVeľkýHoreš)
- D § D GROUP INVEST s.r.o., Košice
- Association of Nagykapos and its Region (Združenie Veľké Kapušanyaokolie)

Achieving the objectives set by the Partnership has been achieved through concerted work and cooperation at the network level of the Partnership. The activities of the sub-projects have contributed to the introduction of competitive products to the market and the creation of new jobs by expanding the potential partnership's business development, by implementing investments in line with the profile choice, in order to develop local products and services based on industrial hemp. Besides the development of production based on the processing of hemp seeds and stalk; the development of infrastructure for the production and marketing of industrial hemp; and the implementation of a processing and employment knowledge-sharing programme, the construction of a road linking the settlements of Nagyrozvágy and Nagygéres was carried out in order to improve cross-border labour mobility.



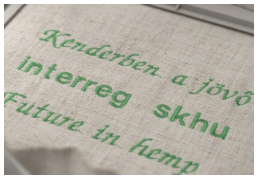




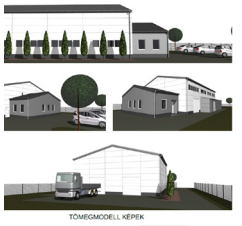








PRESENTATION OF SUB-PROJECTS













Production development based on hemp seed processing

Szatmár Nektárja Nonprofit Ltd., HU Géberjén

This sub-project involved the expansion of a low-capacity oil mill and an artisanal dough making plant in Géberjén.

In the past, the company was mainly known for its certified, high-quality pumpkin seeds, which it produces with the help of workers with disabilities. Disabled workers are involved in every part of the process, from sowing to harvesting and returning the pumpkin flesh to the soil.

After the seeds have been dried, the oil is cold-pressed, again with great care and under artisanal conditions. The raw material for the new product range, hemp seed, will also be used in this manufacturing process, but also seed hulling, seed cream and flour production.

Some of the resulting products are sold as finished products, while others are used as raw materials for further processing, such as pasta and cosmetics.





PRC Invest Ltd, HU Karos

PRC Invest Ltd was founded in 2018 with the aim of stimulating regional economic development by generating manufacturing and industrial projects.

It seeks to develop traditional sectors that are suited to the economic, environmental and social conditions in the area. The cultivation and processing of industrial hemp has a long tradition in the Bodrog region. Having seen the worldwide expansion of this crop in modern food and health, construction and many other industries, and having recognised the positive effects of hemp cultivation on the environment, the local economy and society, it was decided to set up and operate an industrial hemp processing plant.

They aim to promote regional hemp production and processing, covering the entire value chain from locally produced raw material to finished product.

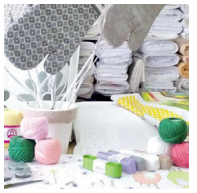
Tímea Csizmadia-Júlia self-employed, SK Nagygéres

The project included the renovation of the sewing building and the purchase of new sewing equipment to make the workflow more efficient and economical. This will allow the sewing shop to expand its product portfolio and to meet higher order demands by increasing its capacity.

They currently employ one extra seamstress, but the scale of the investment will allow for further growth, which is important from an economic point of view. The main profile of the sewing workshop remains sewing of home textiles, but with the increased capacity, there is also the possibility to fulfil orders from larger companies in addition to private or small customers. The sewing of curtains, embroidered decorative cushions, bed linen and other home textiles, tablecloths and kitchen textiles is currently the main activity of the sewing workshop, so interior designers, hotels, restaurants are potential customers, but the sewing of custom bags and small handicraft products is also possible, so the workshop is also open to orders from fashion designers.

Within the project cooperation, hemp bags and pouches are currently being produced for the Szatmár Nektárja Nonprofit Ltd.





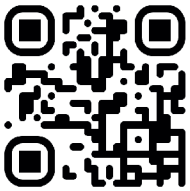
Production development based on hemp processing

Érmellék Centrum Community Nonprofit Ltd., HU Barabás

The sub-project included the construction of a new factory hall in Barabás for the processing of hemp fibre and posdorja. The location of the hemp processing plant near the border will provide employment opportunities for people living in disadvantaged regions and, with its development, could attract other sectors in the future.

The company's portfolio includes the production of hempcrete masonry blocks, fencing elements and insulating panels, which represent a "green" alternative for the construction industry. Masonry blocks are considered as a core sector, providing a building material for the construction of finished hemp houses.

The raw material is to be provided in cooperation with local farmers, which will also indirectly increase the number of jobs in the area.






D § D GROUP INVEST s.r.o., SK Kassa

The company D § D GROUP INVEST s.r.o., based in Košice, is engaged in the sewing business. It mainly produces household textiles, bed linen and curtains. Their main partner is IKEA, which enables the company to handle large orders. They have a large range of high quality fabrics, which they now complement with hemp-based textiles.

The company previously operated its sewing shop in a rented facility, but the Territorial Action Plan gave it the opportunity to renovate a building it owned but which was in poor condition. The works involved the renovation of a building that had been disused for 10 years and was in a very poor state of repair, and which can now be used for expanded activities and with more employees.





Development of infrastructure for production and marketing based on industrial hemp

Municipality of Karos

The historical past and the natural resources of the village of Karos provide excellent opportunities for tourism. Efforts are already underway. The richest known cemetery of the Carpathian Basin, dating back to the Bronze Age, is located here, as well as the site of the National Tomb Garden.

Unfortunately, due to its location in the country and centralisation, the municipality is becoming increasingly depopulated, as is the case in the region in general. To prevent this, the municipality is trying to do its utmost, for example to find the necessary resources to promote local employment.

As the village is proud of its values and traditions, which they strive to preserve, the project also aims to create a "livable village" by reviving the hemp tradition through the construction of a factory hall for hemp processing. The entrepreneur running the factory will thus provide employment opportunities for the people of the village, which will strengthen the possibility of staying in the locality.

Municipality of Nagygéres (ObecVeľkýHoreš)

The village of Nagygéres is located at the Slovakian end of the project road, which provides a direct link to the mainland. In addition to the aim of starting and operating hemp production at the cottage and entrepreneurial level and launching a village enterprise, the village has also undertaken to set up an exhibition centre as part of the project.

With the renovation of the EXPO building, the Municipality of Nagygéres aims to revitalise the tradition of hemp growing and processing in the village and to increase the number of jobs by stimulating businesses, thus promoting local residence. To support this, the municipality is also providing two hundred and fifty hectares of land for the purposes of hemp cultivation.



Expo building in Nagygéres

Manufacturing, employment knowledge sharing programme

Research Institute for National Strategy

In 2017, the RESEARCH INSTITUTE FOR NATIONAL STRATEGY launched three coordinated pilot projects, one of which was "Methodological underpinning of folk crafts and community building based on industrial hemp", to lay the foundation for an industrial hemp-based economic development programme. The aim of this pilot project was to recreate and update knowledge on cultivation and processing that had been forgotten or largely obsolete in recent decades, to collect it and to publish it in new forms of knowledge sharing. The results and the professional development base of the pilot project implemented jointly with the National Institute of Culture provided the basis for the implementation of the TAPE educational sub-project. The knowledge gathering and development programme and the curriculum development workshops involved 41 recognised national experts and practitioners. The content development resulted in a training programme and curriculum development covering almost the entire spectrum of primary processing of hemp production, followed by knowledge sharing programmes involving 19 participants, which resulted in a motivated workforce with the required up-to-date skills, employable in the region.

The Slovak-Hungarian cross-border Interreg project "The Future in Hemp", coordinated by the Research Institute for National Strategy, is an important step in the preparation of a large-scale development programme, as it is the first in the country to create a complex training programme and curriculum package for the transfer of knowledge in hemp farming.

The teaching materials have been prepared on the basis of a common methodological guide in the following subject areas:

- The industrial potential of industrial hemp biopolymers and biocomposites and the current technological background of processing
- Health processing of hemp
- The use of industrial hemp in the construction industry
- Production and potential uses of industrial hemp as a raw material
- Fibre hemp in the textile industry

- The potential of industrial hemp for food and cosmetics and the current technological background of processing
- Secondary uses of industrial hemp - sewing worker training material

Job training has been provided to enterprises processing industrial hemp products to ensure their labour needs are met. In addition to basic theory, practical training in hemp commodity processing, textile processing and construction, as well as in secondary use, provided participants with practical training in the use of machinery and equipment, production technology, occupational safety and health.

Association of Nagykapos and its Region (Združenie Veľké Kapušany a okolie)

The Association of Nagykapos and its Region has decades of experience of the region, both in terms of employment, culture and education, and in preserving national identity.

As the project aims at the development of local products and services, which provide opportunities for the market introduction of competitive products and the creation of new jobs, the Association plays an important liaison and organizing role in the project. A training programme and curricula on "Secondary processing of industrial hemp - industrial hemp worker" has been developed in coordination with our partner, Association Velke Kapusany and Surroundings.

Road construction between Nagygéres and Nagyrozvágy

Nagyrozvágy and Nagygéres lie on two sides of the Hungarian-Slovak border. Nagyrozvágy is located in the Bodrogközi district, while Nagygéres belongs to the Tőketerebes district in Slovakia. The region has been suffering from a lack of north-south road connections. This lack of border road connection forced the population of the two settlements to take a detour. The construction of the road between the two settlements will provide direct access between Nagyrozvágy and Nagygéres.

The direct result of the project will be a 4.3 km cross-border road, with 1,925 m of new 2x1 lanes on the Hungarian side and 2.3 km of 2x1 lanes of new road on the Slovakian side. The primary beneficiaries of the entire new road section will be the inhabitants of the two settlements, school-age pupils and workers, but the road will also help nearby businesses, farmers and suppliers, and hauliers (with a 3.5 weight limit).

By eliminating the 20-20 km detours to the east and west, which take 20-30 minutes, travel distance, travel times and travel costs are reduced. Congestion on bypasses and the risk of accidents will be reduced.



The new way

Coordination and communication

Research Institute for National Strategy

The tasks of the Research Institute for National Strategy include the exploration and coordination of networking opportunities in the Carpathian Basin, professional coordination and support activities. The Institute has also successfully managed two projects aimed at researching educational structures in the Carpathian Basin and strengthening community development and social responsibility. Furthermore, the Institute has built a network of people involved in the cultivation and use of medicinal plants in the Hungarian-Slovak border region and facilitates networking.

The experience described above has also enabled the Institute to coordinate the six projects that make up the Territorial Action Plan, to support the participating SMEs and to disseminate the results of the project. The organisation, development and management of cooperation between different types of organisations operating in different legal environments was of paramount importance, as our forward-looking mission can only work in the future by creating networks and taking on the task of coordinating them. Through the implementation of the Territorial Action Plan, the partnership has succeeded in building a strong network of trust, which, in addition to mutual respect, has also brought a sense of identification of objectives and a feeling of pooling knowledge.

Through the partnership and the implementation of the activities, together with the professional support network that has been established, we have taken an important step towards our development vision of a comprehensive, complex development programme entitled "Building a coherent industrial hemp economic zone in the Carpathian Basin through the cooperation of economic development zones".

Nagykapos and Rural Association (Združenie Veľké Kapušany a okolie)

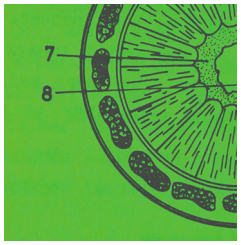
The Nagykapos and Rural Association has decades of experience of the region, both in terms of employment, culture and education, and in preserving national identity.

As the Slovakian coordinator of the Coordination and Communication project (hereafter CCP), he assisted the project partners in their work and supported them in the administration of contracts. He also carried out tasks related to communication and event organization, as well as the organization of the educational project together with the Hungarian CCP partner, Research Institute for National Strategy.



Workshop in Nagykapos






TRADITIONAL HUNGARIAN HEMP-BASED INDUSTRIES THAT ARE AGAIN








TEXTILE INDUSTRY

Hungary used to be a "hemp power", mainly in textiles.

As early as 1877, a hemp processing factory was operating in Szeged, where ropes and twine were made. Later on, bags, tarpaulins and even military clothes were made of hemp, and around 1950 **serious research was started to refine hemp for the textile industry**, which unfortunately was soon ended by the appearance of man-made fibre, so the numerous research projects that had yielded results could not be used, as man-made fibre was then much cheaper. However, it has now become clear that **synthetic fibre is a huge ecological problem.** Micro-plastics that have been released into our water by washing our clothes with man-made fibres have started to appear in our food. Unfortunately, recycling doesn't help, so the world has turned back to natural materials. It is **a global trend that hemp is being reused as a textile raw material in the fashion industry and in the world of technical textiles.**

China was the first to take off, recognising the **unsustainable** production of **cotton and setting a** goal to **replace cotton with hemp.** Then the US followed by Europe launched into the research. Typically, in Europe, old linen spinners were converted, for example in Lithuania, Romania, Belgium, France, but cotton production experiments were also resumed after a 60-70 year hiatus, mainly in Germany. **New technologies and new auxiliary materials still hold a lot of potential**, but it can already be said that hemp can be transformed into textiles by purely mechanical and biological methods, which means that there is no environmental damage at all.

Of course, not everything is working perfectly yet, but in general it is true that the return on investment for hemp textile production is very positive, demand is booming, the technology does not cost more than other textile production technologies, so overall it can be said that soon we will see many more hemp textile products on the shelves. **In this light, now is the time to rebuild the industry in the Carpathian Basin.**

FURNITURE INDUSTRY

During the development of the furniture industry, posdorja board has emerged on the market as a more economical, easier to handle alternative, which is essentially economical because it uses by-products from the textile industry.

Based on the **chipboard production** method, in the 1950s, chipboard was still made mainly from the wood pulp of flax and hemp, and was later called furniture board. Pozdorja was created during the production processes required for the textile industry, through the mechanical fibre processing, i.e. the breaking and damping processes. In the old days, in addition to pressing, resin was used to shape the wood into flap.

In recent decades, such processes have been referred to as **composite technologies**, which in many cases means a raw material formed by combining several mutually reinforcing components.

There has been more research into hemp fibre reinforced plywood type wood substitutes over the last decade, but also posdorja is a popular choice for product lightening, for example. There are also composites containing vacuum-pressed pozdoria pieces or pozdoria powder, which are used for design furniture, bodywork elements or even design accessories. This includes the world of **3D printed furniture** and products, where 3D filaments enriched with hemp powder are now available on the market.

Sustainability-minded people often emphasise the role of fibre hemp as a wood substitute, as the **yield of one hectare of hemp wood is equivalent to the annual yield of eight to ten hectares of pine forest,** and its cellulose content is even higher.

This is the origin of hempwood, which is based on pegboard technology and essentially results in a material that can be worked entirely as wood, compared to the more airy, crumbly pegboards of the past. But there is still potential in the world of traditional laminate furniture boards, as the binders currently used have far surpassed the toxic resins of the 1950s.

PAPER INDUSTRY

Traditionally, paper used for writing in Europe was made from textile waste. The mills were called paper mills because they used operating techniques similar to mills to shred the textile. It was only the increased demand for paper that led to the development of a trend towards wood in Europe.

The use of hemp for paper purposes originated mainly in Arab countries, and although there are earlier records of hemp paper from Europe, it was only produced in large quantities in the 19th and 20th centuries. Then, in the middle of the 20th century, due to various lobbying activities, hemp paper production unfortunately ceased and only in the last decade has it started to revive, mainly for sustainability reasons.

There are several reasons why it makes more economic and environmental sense to make paper from hemp. The most important of these is productivity.

- In 1 hectare, **4 times as much paper material can be produced from hemp than from wood over** 20 years (which is the cutting maturity of the tree).
- It can be harvested in 4 months, unlike wood, which requires serious forest management and many years.
- Industrial **hemp sequesters 8-15 tonnes of CO_2** per hectare per year, **while forest** sequesters **2-6 tonnes.**
- hemp paper **can be recycled 2-3 times more than** wood-based paper with less degradation.
- due to its much lower lignin and pectin content than wood, fibre digestion does not require the use of heavy chemicals and **can be produced cost-effectively**.

Currently, the packaging industry accounts for a large share of paper consumption, where durability is also an important consideration. In contrast to wood-based paper, hemp-based paper is also the winner in terms of durability.

Although it has been argued that the processing machinery required for the production of resistant hemp raw material depreciates faster, the economic benefits mentioned above compensate for this cost ratio.

PAINTS

Over the past centuries, oils, including hemp oil, have played a major role not only in art paints, but also in surface treatments and paints for industrial use, wood care and wood stains. In the heyday of the hemp fibre industry in Europe, hemp seed oil was the main raw material for paints. As the hemp industry declined with the advent of man-made fibres, so did the dominance of oil paints.

Recently, oil-based paints have been on the decline, but **furniture refinishers and custom furniture manufacturers have rediscovered the benefits of hemp seed oil**, which acts as a hybrid surface treatment.

- Like furniture varnish, it can be easily applied with a brush.
- It behaves similarly to tung oil in that it does not form a coating on the surface, but is absorbed in liquid form and then solidifies in contact with air.
- And like furniture wax, it deepens the colours of milk paint.

Hemp seed oil can also be used on its own to protect, seal and refresh untreated, stained wood surfaces or painted surfaces. The oil **forms a moderately water-resistant surface and,** if cold-pressed, has an **antimicrobial effect**, i.e. fungi will no longer multiply on the wood. The seed oil will dry quickly after application, within a few hours, but can take up to 14-28 days to dry completely.

Flaxseed oil has taken the lead as a base oil for **art oil paints**, but it can also be perfectly substituted by hemp seed oil. As a supplement, other oils are also used for paints, with different viscosities.

The sustainability trend hasn't really hit the paint industry yet, but as the sick house syndrome gets more attention and people are reluctant to surround themselves with dangerous paint products, more oil-based paints will most certainly be produced and it will then matter that hemp oil is positioned properly.

THE ROPE INDUSTRY RENAISSANCE

Hemp rope was such an important strategic tool for shipping in the last millennium that wars were decided by who got hemp raw material for rope production and who didn't.

There are alternatives for many things in the world, but hemp rope still holds its position in certain applications. One of these areas is in the food industry, especially in the smoked meat industry, where hemp twine is used to ensure that hams weighing several kilos can be cured in compliance with health conditions. But it is also used in the aforementioned shipping sector for its excellent antimicrobial and UV resistance. Even in humid environments, hemp rope has excellent tensile strength and its durability is renowned.

More serious uses are in animal husbandry and other agricultural activities, floriculture, decoration and home accessories.

The main reason for the increase in applications is that there is still a lot of plastic-based string in use in agriculture. These plastics, such as baling twine or various plastic ropes used for fencing, are released into the environment quite frequently. In many cases, it gets entangled with birds, wild animals or even gets into the ground and pollutes the environment. This type of plastic use also causes serious environmental pollution worldwide. When this is regulated, at least at the European level, and only biodegradable, compostable materials will be able to be used in agriculture and animal husbandry, then the production of hemp straw will really take off.













OVER THE PAST DECADE, MATURE INDUSTRIES HAVE BEEN CREATED, PARTLY AS A RESULT OF TECHNOLOGICAL PROGRESS













COMPOSITE INDUSTRY

In 1941, Henry Ford created his first car from parts made from hemp fibre-reinforced natural polymer, biopolymer. Even then, hemp was known to combine with other materials to create a new material with beneficial properties.

It took 80 years for automotive manufacturers to rediscover hemp composites after the "plastic dream". They were the pioneers in the field, initially producing hemp for car interiors, and then hemp modified fibre for 3D printing, so the possibilities have multiplied exponentially.

In terms of production, several processing methods are known:

- extrusion blow moulding
- injection moulding
- deep drawing
- rotational moulding
- 3D printing

From an environmental point of view, the switch would be very justified, as the **environmental impact of products produced by the biopolymer and biocomposite industry is much lower than that of traditional oil-based polymer products**. Depending on the products and technologies the CO_2 load is only 10-20%.

The machinery currently in **use** in the Hungarian plastics industry **is suitable for the production of hemp biopolymer products**, only the determination is lacking, but as the automotive industry is still the main driver of hemp composite use, the top pressure is expected to be there. In addition, there are serious efforts to replace single-use plastics as disposable food accessories.

Finally, I would like to highlight the application in 3D printing, as this is the fastest growing area of the plastics industry. 3D printing technology has already been used to print space rockets, but there are many everyday objects that can be printed that would be economical and sustainable to print specifically from hemp composite materials.

CONSTRUCTION

In terms of the building industry, building with hemp is definitely one of the most sustainable alternatives, since not only does the raw material used sequester large amounts of CO_2 (8-15 t/ha), but the walls of the house absorb and store it for many decades.

People spend almost 90% of their time indoors, so it is very important that the air indoors is healthy for them. Unfortunately, the masonry of many houses is currently filled with chemicals, some of which evaporate into the air. The lack of proper vapour permeability and other factors combine to make the air inside a house often 5 times more polluted than the air outside. In **order to avoid the sick-house syndrome** and for sustainability reasons, the most suitable living space is the hemp house. Fortunately, many people now see it in the same way and we can say that more people want to live in a hemp house than the construction industry has the capacity to build.

Hempcrete is 100% natural: it is a mixture of hempcrete, water and a special lime-based binder, which can be used to build or insulate a hemp house using a variety of technologies:

- sliding shutter construction
- hempcrete wall construction with blowing machine
- hempcrete masonry block by

If insulation is the only purpose, hemp fibre insulation board or sprayed hemp fibre pulp can be used in addition to hemp concrete.

Currently, there are also hempcrete house construction and insulation projects in Hungary with the participation of several construction companies, but there are also initiatives in the production of hempcrete masonry blocks, including our project partner Érmellék Centrum Community Nonprofit Ltd.

The low cost of the posdorja needed for hemp concrete makes hemp house construction **economical**, but it is also the reason why it is not worth growing hemp on posdorja alone. On the other hand, as a by-product it is a perfect financial addition.

FUEL

The use of industrial hemp for fuel purposes can be considered more economical and sustainable compared to wood if direct cultivation is taken into account, as it is 3 times more productive than acacia, for example, in terms of mass, when considering a 35-year maturity of cutting.

For briquetting, the

- **hemp has a calorific value of 17.5 Mj/kg**, while the
- acacia not much more: 18.5Mj/kg.

So in terms of its sale value, even if it is grown only for briquetting, **the return on the investment in rotation costs is several times higher**, but if it is used as a by-product, for example for commodity or seed production, it can yield a very high return.

Hemp can also be used as a feedstock for gas boilers, in which case it also ranks highly in the lists compared to other crops. The calorific value of hemp gas is 4.7836 Mj/m^3, which is 4.9042 Mj/m^3 when mixed with 50% sewage sludge, with only willow chips performing significantly better at 5.5274 Mj/m^3.

The high cellulose content of the hemp plant is not only useful in paper production, but also in fuels. After proper pre-treatment, hemp can also be used **as a feedstock for second generation ethanol production with** good results.

Regarding the different fuel crops, it is important to note that hemp is not only sustainable, sequestering high amounts of CO_2 during cultivation, but also **a plant for phytoremediation**, so in case of soil rehabilitation or to achieve organic certification of the area, cultivation for fuel is highly recommended.

ANIMAL BEDDING AND FEED

In terms of animal feed, hemp seed is the most important **food for fish**, apart from maize. So much so that, even under the Hungarian National Fishing Federation competition rules, only these two types of kernels can be used as feed.

There is another use of hemp seed for racing, and that is to **feed racing pigeons**. This is no coincidence, as its nutritional content is outstanding among seeds. It also has a **beneficial effect on the nutritional composition of hen eggs**, which is why it is recommended for use in egg production.

Of course, hempseed is also beneficial as a feed supplement in other animal feeds due to its high protein content and amino acid composition similar to meat. It is **useful in the meat yields of pigs, cattle and chickens,** and is also highly beneficial as an additive to dog food.

A different type of food is hemp leaf pellets, which can be used mainly **as a staple food for** rabbits and small rodents, but also **as a supplementary food** for larger mammals, with a beneficial, health-promoting, vitalising effect due to the phytocannabinoids and terpenes it contains. In such cases, it is recommended to give 20% of the diet.

As an animal, hemp is also found in the racing world, where it is used as a litter for racehorses. It is also mainly used for littering rabbits and small rodents because of its many good qualities:

- insect-free,
- good thermal insulation,
- odour absorber
- antimicrobial,
- high absorbency,
- does not dust,
- after use, quickly biodegrades in the soil when applied.

FOOD INDUSTRY

The food industry uses hemp in countless ways. Of course, the hemp seed is the main part used for its valuable nutritional value, but the leaves can also be used to make tea, for example, or raw in salads and stews, as it **contains** some **phytocannabinoids and terpenes**, which are beneficial to the body.

Hempseed is an extremely valuable source of protein (30-40%) and amino acids, **containing all the essential amino acids**. Compared to other protein sources such as milk, soy or even insect proteins, it performs perfectly, being a highly absorbable and digestible protein source.

In addition to its protein, amino acids and high levels of omega 3-6 unsaturated fatty acids, it also contains a number of minerals. Higher levels of phosphorus, potassium, magnesium and calcium.

As an oil seed (25-30% oil content), it is currently used in most cases **for oil pressing.** Hemp seed oil is extracted by cold pressing the seeds. The concentration of polyunsaturated fatty acids is 75-85% of the total oil content. This valuable oil is not only used for food purposes, but is also used in large quantities in the cosmetic industry.

Hempseed flour is made from the cake left over after the oil pressing, and **protein powder is made** by further sifting. Both are further processed, from protein gelatine, through bakery products, to other protein-enriched products such as pâtés and yoghurts.

Hemp seeds are used roasted whole for flavouring, but in the hulled form they are a real delicacy in muesli, chocolates or even baked goods. With further processing, it can be made into a seed cream that, when flavoured, rivals the famous hazelnut creams.

Seed milk is also a fashionable use, for which hemp seed is also perfectly suitable, but coffee and beer have also been made from it. In Hungary it is not yet a food product, but in Europe there are several CBD-enriched foods.

MEDICINE

From a medicinal point of view, we are now only looking at industrial hemp, so the medicinal effects of the THC compound are not considered. However, **105-110 useful molecules** still remain in the plant. The extraction of the various substances with medicinal properties is not always easy and is subject to heavy legal regulation, so this part of the processing industry is not without its problems. If there is a change in the regulation of the treatment of the hemp plant in this way, it will certainly be worth the investment to set up an extraction plant, but it is still a large investment.

Currently, the following legal classifications exist in the healthcare industry:

- drugs
- medicinal products
- magistral medicines
- traditional herbal medicines
- medical devices
- foodstuffs for special medical purposes, food supplements, cosmetics

Most of the products in these categories are subject to authorisation, but "foodstuffs for special medical purposes, food supplements and cosmetics" are not subject to prior examination by the OGYÉI, but only to notification, so products in this category currently have a right to exist on the market. These products cannot include a recommendation of use for the treatment of the disease in question, so the situation is not simple in this case either.

In any case, research is still ongoing on most of the compounds in hemp, but **CBD is already known to play a major role in immune regulation** by binding to our CB2 receptor. So it will definitely be worth looking into the medicinal use of hemp in the future, once the legal background has been sorted out.

COSMETICS INDUSTRY

For cosmetic purposes, two important raw materials are considered to be prominent in hemp: the seed oil and the CBD oil.

Hemp seed oil is **an excellent alternative to chemicals and petroleum derivatives in creams and cosmetics**. As people are increasingly looking for ingredients in cosmetics that are not tested on animals, SLS-free or even vegan, natural ingredients such as hemp seed oil, which already has valuable ingredients and is currently in fashion, are becoming more and more valued.

Its beneficial properties are mainly due **to its high antioxidant content**, but the numerous trace elements and vitamins taken together result in the following beneficial effects:

- anti-inflammatory,
- skin softener,
- skin soothing,
- moisturising.

Hemp seed oil is the most common ingredient in soaps, shower gels, shampoos and body lotions, but it is also found in many face and hand creams and sunscreens. **It is especially recommended for sensitive skin due to its soothing properties.**

CBD oil is used as an additive in cosmetics, first used **for the regeneration of sports injuries and scar treatment**, and then, recognising its beneficial properties, it has been used more widely in anti-ageing creams.

CBD oil has many good properties:

- anti-inflammatory,
- wound healing (supports cell regeneration),
- skin soothing, moisturising,
- inhibits the breakdown of collagen,
- painkillers

At present, the market is not yet saturated with hemp-based products, which is why this use is also recommended, both at artisanal level and in large-scale industry.









CRAFTS








TRADITIONAL TEXTILE MAKING

Due to the climatic conditions of the Carpathian Basin, traditional **textile production is mainly based on three basic materials**: wool, flax and hemp, and possibly nettle. The three vegetable raw materials are processed in essentially the same way, with the exception of wool, although if the approach is somewhat innovative and the aim is not long-fibre spinning, the processing can be continued in the same way from a certain stage.

At the craft level, a hemp breaker, eradicator and rake are worth getting, but having a carding machine can also help. Spinning and weaving of mixed fibres can also be of interest, and effect yarns can be made at craft level with greater added value.

HEMP-BASED FURNISHING TEXTILES, FASHION GOODS

There are some textile products that were traditionally made from hemp textiles in the past. Most of these are traditional dresses, but also kitchen linen, towels, bed linen, aprons and various crop bags used in peasant life were also made of hemp.

In today's world, many of these products still have a place, as most of them have found their role in life because of the good qualities of hemp. For example, the **good moisture-wicking** properties **of hemp textile are** very beneficial for towels, aprons, kitchen towels and even bed linen.

As hemp is no longer considered a cheap raw material, it is possible to develop mainly small-scale ranges of hemp textiles, whether for home textiles or for produce bags and storage. It can be combined with basket weaving and dyeable vegetable dyes, all of which add great value.

NATURAL COSMETICS, SOAPS

The production of handcrafted cosmetics is very common nowadays, as these products typically do not contain major chemicals and hazardous substances, so there is a growing demand for **natural cosmetics**.

People have more trust in these products, because trust is directed towards the maker, who personally assures us of the product's beneficial effects and natural ingredients. Hemp seed oil fits perfectly into this perspective, as it **can be used with hemp seed oil from local farmers, which** further deepens the relationship of trust with customers. In the best cases, most of the ingredients in the products are local.

ARTISAN FOOD

Many foods can be made from hemp seeds or even hemp leaves on a craft scale. The market for these products is multifaceted, ranging from the **local farmers' market to private label**, which can even turn the maker into a supplier to a restaurant or retailer.

Hempseed flour can be used to make bakery products, biscuits and muesli, which can be further flavoured with hulled or unhulled hempseed.

The seed is most easily used to make a variety of flavoured distillates, but the oil can also be used to make spice oils and as a base oil for many other products.

The only limit is the imagination of the maker, which can make good use of the many benefits of hemp seed, and in any case the trends promise a growing market for this industry.

CONCLUSION, VISION

As a result of the knowledge gathering and partnership building process of the past seven years, which also included the Slovak-Hungarian cross-border Interreg project "The Future in Hemp", the basic conditions have been created for the reconstruction of the industrial hemp economy, which was once extensively and systematically operating in Hungary and was also at the forefront at a European level, in line with the growth already started at international level, in a modern form and for **bringing our country and the Carpathian Basin back to the forefront of the world with a European model programme in this new, future-shaping, leading sector**. In the cultivation, processing and territorial cooperation of our most versatile industrial crop for self-sufficiency, we have reached new approaches and solutions which, when combined, will **enable us to build Europe's largest, most modern and most profitable industrial hemp economy in the** next decade.

The implementation of this internationally unique programme for the development of the industrial hemp economy requires simultaneous cooperation and coordination within product lines, between sectors and industries, and between geographical areas. A diverse and integrated knowledge base and the necessary market, research, development and innovation partnerships have been established, thus ensuring technological consistency and the possibility of reconciling business interests (as evidenced by the existence of local and sub-regional initiatives and the development of cross-border partnerships and cooperation). For example, in the "The Chess Circle" programme, launched under the coordination of the National Institute of Culture, craft groups based on hemp raw material are being organised throughout the Carpathian Basin.

Overall, it can be concluded that **the conditions for the implementation of the developed programme for the development of the hemp economy - including the specific motivations, mental, spiritual and physical energies - are gathered and ready for action.** In addition to the development models and concepts that have already been worked out, the only thing that remains to be done is to create a Carpathian Basin framework for implementation, which is possible thanks to the economic development zones created by the government, which also have a cross-border sphere of influence, and which are complemented by a region of Szeklerland and its region of influence in Transylvania. With this combination of conditions, one of the most significant (if not the most significant) agro-based industrial development programmes

of our time can be implemented. **The coincidence of national, macro-regional (Central European) and continental economic development interests and objectives**, which will **determine the decades ahead, represents an exceptional historical moment.**

Interreg
Szlovákia-Magyarország

BUILDING PARTNERSHIP!

IT WAS PREPARED IN THE FRAMEWORK OF THE FUTURE IN HEMP – CCP (SKHU/1802/3.1/013) PROJECT. THIS PROJECT IS FINANCED BY THE EUROPEAN REGIONAL DEVELOPMENT FUND.

www.skhu.eu

ISBN:
978-615-5639-49-4

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Editors:
Ivanics Anna és Simon Andrea

Graphics and photos:
Ivanics Anna and Nemzetstratégiai Kutatóintézet

Publisher:
Nemzetstratégiai Kutatóintézet

Printing and binding:
Duna-Mix Kft.

THE CONTENT OF THIS PUBLICATION DOES NOT NECESSARILY REPRESENT THE OFFICIAL POSITION OF THE EUROPEAN UNION.



Nemzetstratégiai
Kutatóintézet

The purpose of the publication is to introduce the wide range of industrial uses of hemp. It presents both traditional and innovative solutions that can be easily adapted to existing industries, but also excellent for independent investments.

The publication describes the economic development results based on industrial hemp achieved by the partners of the cross-border project Future in Hemp.