How to implement a systemic design strategy in Cyprus island

Politecnico di Torino
Department of Architecture and Design
Master Degree in Systemic Design
Project of Master Thesis
Academic Year 2020/2021

Candidate: Federica Cipriani
Supervisor: Silvia Barbero
Co-supervisor: Carolina Giraldo Nohra
Partner Company: ISA Energy

Politecnico di Torino
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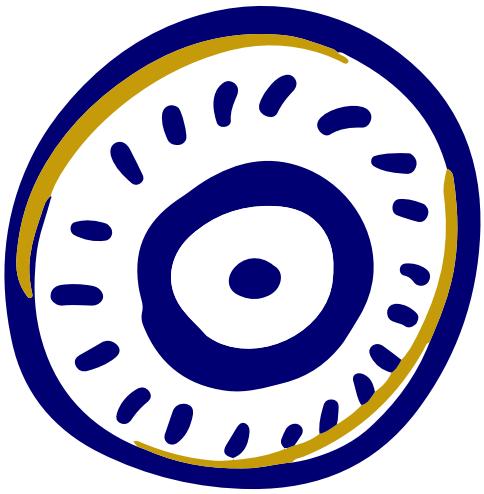
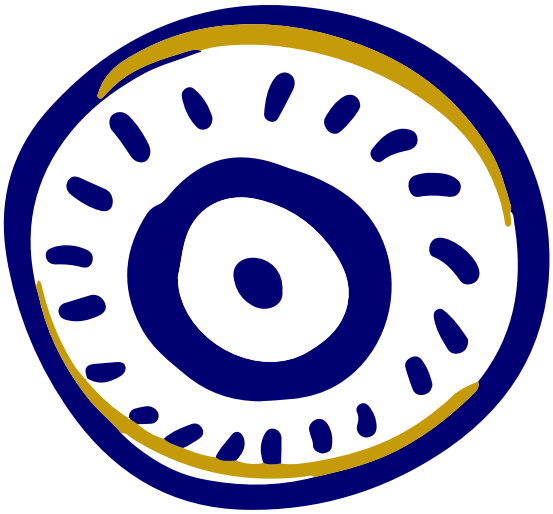

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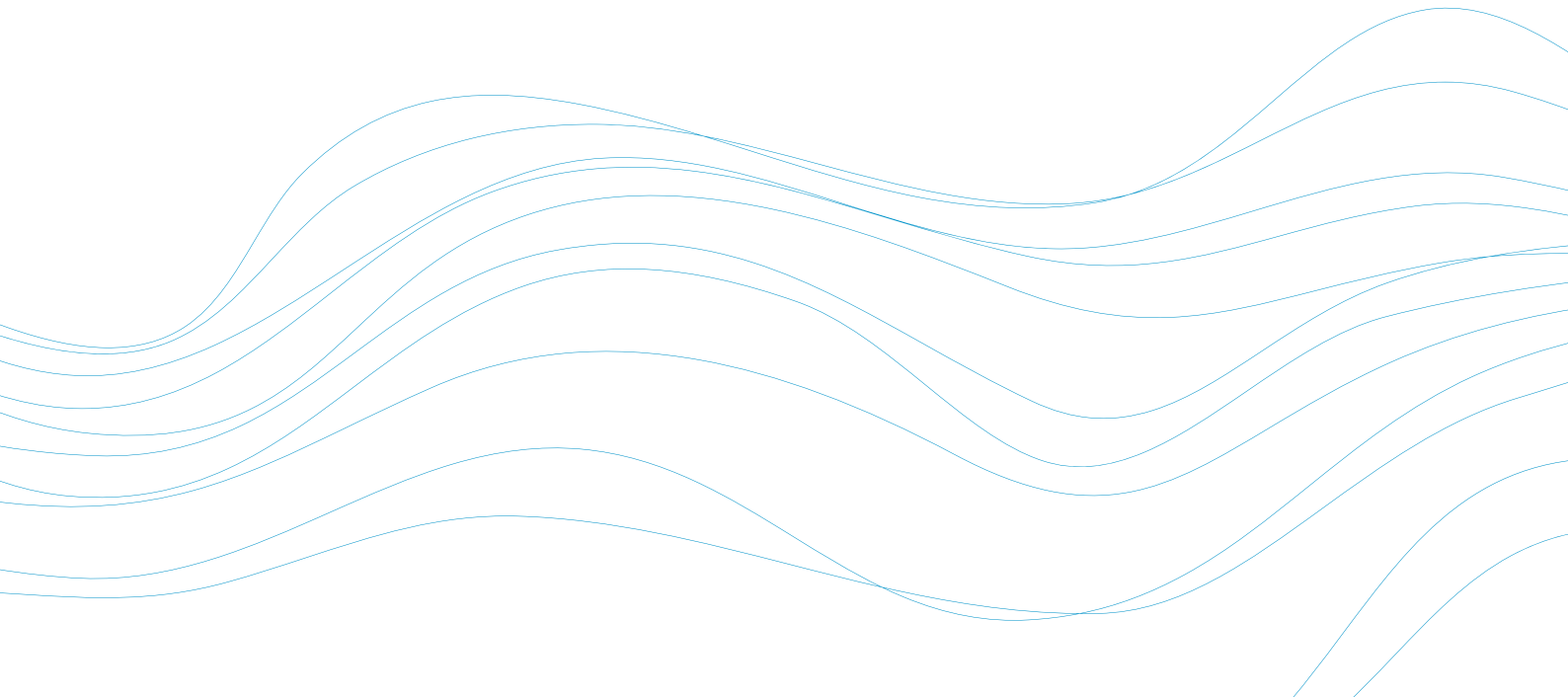
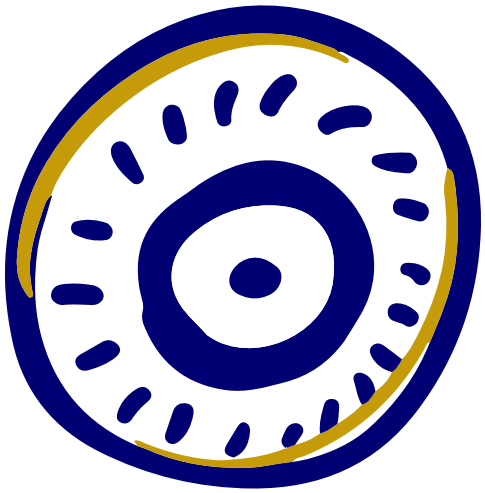
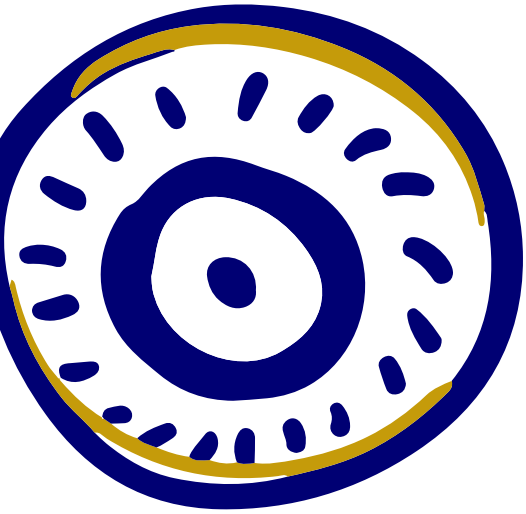
Ruins at Kourion (Curium), near Limassol, Cyprus. Image: © Ron Gatepain (A Britannica Publishing Partner)



... there is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage than a new system or than a creation of a new order of things ...

Niccolò Machiavelli, The Prince (1513)





Abstract

The following master's thesis represents the final dissertation of the academic career in Systemic Design carried out at the Politecnico di Torino within the Department of Architecture and Design. The development and conclusion of the project would not have been possible without the involvement and collaboration of my supervisor Silvia Barbero, co-supervisor Carolina Giraldo Nohra and direct contacts on the territory such as Roberto Sciffo and Ihsan Malik of ISA energy, the Statistical Service of Cyprus and the editorial of Cyprus Profile.

Systemic Design
Systemic design helps designers cope with complex design projects. The recent challenges to design coming from the increased complexity caused by globalization, migration, sustainability render traditional design methods insufficient. Systemic design intends to develop methodologies and approaches that help to integrate systems thinking with design towards sustainability at environmental, social and economic level. It is a pluralistic initiative where many different approaches are encouraged to thrive and where dialogue and organic development of new practices is central.

Cyprus Island
Cyprus is an island country in the eastern Mediterranean. Neighboring countries include Turkey, Syria and Lebanon. Geographically, Cyprus is a central plain with mountains to the north and south. The national system is a republic. The President is the head of state and the head of government. Cyprus has a market economy system in which prices for goods and services are determined by a free pricing system. Cyprus has been a member of the European Union (EU) since 2004.

Agri-food
NOUN, (countable and uncountable, plural agri-foods), (chiefly Canada, also US)
The business of producing food agriculturally (as opposed to through hunting, fishing, gathering, and so on); *food so produced*.
Agrifood is a set of activities that includes individual agricultural producers and associations, the food processing industry, food trade and administration activities.
Local food production depends on the climate and environmental conditions of the area. The other activities are based both on the yield of local production and on an efficient use of logistics and infrastructures, to ensure a stable flow of the necessary goods.

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Introduction

The analysis of Cyprus territory has been conducted through the historical and cultural background of the territory, leading to the definition of the **holistic diagnosis (HD)**. Several aspects has been taken in to consideration for an exhaustive understanding of the complex island's dynamics.
The tools of **systemic design** made it possible to identify strengths and criticalities within the Cypriot system from the point of view of environmental, social and economic sustainability. Given the geographical and morphological properties of the island, Cyprus has ample scope for intervention in the **agri-food sector**, trying **to make the island reality more autonomous and sustainable in the management and consumption of resources**. Agri-food is a industry that has to do with food production, it is the business of producing food in an agricultural way, opposed therefore to methods such as hunting and fishing. Today the agrifood industry is at the center of a very important economic complex that is called "food system", whose purpose is to feed the populations, mostly through a system of market relations. It includes the processing of the food, the retail, catering and advertising services. Systemic design methodology allowed to identify some **operational strategies for the creation of new networks of material and immaterial flows** aimed at transforming the economy and production processes in the territory from a linear to a circular approach. The application of these strategies, following the principles of **circular economy**, becomes successful if they are rooted in the **local cultural and territorial context**.

1.1 Investigation domain

The whole thesis project starts with the aim of answering three basic questions belonging to the fields of circular economy, resilient island and agri-food sector. The three specific questions, therefore, of the project research field are:
1. How can the tools of systemic design boost the principles of the circular economy?
2. How can the methodological approach of systemic design be applied in an island context to foster its resilience and sustainability?
3. How can systemic design intervene in the agri-food sector to favor the implementation of sustainable development policies?

Investigation domain

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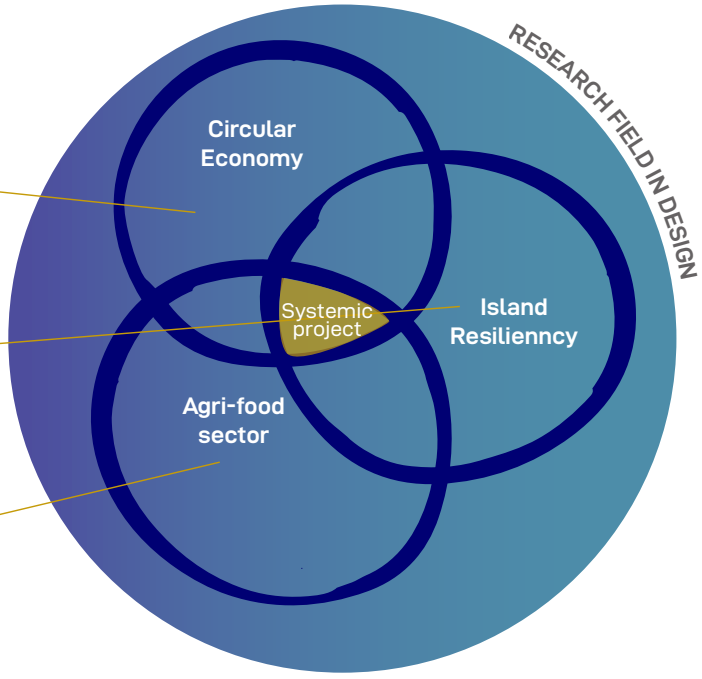
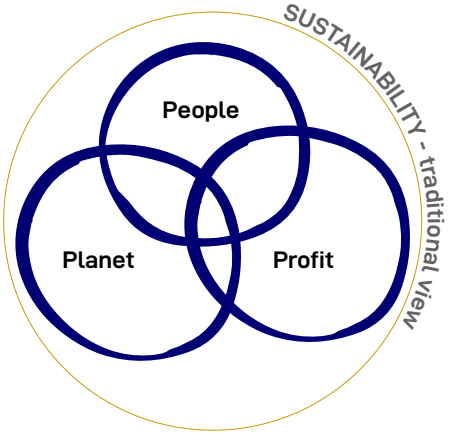


Investigation domain: fields of interest of the thesis and systemic project domain

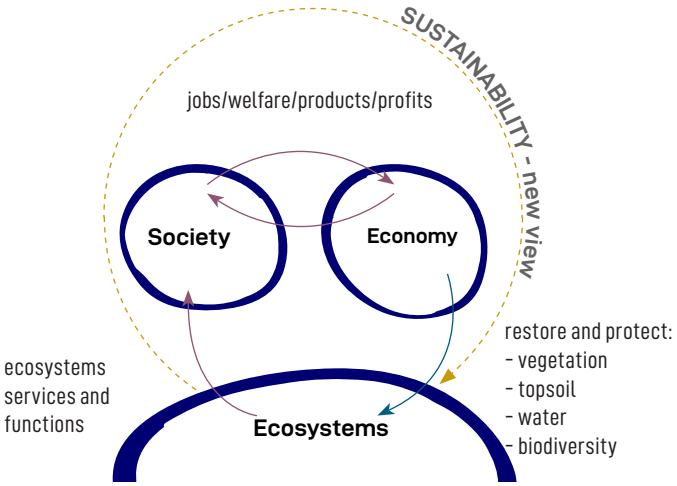
1.2 Defining sustainablity & resilience

The definition of resilience is "the capability of a system, be it an individual, a forest, a metropolis or an economy, to deal with change and continue to develop." The definition of sustainability is "the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs."
Linking resilience and sustainability comes right all the way down to spotting wherein every of the two has its area in conservation policies. Developing our Earth sustainably approach protecting assets and being capable of get better for the destiny. The idea of resilience is getting into the communique at a time whilst there`s presently some of unknowns, specifically associated with weather alternate.
Resilience aids conservation as it permits the most quantity of alternatives at any given factor in time.

By growing resilience withinside the regions of land, water, and biodiversity, assets a considerable whilst they're maximum needed. When resilience is constructed right into a system, conservation happens naturally. It will become a manner for the ones maximum invested withinside the Earth to repair stability to it and permit it to preserve itself naturally. Nonetheless, resilience additionally indicates that alternate is natural. Change will come, and when there is change, proper procedures will be able to restore the environment. Focus on resilience, in addition to sustainability, provides the ability for the environment to renew itself even after tragedy strikes.



The traditional triple-P view (Planet, People, Profit) is not sustaining our ecosystems



In the new view, resilience is based on sustaining ecosystem functions

The traditional view of the sustainability model (left), versus a more complete view where ecosystems form the basis (right). The **pink arrows** **are the basis of our unsustainable economic system**. We **need to organise** the **light-blue arrow** with all stakeholders, including business, **to sustain ecosystem functions**, implementing **resilience**: the ability of a system to recover quickly after an external shock, better withstanding environmental, political, economic and social stresses.

Source: Willem Ferwerda, Nature Resilience - Organising Ecological Restoration by Partners in Business for Next Generations, 978-90-820088-0-7;November 2012, Rotterdam School of Management.

Sustainability

Sustainability is the minimum state that we need to keep as s status quo.
The Blekinge Institute of Technology (Sweden) has worked over the past 30 years, in collaboration with scientists, industry partners and government entities, and have refined in an international consensus, a set of Sustainability Principles. This has been an interactive process that has been developed with companies like IKEA and Volvo, and governments/municipalities and even Åland (an autonomous region of Finland) alike. The result is a set of eight Sustainability Principles (SPs) that apply across all domains/sectors/industries; principles that are underpinned by scientific laws and knowledge, that we all can use in our own lives and businesses to help humanity live sustainably with the planet. The first three relate to the environment, while the latter five toward society. The first 3 SP's were developed with the need to find what is essential for our ecological system (Biosphere) to be sustained in order for future generations not to have their needs systemically undermined.

These first three Sustainability Principles dictate that nature is not subject to systemically increasing:
1. Concentrations of substances extracted from the earth's crust: there are naturally occurring exchanges between the biosphere and the lithosphere (earth's crust); however activities like mining and polluting exceed these natural processes, placing pressure on the biosphere.
2. Concentrations of substances produced by society; emitted or leaked substances that the biosphere cannot degrade, or that can be naturally deposited into the lithosphere. These apply to naturally occurring elements such as Nitrogen Oxides (NOx), or elements that have never existed in the biosphere such as chlorine or CFC's.
3. Degradation by physical means; human activities that influence the biosphere by physical means, such as the destruction of wetlands, deforestation, over-harvesting, and in many cases the methods used in industrial food production.

The latter 5 principles pertain to society, whereby people are not subject to structural obstacles to:
4. Health; people are not exposed to environments that undermine their physical, mental or emotional wellbeing (e.g. dangerous working conditions, or lack of sleep).
5. Influence; people are not systematically prevented from participating in shaping social systems (e.g. suppression of free speech, or neglect of opinions).
6. Competence; people are not systematically prevented from learning or developing competence (individually or together); (e.g. education).
7. Impartiality; people are not systematically exposed to partial treatment (e.g. discrimination or unfair selection to job positions).
8. Meaning-making; people are not systematically prevented from creating individual meaning, or common meaning as a group (e.g. suppression of cultural expression).

The above Sustainability Principles are a guide for achieving an absolute minimum state for a society to exist inline with the earth's bioshpere. To be resilient, we need to define what a healthy society would be and the function of which would be supportive of our biosphere.

Defining a healthy society

In the Anthropocene era, mankind is the biggest influencer of planetary function; mankind's psyche is the biggest driver and risk factor to planetary evolution. For mankind to thrive, Gaia must thrive, and therefore planetary function must be the guiding force or foundation on which all is based.

Main source: Thompson, A. W., & Blume, R. (2010). The Natural Step Framework. 2, 350–352.

Sovereignty of the individual
Assess for all to:
- The consitution, individual rights.
- Soverignity, individual (including following ethics).
- Understanding oneself (health, wealth, personal growth).
- Self resiliency (affordable/accessible healthy food, self defence, meditation).
- Belief/culture, freedom to practice.
- Adaptive learning, free access to learning.

Societal prosperity (healthy functioning society), collective
Assess for all to:
- Transparency in institution (anything with rules; eg. company, marrage, governemnt, clubs, monetary, religion, etc.).
- Education/knowledge.
- Access to jobs/income.
- Ease of ownership.
- Security (physical/virtual).
- Culture/norms.
- Viable currency, trust in an exchange (cash & crypto); non-central bank based indepencence, with the abilty to self-regulate/ create their own rules.
- Rules/regulations, defined within natural function (as below).
- Productivity, he ability for the society to be productive.
- Value, increasing value of the local captial (human + business).
- Diversity, many ways of getting things done (for intstitutional structures, businesses, supply chains, land use options, people).
- Redundency, flexible systems, a spare capacity within the system (e.G storage of energy, food, medicine, safer infrastructure).
- Connectivity, connections within and between systems (e.G. Interconnectors for energy supply, import of food, information accesss/exchange, etc.).
- Healthy neighbours, regional security and interdepencence.
- Public ownership, restricted to local (no multinational influence).
- Clean people based towns (priority public transport, green areas, good water, 15-minute city).
- Quality public healthcare (efficient, high standard, safe, patient-centred healthcare).
-Waste and circular economy, how is waste (municipal, solid waste, industrial, marine etc.) handled?

Healthy functioning ecosystem
Echnical infrastructure (human activities) are established through:
- Agroecology, agroforestry.
- Minimal chemical use.
- Nature based solutions (e.g. polyculture forests, gabbions/swales, composting).
- Water filtration (road runoff, factory outputs, plastics from waterways, wastewater, etc).
- Clean energy production (e.g. hydrogen).
- Efficient public transport.
- Ease of communicating/exchange with government.

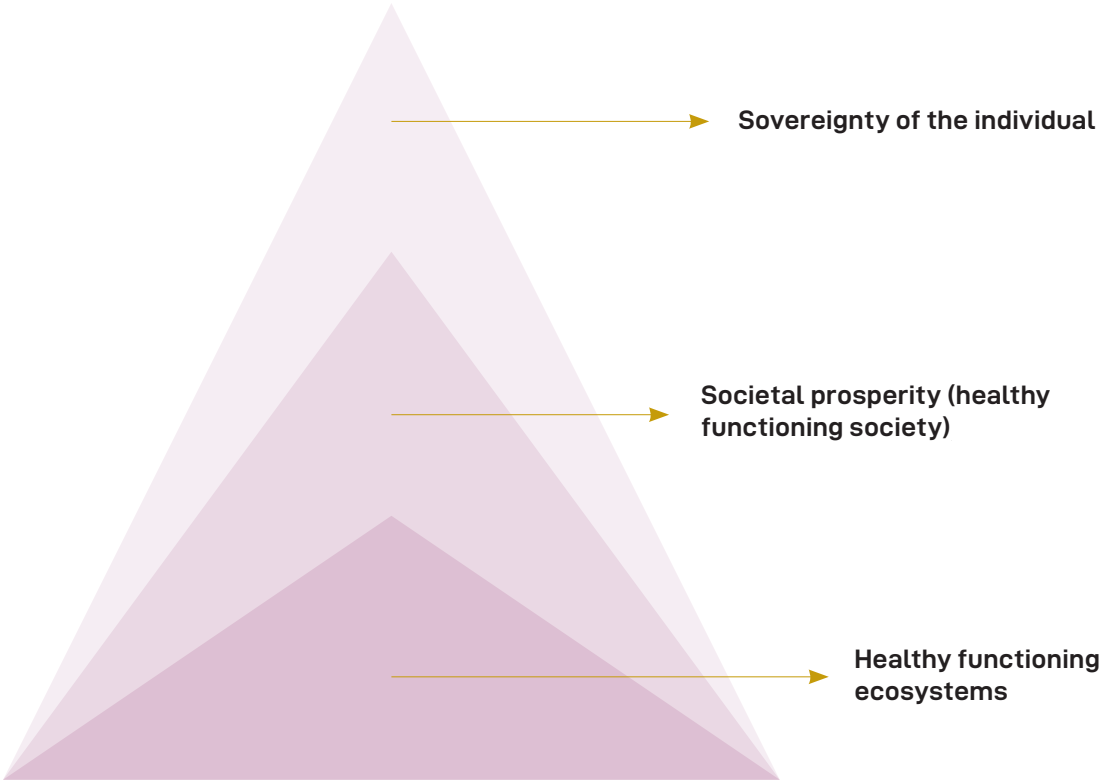
Main source: Thompson, A. W., & Blume, R. (2010). The Natural Step Framework. 2, 350–352.

Natural infrastructure are established through:
- Biodiversity.
- A positive water cycle (biotic pump), clean air & water.
- Apex predators.
- Rewilding.
- Biological active soils rejuvination of aquifers.

Water as the key for resilience development

The most urgent needs for the island are water security, as water is the basis of life, and leads to food security, while contributing greatly to social security.

Water security can be established by observing the water cycle with the aim to create a functional action: increase the biotic pump. The biotic pump is an increase in the attraction of rainfall inland; water vapour is drawn (pumped) from the sea inland through the attraction of cooler land surface, green areas like forests that 'seed' the atmosphere with bacteria that attract water microdroplets to form rain, which falls on land that is cool, has greenery to slow the falling water before striking the ground, and slows and sinks water into the landscape. Water is the basis of life and access to clean fresh water is the foundation to any society or civilisation. Healthy food security is fundamental to securing the health of a society/nation. Both the above are achieve through healthy soil and a positive biotic pump. This is the key on which resilience can develop.



Main source: Thompson, A. W., & Blume, R. (2010). The Natural Step Framework. 2, 350–352.

Death spiral cycle

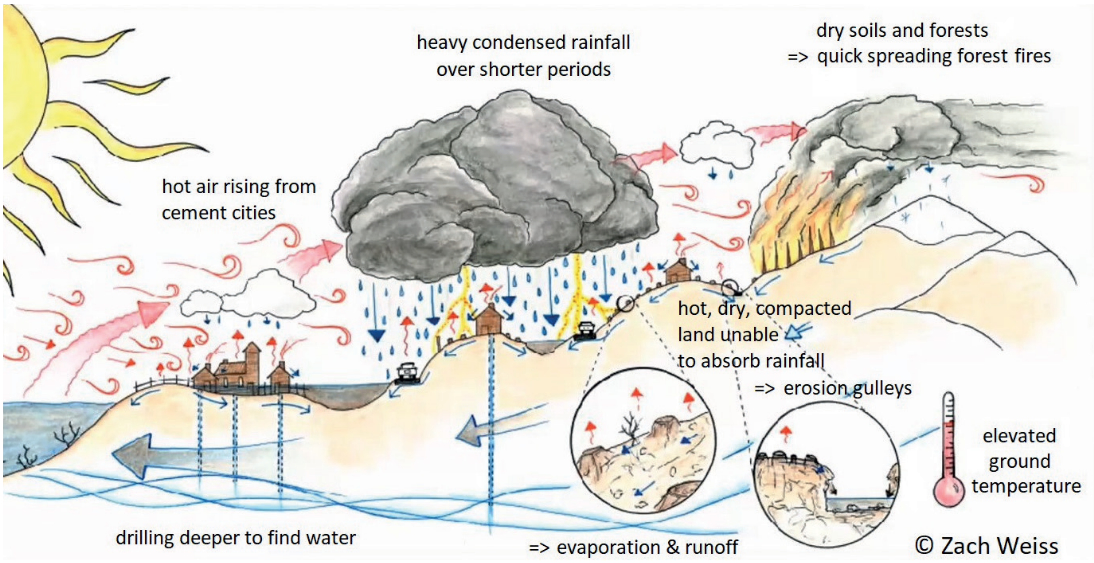
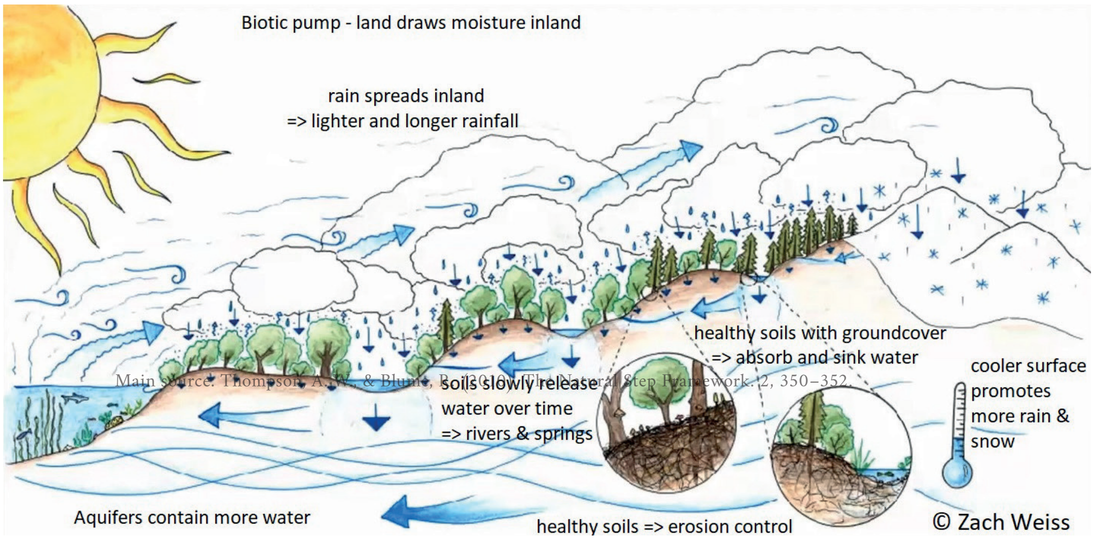


Image credits: Weiss Zach, Hope in a world of crisis: Water cycle restoration, TEDxBozeman, Youtube video

Regenerative water cycle



Main source: Thompson, A.W., & Blume, B. (2019). The Natural Step Framework. 2, 350–352.

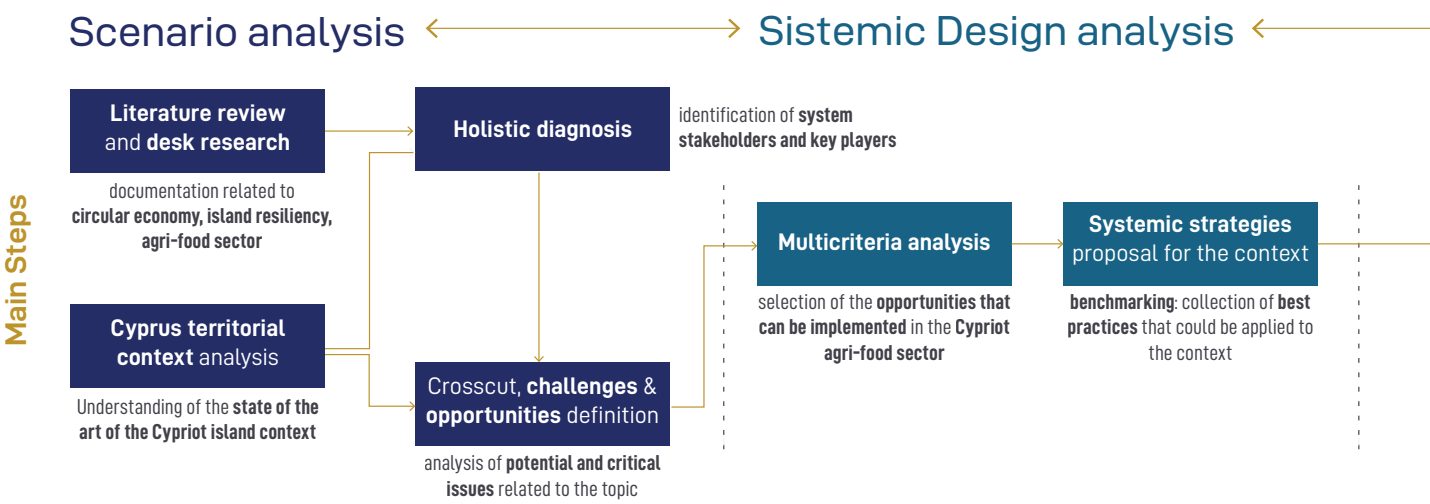
Image credits: Weiss Zach, Hope in a world of crisis: Water cycle restoration, TEDxBozeman, Youtube video

1.3 Systemic approach

The highlight of this systematic design project was the ability to take into account all possible aspects, analyze them in detail and develop strategies to increase efficiency and its relationship to sustainability, indeed systems design is a discipline with the ability to implement systems theory with creative methods and attitudes that bring deep technical knowledge, aesthetic abilities, and creative implementations to different types of realities.

System designers have the ability to research and develop solutions for complex systems such as an island context. Systemic design is the best approach for this project, since it embraces best practices in rigorous research and teaching, practice of critical and creative thinking, sub-discipline crosscut and in-depth skills.

To define robust solutions for complex scenarios, systems design expertise provides a way to engage in holistic analysis of these contexts, enabling the design discipline to create autopoietic open systems based on contextual resources. Systemic design is an alternative design model and future design strategy for sustainability based on a holistic diagnosis. Because of the importance of this tool as an innovative contextual framework for gaining a holistic view of heart conditions and identifying the benefits of change, a holistic diagnosis should be defined



Project roadmap: structure of the research steps and systemic design phases

Expected Results

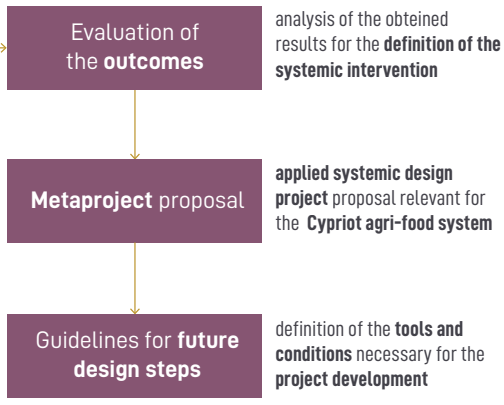
Understanding of the current Cypriot scenario, through desk research, literature review and holistic diagnosis

Shifting from a linear to a systemic model of the agri-food sector in Cyprus, redefining new flows, processes and features

and evaluated through a structured process based on a deep understanding of design thinking and systems thinking concepts, which frame the process to define it.

This disruptive approach improves the design methodology in the first phase of problem definition and investigation, allowing each individual aspect of the system to be fragmented, helping designers to solve problems and create complex alternative scenarios through an innovative and interdisciplinary approach. To perform a relevant holistic diagnosis it is necessary to know the context of study in the smallest details, to be able to discover both its opportunities and its treaths.

Implementation and conclusion



Proposal of specific project interventions for the analyzed context taking into consideration **sustainable development policies and funding promoted by the Republic of Cyprus**

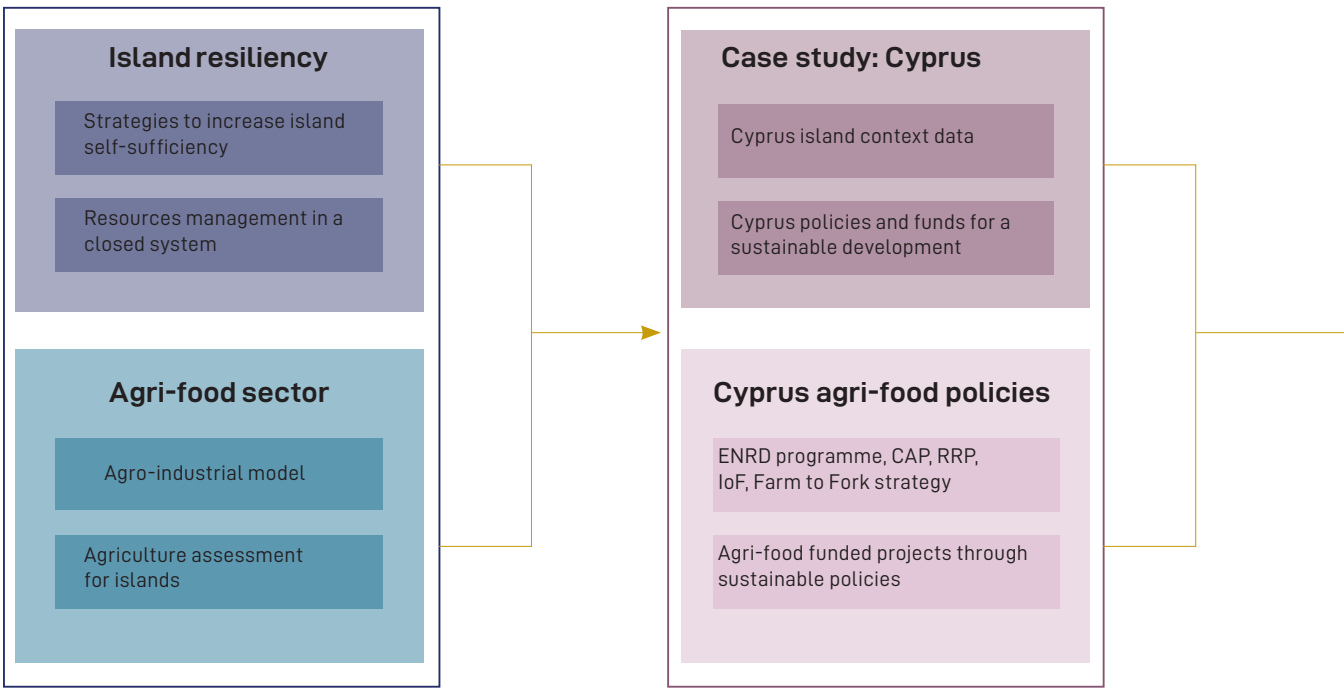
1.4 Literature review

"An island is a closed and bounded system in many respects and presents a manageable unit of study."
Deschenes, P. J., & Chertow, M. (2004)[1].

What is an island-system
The island is in many ways closed and limited in the system that provides scientists with a manageable unit of research. These same attributes face the island's population with the problems of limited availability of resources, weak resource security, and limited natural capacity. The island system represents a great opportunity to apply industrial ecology tools focused on providing sustainable solutions for human development. Modern transportation has made most of the geographic boundaries surmountable and has increased the island's ability to connect with the rest of the world. "However, the island is still somewhat isolated due to transportation time and cost. Although the fineness size is limited, the upper limit of this characteristic is still controversial. However, the combined nature of scarcity, isolation and size limits the island's resource availability. From an ecosystem point of view, it is worth noting that these traits open up niche markets and reduce external competition" (MacArthur & Wilson, 1967).

Island states exist as a continuum based on size and connectivity, the latter characteristics of which determine the extent to which an island is a closed system. Isolation from major development centers in terms of human resource requirements limits the ability of many islands to import electricity or freshwater.
These resources often have to be produced internally and used conservatively. Waste management is also limited due to the island's resources and ability to assimilate. However, many resources can be brought to the island, including food, minerals, raw materials, and fuel. Some islands even send drinking water.
Islands are microcosm in that they represent the dynamics of competition for limited resources, and increasingly human pressures and influences on the environment.

Literature review map

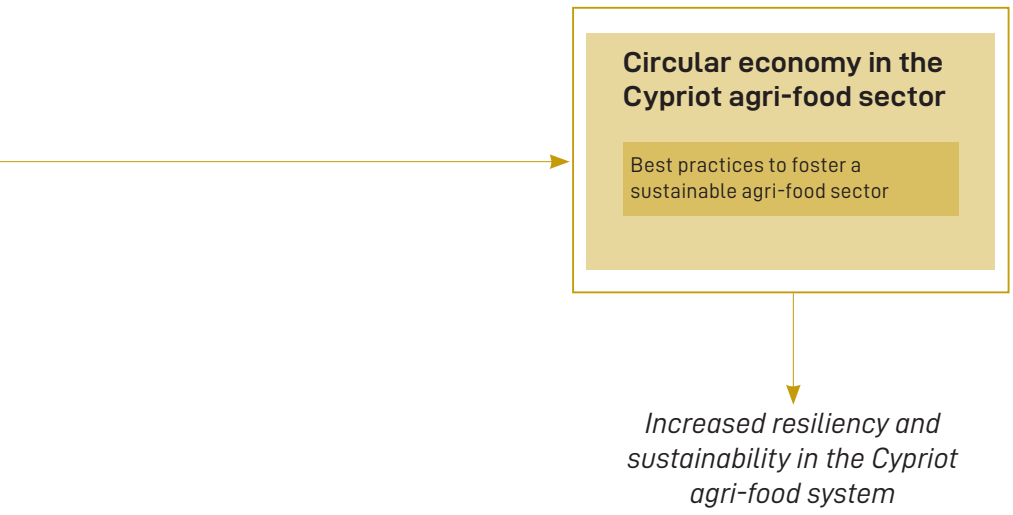


Literature review: scientific literature mind path used in the analysis

However, the island is distinguished by its role as a small system exposed to global forces. Many unique challenges arise when a closed and fragile island environment is combined with an open global economy. An island is a system that is under pressure from its internal dynamics and the larger system in which it exists. It is more appropriate for environmental managers and planners to consider the island context, which is an isolated system with limited resources, than the island paradigm, which is a constrained system with controlled conditions. The island context is therefore rapidly bringing sustainability issues to the fore in environmental management and planning. The size and isolation of the island limits the availability of important resources such as fresh water and fertile soil. The extraction of resources and the release of by-products occur within small areas of the island, so environmental externalities are more closely related to the use of the resources involved. Resource security issues for externally sourced resources. The supply of vital resources can suddenly stop or become prohibitively expensive, leaving the island without a well-developed regional alternative. In addition, large islands with outward-facing economies often rely on several high weighting factors, such as tourism, oil imports, or tax cuts. These factors not only overlook the ecological constraints of the island system, but a sudden collapse could leave the island vulnerable to severe resource shortages.

Industrial Ecology

Industrial ecology has many useful concepts that can be used to address the sustainability issues of island systems. First, industrial symbiosis, which takes into account the geographical proximity between traditionally distinct industries (Chertow, 2000). This collaboration can take many forms. This collaboration can take many forms. Businesses can physically exchange substances, water, energy or by-products. They can also exchange information or adjust plans to increase operational efficiency. Streamlined regulatory approvals and co-marketing can also be hallmarks of industry symbiosis. Industry symbiosis enhances the resilience of participating companies while meeting society's needs to conserve resources and protect the environment. Biological symbiotic relationships promote interconnection and resource circulation.



Industrial Symbiosis

Industrial symbiosis seeks to increase resilience by extending these characteristics to industrial systems (Wallner et al., 1996). Ehrenfeld and Gertler (1997) discuss several factors critical to the success of industrial symbiotic networks. Of course, all resource exchanges must be technically feasible. When exchanging resources, participants should be close to each other to facilitate the exchange and minimize handling and transportation costs. The feasibility is higher, for example, even for large continuous waste streams than component waste.

The exchange must be economically competitive with the flow of resources to be replaced.
Shipping costs, processing costs, organization costs, or transaction costs can make the exchange economy more or less favorable. Environmental regulations, especially those dealing with the recycling of potentially hazardous materials, must be flexible so that the exchange can be economical and efficient.

Material flow tracing is used in the industrial system (Bringezu & Moriguchi, 2002) to identify and quantify all important material inputs and outputs of each company. By analyzing the results, opportunities for material exchange between companies and opportunities to use resources more efficiently in the industrial ecosystem were presented. In conclusion, islands benefit from an industrial ecology approach, and industrial ecology research benefits the islands. These islands face serious sustainability challenges.

Local natural resources are scarce and often in short supply. Resources are imported with the risk of supply disruptions and price fluctuations. Human development and industrial systems depend on the ecosystem services of fragile and limited island ecosystems. The island's small size and isolation highlights these issues in the planning scope. Sustainability issues tend to be much more relevant in an island context than in a continental context. Industrial ecology, which takes into account the industries inherent in the limited natural environment, is a way to solve these problems while taking into account the needs of environmental conservation and economic development[2].

[1] Deschenes, P. J., & Chertow, M. (2004). An island approach to industrial ecology: Towards sustainability in the island context. Journal of Environmental Planning and Management, 47(2), 201–217. https://doi.org/10.1080/0964056042000209102.
[2] Chertow, M. R. (2000). Industrial symbiosis: Literature and taxonomy. Annual Review of Energy and the Environment, 25(November 2000), 313–337. https://doi.org/10.1146/annurev.energy.25.1.313

Islands of sustainability

"An island is an area where sustainability is reached at a local or regional level. Exchange activities within the regional network and with the environment are key points in creating an island of sustainability."
H.P. Wallner, M. Narodoslawsky, F. Moser (1995)[3].

When considering the methodology for achieving sustainability, two approaches can be distinguished: a topdown approach and a bottomup approach. Both approaches will play an important role in achieving sustainable development. Bottomup usually refers to initiatives initiated by neighbors and in most cases does not involve city or local governments. The Island of Sustainability (IOS) is primarily considered a regional concept, but can also be introduced regionally. For IOS, a bottomup approach is an initiative that operates at a regional or regional level, whether or not governments are integrated.

A regional or regional approach is important from a regional planning perspective, and the pace of transition from an unsustainable system to a sustainable system is faster at the regional level. For convenience, the entire system can be divided into the human sphere and the biosphere to manage the interactions that occur at the boundaries of the two systems. The human sphere is part of the environment under human control [4].

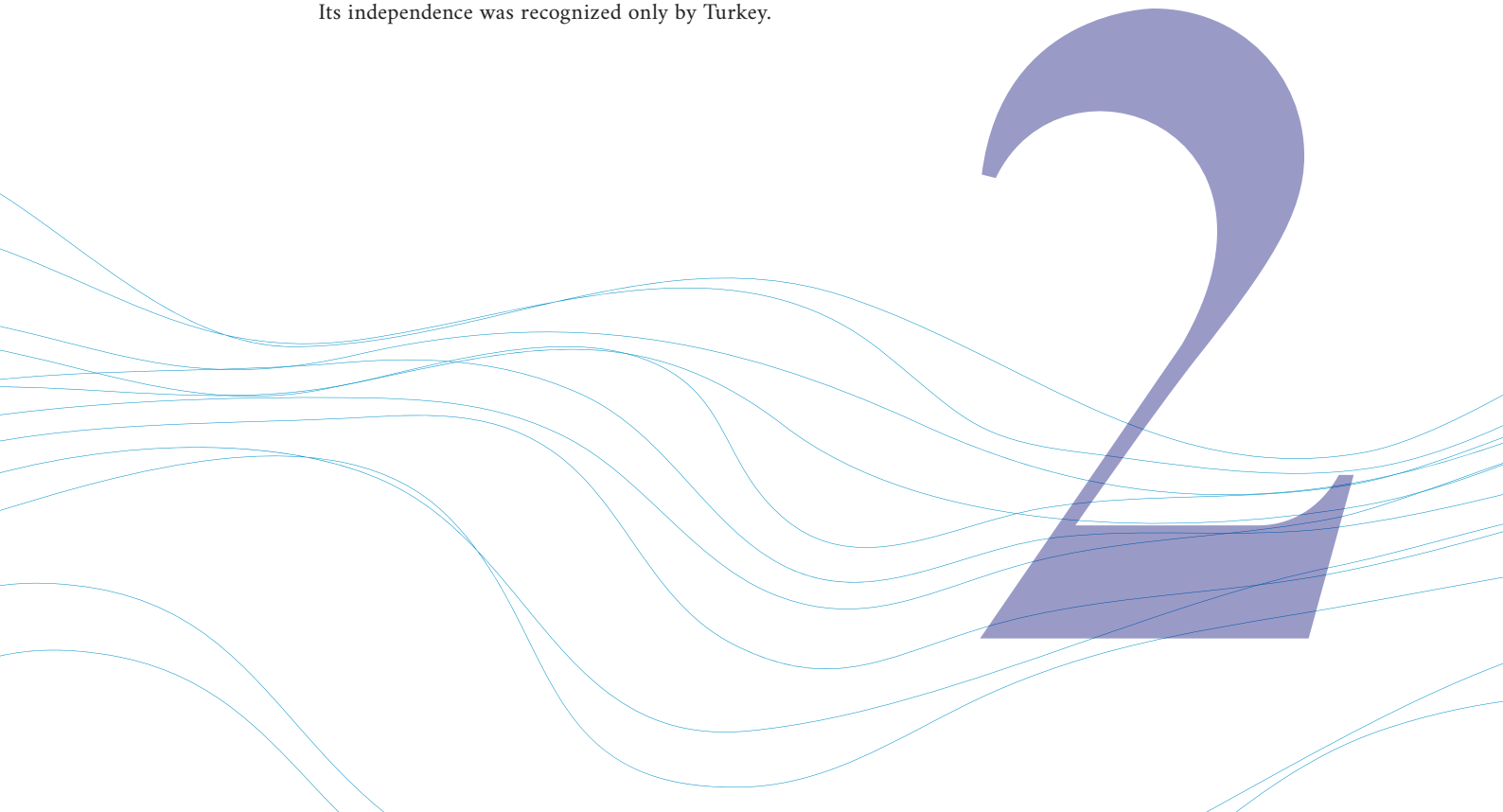
The human sphere integrates all human activities and processes and can be seen as an open system of material and energy flows and an interconnected network of these flows. Sustainability research focuses on the impact of the human sphere on ecosystems. At the boundary between the human and biosphere, exchange activities between these systems need to be controlled in order to achieve sustainability.

[3] Wallner, H. P., Narodoslawsky, M., & Moser, F. (1996). Islands of sustainability: A bottom-up approach towards sustainable development. Environment and Planning A, 28(10), 1763–1778. https://doi.org/10.1068/a281763
[4] McAlpine, K. G., & Wotton, D. M. (2009). Conservation and the delivery of ecosystem services. Science for Conservation, 295, 5–81.

Holistic Diagnosis

Cyprus, also called Kípros in Greek and Kıbrıs in Turkish, is an island in the Eastern Mediterranean that has long been known for its mineral abundance, excellent wines and agricultural products, and natural beauty. Lying on the crossroads of Europe, Asia and Africa, Cyprus has lengthy served as a chief buying and selling post. It is a small country, however the **3rd biggest island withinside the Mediterranean Sea**. With 10,000 years of history, the island`s strategic vicinity has lengthy made it a jewel withinside the crown of the powers of the day. **Cultural influences have come from all directions**, with many civilisations leaving their mark at the island, contributing to the improvement of a wealthy and various cultural heritage. Its leader cities — the capital of Nicosia, Limassol, Famagusta and Paphos— have absorbed the affects of generations of conquerors, pilgrims, and vacationers and feature an air this is each cosmopolitan and provincial.

Today, Cyprus is a popular tourist destination for visitors from Europe, honeymooners (suitable for the legendary home of the ancient Greek goddess of love Aphrodite), bird watchers depicted on the island's diverse migratory bird. **In 1960 Cyprus became independent of Britain** (it had been a crown colony since 1925) as the Republic of Cyprus. The **long-standing conflict between the Greek Cypriot majority and the Turkish Cypriot** minority and an invasion of the island by Turkish troops in 1974 produced an actual — although internationally unrecognized — partition of the island and led to the establishment in 1975 of a de facto Turkish Cypriot state in the northern third of the country. The Turkish Cypriot state made a unilateral declaration of independence in 1983 and adopted the name Turkish Republic of Northern Cyprus.
Its independence was recognized only by Turkey.



2.1 Cyprus at a glance

Land
Cyprus is located about 65 km south of Turkey, 100 km west of Syria and 770 km southeast of mainland Greece. The maximum length from Cape Arnauti in the west to Cape Apostolos Andreas at the tip of the northeastern peninsula is 140 miles (225 km). The maximum range from north to south is 60 miles (100 km). It is the third largest Mediterranean island after Sicily and Sardinia.

Relief
The rugged island of Cyprus resembles a pot and the handle extends northeast from its main part. The entire picture of the roughly 400 miles (640 km) coastline is made up of pitted rocks with long sandy beaches. The Kyrenia Mountains—the western portion of which is also known as the Pentadaktylos for its fivefingered peak—extend for 100 miles (160 km) parallel to and just inland from the northern coast. It is the southernmost range of the great AlpineHimalayan chain in the eastern Mediterranean; like much of that extensive mountain belt, it is formed largely of deformed masses of Mesozoic limestone.
The Troodos Mountains in the south and southwest are of great interest to geologists, who have concluded that the range, made up of igneous rock, was formed from molten rock beneath the deep ocean (Tethys) that once separated the continents of Eurasia and AfroArabia. The range stretches eastward about 50 miles (80 km) from near the island`s west coast to the 2,260foot (689metre) Stavrovouni peak, about 12 miles (19 km) from the southeastern coast. The range`s summit, Mount Olympus (also called Mount Troodos), reaches an elevation of 6,401 feet (1,951 metres) and is the island`s highest point. Between the two mountain ranges is the flat, low-lying Mesaoria Plain (its name means "between the mountains") stretching from the Gulf of Morfu in the west to the Gulf of Famagusta in the east. Approximately in the center of the plain is Nicosia.
The plains are the main grain-growing areas of the island.

Drainage and soils
The main rivers of Cyprus originate in the Troodos Mountains. The largest of them, the Pedieos, flows east towards Famagusta Bay. Serakhis flows to the northwest and Karyotis flows to the north into Morphou Bay. Kouris flows south into Episkopi Bay. The river is completely supplied with runoff from winter precipitation. In summer it becomes a dry passage. The island's main soil type consists of incomplete gravel rocks found in the Troodos and Kyrenia mountains and agriculturally productive vertisols located along the Messaorian Plains and the southeast coast. Other less productive soils include solonchak and solonet soils.
The latter is only found in isolated salt marshes throughout the island.

Climate
Cyprus generally has an intense Mediterranean climate with distinct seasonal rhythms.
Hot, dry summers (June to September) and rainy winters (November to March) are separated by short autumn and spring seasons (October and April to May, respectively) of rapid change.
Autumn and winter precipitation, on which agriculture and water supply depend, is variable. Average annual precipitation is about 20 inches (500 mm). The lowest average precipitation of 14 inches (350 mm) occurs at Nicosia, and the highest, 41 inches (1,050 mm), is on Mount Olympus. Summer temperatures in Nicosia range between an average daily maximum of 98 °F (37 °C) and an average daily minimum of 70 °F (21 °C); in winter the range is between 59 °F (15 °C) and 41 °F (5 °C). From December to March, the Troodos Mountains experience sub-zero night temperatures and heavy snowfall for several weeks.

Main sources: Britannica.com, Atlantisnpaphoscruises.com, e-ambasada.pl

CYPRUS
KÍPROS
KIBRIS

Plant and animal life

There is a slim fertile simple alongside the northern coast, in which the flowers is basically evergreen and consists of olive, carob, and citrus trees. The Troodos variety has pine, dwarf oak, cypress, and cedar wooded area coverings. The southern and western slopes are notably planted with vineyards.

Between autumn and spring the Mesaoria Plain is inexperienced and colourful, with an abundance of wildflowers, flowering bushes, and shrubs; there also are patches of wooded area wherein eucalyptus and diverse forms of acacia, cypress, and lowland pine are discovered. Orange plantations dot the island`s northwestern cease withinside the region round Morphou. Fossil stays of elephants and hippopotamuses had been discovered withinside the Kyrenia region, and in historical instances there had been huge numbers of deer and boar. The simplest huge wild animal now surviving is the agrino, a subspecies of untamed sheep associated with the mouflon of the western Mediterranean; it's miles below strict safety in a small forested region of the Troodos variety. Small recreation is considerable however keenly hunted. Snakes had been vast in historical instances, giving the island the call Ophiussa, "the Abode of Snakes"; they're now noticeably rare.

Green and loggerhead turtles, which might be included with the aid of using law, breed at the seashores alongside the coast. Cyprus lies on important migration routes for birds. In spring and autumn hundreds of thousands byskip over the island, even as many species wintry weather there.

Among the severa resident species are francolin and chukar partridges.

Main sources: Britannica.com, Atlantisnpaphoscruises.com, e-ambasada.pl

Kakopetria, Cyprus: Troodos Mountains, southern Cyprus. Image: ©Palis Michalis/Shutterstock.com

South Nicosia, looking toward North Nicosia, Cyprus. Image: BestTravelPhotography/iStock/Getty Images Plus

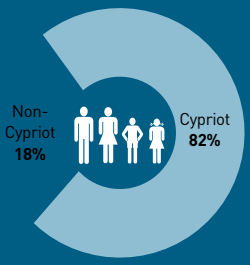
CYPRUS at a Glance

Lying at the crossroads of Europe, Asia and Africa, Cyprus has long served as a major eastern trading post. It is a small country, but the third largest island in the Mediterranean Sea and shares a maritime border with Egypt 300km to the south, Lebanon 108km to the east and Turkey 71km to the north, while inland Greece lies 800km to the north-west. With 10,000 years of history, the island's strategic location has long made it a jewel in the crown of the powers of the day. Cultural influences have come from all directions, with many civilisations leaving their mark on the island, contributing to the development of a rich and diverse cultural heritage.

INDEPENDENCE DAY
October 1st

OFFICIAL LANGUAGES
Greek & Turkish
(business generally conducted in English)

TOTAL POPULATION
875,900
Republic of Cyprus



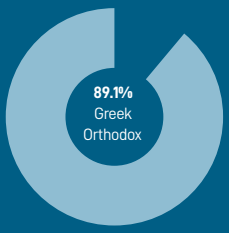
CURRENCY
Euro (€)

TIME
+2 Hours
ahead of GMT

SUNSHINE
340 Days
of sunshine / year

AREA / SIZE
9,251 km²
(3,355 km ² in the occupied area)

RELIGION



2.9% Roman Catholic
2.0% Protestant/Anglican
1.8% Muslim
1.7% Unknown/Atheist
1.4% Other **1.0%** Buddhist

MEMBERSHIPS
EU & Eurozone
World Trade Organization
United Nations
Council of Europe
Commonwealth
World Bank & IMF

AVERAGE TEMPERATURE

Winter	Summer
+13°C	+34°C

ANNUAL RAINFALL
790.1 mm
average

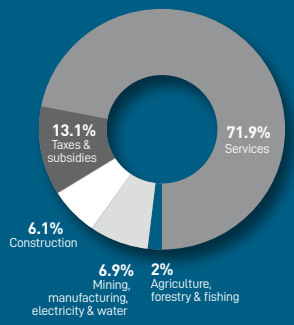
POPULATION DENSITY
128.7
(PERSONS PER KM²)

MEDIAN AGE
37.9

Business FIGURES

MAIN MEDIA
Cyprus Mail
Philelefteros
Politis
CyBC

GDP BY SECTOR



TOTAL GDP
€21.9 billion
(2019)

GDP PER CAPITA
€24,925
(2019)

GDP GROWTH
3.2%
(2019)

CORPORATE TAX RATE
12.5%

INFLATION
0.5%
(2019)

UNEMPLOYMENT
6.9%
(July 2020)

TIME TO START UP A BUSINESS
1-3 days

ACCOUNTING STANDARD
IFRS

CRIME
0.9
100 persons
Cyprus is the **safest country in the world for young people** out of 184 countries across the globe.
(World Health Organisation WHO 2017)

INTERNATIONAL RANKINGS

37th
Economic Freedom Index 2020
Heritage Foundation
(out of 186 countries)

29th
Global Innovation Index 2020
INSEAD and the World Intellectual Property Organization
(out of 131 countries)

45th
in World Happiness Report 2020
(out of 153 countries)

Overall Doing Business ranking: 54th
(out of 190 economies)

STANDARD & POOR'S	FITCH	MOODY'S
BBB- (September 2020)	BBB- (September 2020)	Ba2 (September 2020)

Source: Country Report CYPRUS 2020, Country Profiler October 2020

2.2 People of Cyprus

Ethnic groups and languages
The humans of Cyprus constitute essential ethnic corporations, Greek and Turkish.
The Greek Cypriots, who represent almost four-fifths of the populace, descended from a aggregate of aboriginal population and immigrants from the Peloponnese who colonized Cyprus beginning approximately 1200 BC and assimilated next settlers as much as the sixteenth century. Roughly one-5th of the populace are Turkish Cypriots, descendants of the infantrymen of the Ottoman navy that conquered the island in 1571 and of immigrants from Anatolia delivered in with the aid of using the sultan`s authorities. Since 1974 extra immigrants from Turkey had been delivered in to paintings vacant land and growth the overall labour force.
The language of the bulk is Greek and of the minority, Turkish. There also are a small variety of Arabic speakme Maronite Christians, in addition to a small organization who talk Armenian.
These corporations every overall just a few thousand speakers, and they're usually bilingual, with both Turkish or Greek their 2nd language. English is extensively spoken and understood.
Illiteracy is extraordinarily low, the end result of an exquisite instructional system.

Religion
The Greek Cypriots are mainly Eastern Orthodox Christians. Their church, the Church of Cyprus, is autocephalous (now no longer below the authority of any patriarch); this privilege turned into granted to Archbishop Anthemius in AD 488 with the aid of using the Byzantine emperor Zeno.
Under the Ottoman Empire, the archbishop of the Church of Cyprus turned into made accountable for the secular in addition to the non secular behaviour of the Orthodox network and given the name ethnarch.
The Turkish Cypriots are Sunni Muslims. There also are smaller Maronite, Armenian, Roman Catholic, and Anglican Christian groups at the island.

Settlement patterns
The Cypriots were traditionally a largely rural people, but a steady drift toward towns began in the early 20th century. The census of 1973 recorded six towns, defined as settlements of more than 5,000 inhabitants, and nearly 600 villages. Following the Turkish occupation in 1974 of the northern portion of the island, this pattern changed, the result of the need to resettle some 180,000 Greek Cypriot refugees who had fled from the Turkish-controlled area to the southern part of the island. The accommodations built for them were situated mainly in the neighbourhood of the three towns south of the line of demarcation, particularly in the Nicosia suburban area, which was still controlled by the government of the Republic of Cyprus. In contrast, the northern portion of the island is now more sparsely populated despite the influx of Turkish Cypriots from the south and the introduction of Turkish settlers from the mainland. The six towns recorded in the 1973 census, under the undivided republic, were the headquarters of the island's six administrative districts.
Of these Kyrenia (Turkish: Girne), Famagusta (Greek: Ammókhostos; Turkish: Mağusa), and the northern half of Nicosia are to the north of the demarcation line drawn in 1974 and are in Turkish Cypriot hands; that part of Nicosia is the administrative centre of the Turkish Cypriot sector.Limassol, Larnaca, Paphos, and the southern part of Nicosia remained in Greek Cypriot hands after 1974; that part of Nicosia is the nominal capital of the entire Republic of Cyprus and the administrative centre of the Greek Cypriot sector.

Demographic trends
At instances Cypriots have emigrated in huge numbers, and it's miles expected that as many stay overseas as at the island itself. The extraordinary majority of emigrants have long past to the UK or to the English-speakme nations of Australia, South Africa, the United States, and Canada. Waves of heavy emigration observed the negotiation of independence in 1960 and the Turkish career of northern Cyprus in 1974.
The populace reduced barely among mid-1974 and 1977 due to emigration, conflict losses, and a transient decline in fertility. After 1974 the growth in numbers of Greek Cypriots leaving the island on the lookout for paintings, specially withinside the Middle East, contributed to a decline in populace, however this tapered off withinside the 1990s. More than three-thirds of the populace is urban.

Main sources: Britannica.com, Atlantisnpaphoscruises.com, e-ambasada.pl

Woman crocheting lace doilies in Omodhos, Cyprus. Image: Wknight94

Byzantine frescoes in Asinou Church, Nikitari, Cyprus. The image depicts Christ's apostles receiving communion. Image: unbekannter Maler A.D. 1106

2.3 Economy of Cyprus

The economy after independence

Between 1960 and 1973 the Republic of Cyprus, working a free-employer economic system primarily based totally on agriculture and trade, accomplished a popular of dwelling better than maximum of its neighbours, excluding Israel. This development turned into drastically assisted with the aid of using diverse corporations of the United Nations (UN), working thru the UN Development Program. Generous monetary help turned into given with the aid of using the World Bank and the International Monetary Fund withinside the shape of loans for unique improvement projects, along with strength supply, port improvement, and sewerage systems. Individual overseas nations additionally made a few resource to be had to Cyprus.

These countries and organizations provided experts to advise economic planning and initiate productive projects; scholarships and grants provided for the training of Cypriot specialists in these areas. During this time gross domestic product (GDP) and per capita income grew substantially, agricultural production doubled, industrial production and exports of goods and services more than tripled, and tourism became a significant earner of foreign exchange.

Effects of partition

The Turkish occupation of nearly twofifths of the country in 1974, involving the displacement of about one third of the total population, dealt a serious blow to the island`s economic development. Greek Cypriot losses of land and personal property in the occupied areas were substantial, and they also lost Famagusta, the only deepwater port, and the Nicosia International Airport. GDP of the Greek Cypriot sector dropped by about one third between 1973 and 1975. Through vigorous efforts, real growth was resumed in the area that remained under the control of the government of the Republic of Cyprus, and between 1975 and 1983 the annual rate of growth was estimated to average about 10 percent. Since 1983 the economy of the Greek Cypriot sector has flourished, and unemployment and inflation have remained relatively low. Tourism has provided the main leverage of economic growth, and many areas have undergone technological upgrading. In the 1990s the Greek Cypriot sector increasingly transformed itself into a centre of international transit trade, merchant shipping, banking, and related services. The republic`s Greekrun government established special tariff arrangements with the European Union and from 1990 sought admittance to the organization, whose member countries account for about half of the island`s imports. The Greek Cyprus region joined the EU in 2004 and adopted the euro as its official currency in 2008. However, the territories occupied by Turkey did not enjoy the same prosperity, and the Turkish government had to subsidize the economy. Turkey's territory is still heavily dependent on agriculture. Trade between the two regions ceased in 1974, and the two economies remained independent. However, the southern region continues to supply electricity to the northern region, and the northern region processes the sewage of Greek Nicosia.

Agriculture, forestry, and fishing

More than onethird of the island`s arable land is irrigated, mainly in the Mesaoria Plain and around Paphos in the southwest. Woodlands and forests occupy about onefifth of the total land area. Landholdings are generally small, highly fragmented, and dispersed under traditional laws of inheritance. A program of land consolidation was enacted in 1969; it met with resistance, particularly from Turkish Cypriot landowners, and was only very slowly implemented, but it has proceeded with considerable success in the Greek Cypriot sector.

The major crops of the Greek Cypriot sector include grapes, deciduous fruits, potatoes, cereal grains, vegetables, olives, and carobs. The area under Turkish occupation produces the bulk of the country`s citrus fruits, wheat, barley, carrots, tobacco, and green fodder. Livestock—especially sheep, goats, pigs, and poultry—and livestock products account for about onethird of the island`s total agricultural production.

Some cattle are also raised. Cyprus was once famous for its extensive forests, but the demand for timber for shipbuilding by successive conquerors from the 7th century BC onward and extensive felling for building and for fuel have cleared most of them. Under the British administration a vigorous policy of conservation and reforestation was pursued, and the Cyprus Forestry College was established at Prodhromos, on the western

Main sources: Britannica.com, Atlantisnpaphoscruises.com, e-ambasada.pl

Gaziveren, Cyprus: local streets in northern Cyprus. Image: Federica Cipriani

Lemesos omodos vineyard, Cyprus. Image: CondèNastTraveller

slopes of Mount Olympus; the Greek Cypriot government continues to operate an ambitious program of forest preservation and development. Forests are found mostly in the mountainous areas and in the Paphos district. The fishing industry is small, in part because coastal waters are deficient in the nutrients and associated plankton needed to sustain large fish populations. Although the industry has shown some growth in the Greek Cypriot sector, most fish is imported.

Resources and power

Cyprus was for many centuries a noted producer of copper; in Greek the name of the island and the name of the metal are identical. As early as 2500 BC its mines were being exploited. After other mineral sources were discovered, the mines remained neglected for centuries until they were reopened shortly before World War I. They were subsequently exploited from 1925 until they were closed during the Great Depression of the 1930s. Production resumed after World War II, and copper and other minerals—iron pyrites, asbestos, gypsum, chrome ore—have contributed somewhat to external trade; bentonite (a form of clay), umber, and ocher are also exported. The island`s most important copper mines are located in the area of Skouriotissa in the Turkish occupied zone, but copper ore reserves have declined substantially. Extensive quarries for stone and other building materials are for local use. Cyprus imports all the petroleum needed to power vehicles as well as to generate electricity, which is produced by thermal power stations. The country also continues to be one of the world`s major producers of solar energy. Although there are several dams, an adequate water supply remains a constant problem. As exploration for natural gas in the eastern Mediterranean took off in the 21st century, large deposits of natural gas were first discovered off Cyprus in 2011.

The reserves remained largely untapped over the next several years, however, due to ongoing disputes between the Greek Cypriot and Turkish Cypriot governments .

Main sources: Britannica.com, Atlantisnpaphoscruises.com, e-ambasada.pl

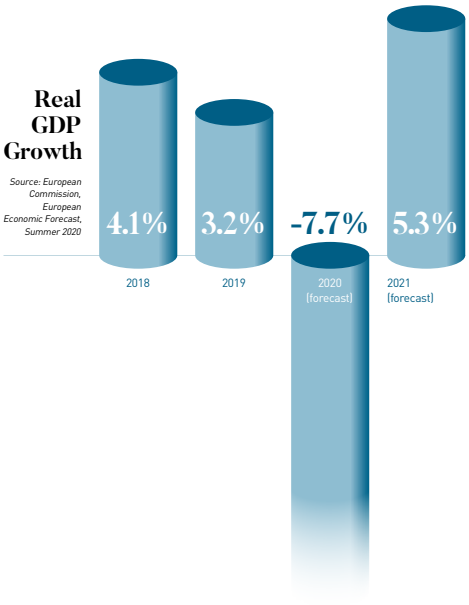
Copper-mining operation in the area of Skouriotissa, Cyprus. Image: © Lakis Fourouklas/Shutterstock.com

A 1.5 MW solar power plant in Nisou, Cyprus. Image: EBRD

Economy

Real GDP Growth

Source: European Commission, European Economic Forecast, Summer 2020



GDP in € Billions

Source: Cystat

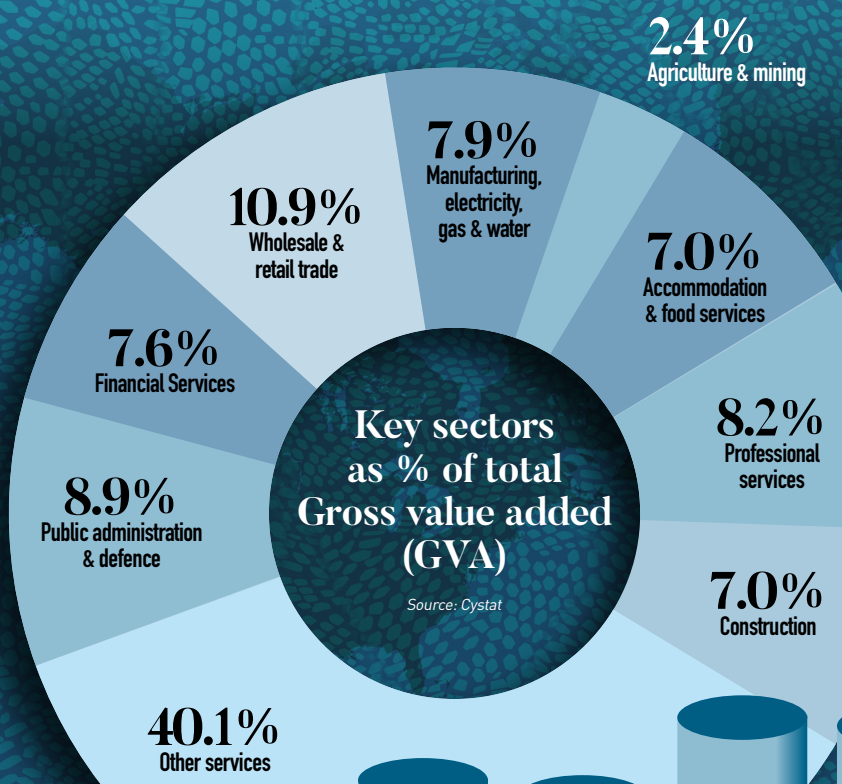
GDP per capita in €

Source: Cystat

19.4	2010	23,402
19.8	2011	23,273
19.4	2012	22,502
18.0	2013	20,877
17.4	2014	20,421
17.8	2015	21,031
18.9	2016	22,163
20.0	2017	23,315
21.1	2018	24,294
21.9	2019	24,925

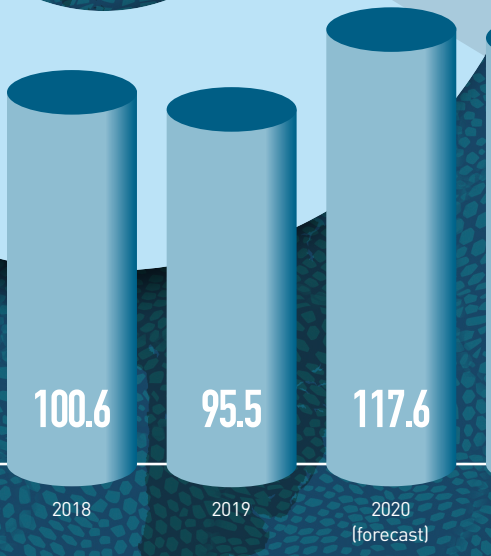
Key sectors as % of total Gross value added (GVA)

Source: Cystat



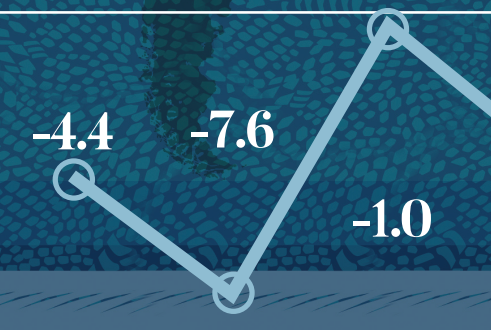
Gross public debt as % of GDP

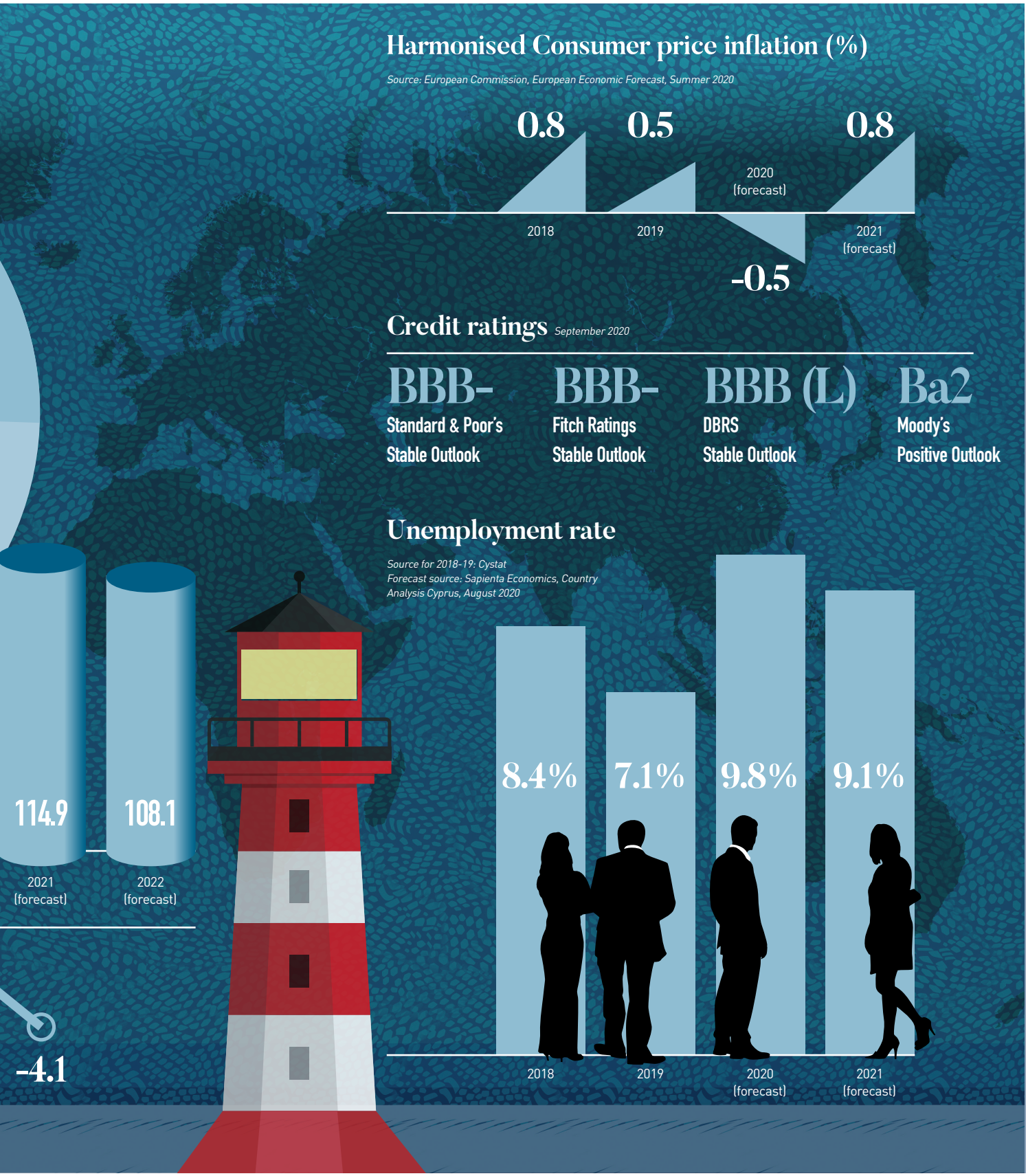
Source for 2018-19: Ministry of Finance
Forecast source: Sapienta Economics, Country Analysis Cyprus, August 2020.



Current account balance (% of GDP)

Source for 2018-19: Central Bank of Cyprus
Forecast source: Sapienta Economics, Country Analysis Cyprus, August 2020.

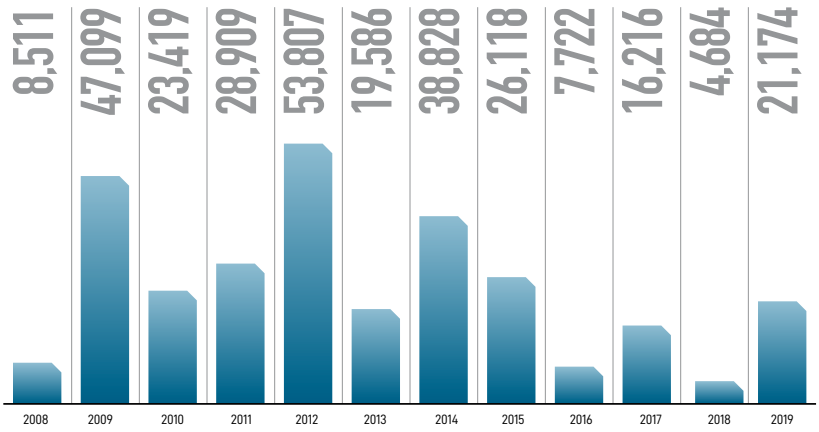


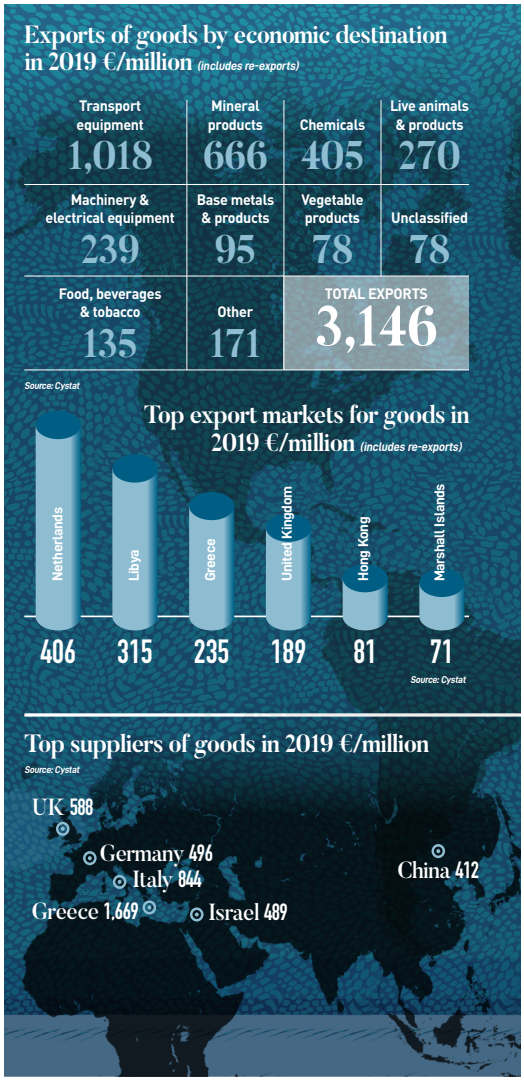


Source: Country Report CYPRUS 2020, Country Profiler October 2020

Economy

FDI LIABILITIES (INVESTMENTS IN CYPRUS) *Source: Central Bank of Cyprus*





Shipping accounts for

7%

of Cyprus' GDP

1 in 5

vessels under third-party management are controlled from Cyprus

3rd largest merchant fleet in Europe

11th largest merchant fleet in the world

200+ shipping related companies based in Cyprus

EU's largest shipmanagement centre

5%

of the world's fleet and around 20% of global third-party shipmanagement activities are controlled from Cyprus.

Cyprus employs around

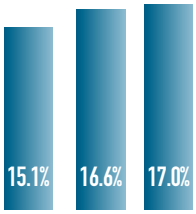
60,000

seafarers from around the world and

9,000

personnel onshore

Core Tier 1 Capital of Cyprus banks



500+

European insurance/reinsurance undertakings operating under the freedom to provide services (FOS)

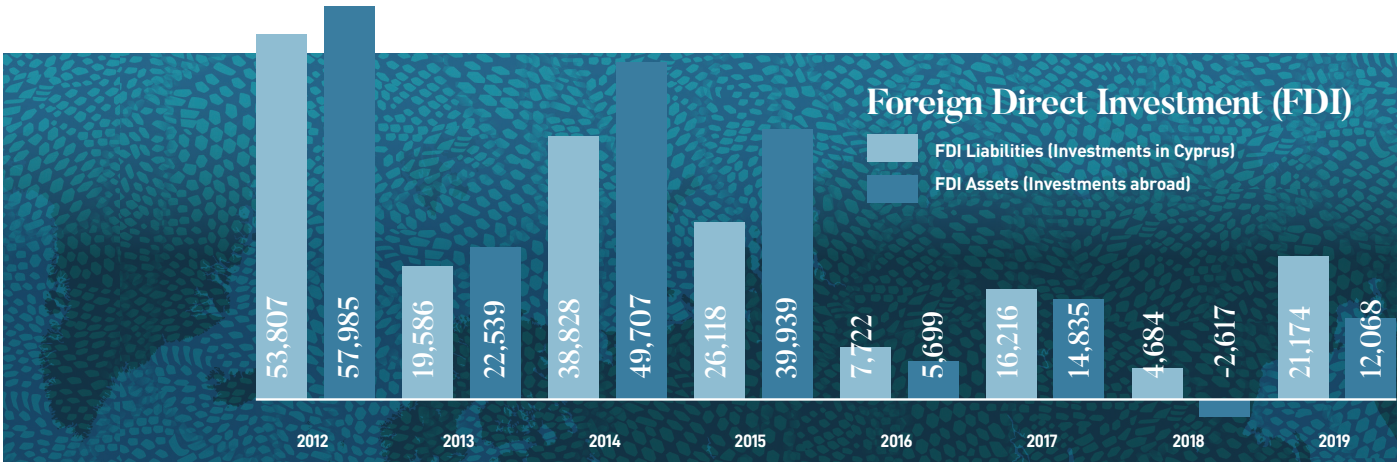
32

Insurance Companies

Licenced Blocks

Block	Licensors	Year
2	ENI, Kogas	2013
3	ENI, Kogas	2013
6	ENI, Total	2017
7*	ENI, Total	2019*
8	ENI	2017
9	ENI, Kogas	2013
10	ExxonMobil, Qatar Petroleum	2017
11	Total, ENI	2013
12	Noble Energy, Delek Drilling, BG Cyprus Limited	2008

** Formal licence approval still pending*



Cumulative inward FDI stock by country €/million

Russian Federation	45,191
Jersey	33,708
British Virgin Islands	18,856
Netherlands	18,071
United Kingdom	16,219
Germany	8,216
Bermuda	6,047
Poland	3,223
Marshall islands	3,188
Ireland	2,408

Total including others

€374,172m

Source: Central Bank of Cyprus

Inward FDI flow by country in 2018 €/million

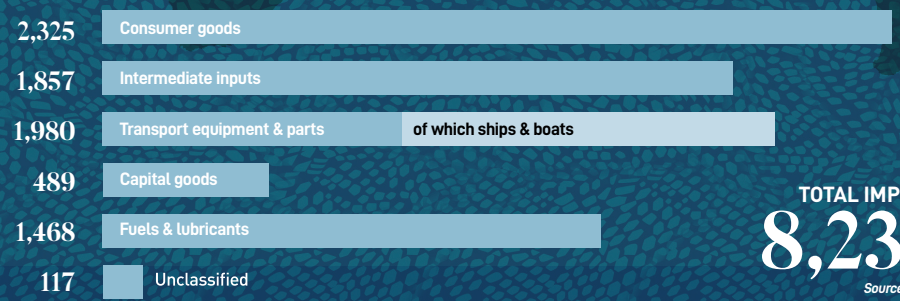
Russian Federation	5,224
China	165
Germany	136
Other Near and Middle East countries	99
Greece	98
Israel	44
Lebanon	29
Ukraine	22
Jordan	20
Vietnam	8

Total including others

€5,478m

Source: Central Bank of Cyprus

Imports of goods by economic destination in 2019 €/million



TOTAL IMPORTS

8,236

Source: Cystat

Source: Country Report CYPRUS 2020, Country Profiler October 2020

2.4 Manufacturing of Cyprus

The raw materials in Cyprus are limited and this situation limits the scope of industrial activity.
Prior to the island's division, production was primarily goods made in small owner-controlled factories for the domestic market, with a significant number of these factories in the Turkish-occupied area in 1974. did. After that, the industry of the Republic of Cyprus was turned to export production, and many factories were built in the south. Oil refining, cement and asbestos pipe production, and thermal power generation are heavy industries in the Republic, and their light industry produces the following products: clothing, shoes, beverages, some machinery and transportation equipment, etc.
Printing and publishing also contribute to Greece's Cyprus economy.

Finance and trade
The Central Bank of Cyprus issues the Cypriot Pound and the Turkish Lira circulates in Turkish-occupied territories. The Republic of Cyprus began expanding its financial services, including offshore banking, in 1982. Light industrial products, especially clothing and footwear, and food products, including potatoes and citrus fruits, account for the majority of the Republic's exports. The main import items are petroleum, petroleum products, food and machinery. The chronic trade deficit is offset by receipts from tourists, remittances sent home by expatriates from Greece and Cyprus, and receipts from British military bases on the island. The main exports of the Turkish sector are citrus fruits, potatoes, carobs and textiles. Food, machinery and transportation equipment account for the majority of income.

Services
Tourism has been a major component of Cyprus' economy since 1960. However, most tourist accommodations were located on parts of the island that were occupied by the Turks in 1974. Sector: In response to the loss of the major seaside resorts of Kyrenia and Famagusta Varosha, the southern coastal cities of Limassol, Larnaca and Paphos have been further developed to accommodate tourists. Since the mid-1980s, tourism has been the largest source of foreign income for the Greek Cyprus region.

Labour and taxation
Except for the years immediately following the Turkish invasion, Cyprus has maintained a low unemployment rate overall, which is one of the lowest levels in Europe, with active trade union activity and almost all Cyprus workers. Two-thirds are union members. Approximately one-quarter of Cyprus' workforce is employed in commerce, and the services sector is the second largest employer, with more than one-fifth of workers in service-related professions, primarily the tourism sector. Agriculture, once the mainstay of the Cyprus economy, now employs less than one-tenth of the workforce. Taxation is an important source of income for the government, and the Government of the Republic of Cyprus imposes direct taxes, including income tax, and various consumption taxes and indirect taxes, including VAT, introduced in the mid-1990s.

Main sources: Britannica.com, Atlantisnpaphoscruises.com, e-ambasada.pl

Traditional terra-cotta pots and vessels, Cyprus. Image: © GalaMostova/Shutterstock.com

Traditional lefkaritiko crafts in the village shops in Lefkara (March 2012), Image: Minna Kaipainen.

Transportation and telecommunications
In Roman times, the island had a good network of roads, but by the time of the occupation of the British Empire in 1878, the only carriage route was between Nicosia and Larnaca. Under British control, a large new road network has been built. Public narrow-gauge railways turned out to be uneconomical and were closed in the early 1950s, and since then domestic transportation has been entirely by road. The Greek Cyprus sector continues to develop and maintain an extensive network of modern highways. In 1994, the highway connecting

Nicosia, Antopolis and Cockini Trimicia was completed. International Aviation Services provides connections to all regions of Europe, in some parts of the Middle East and Africa. Nicosia International Airport was closed in 1974, and the airport at Larnaca was developed instead to service the Greek Cypriot sector.

An airport at Paphos, also handling international flights, opened in 1983. Flights to the Turkisho occupied sector arrive from or through Turkey and use an airport at Gecitikale (Lefkoniko). There is no significant coastal shipping, and much of the merchant marine registered to Cyprus is foreignowned. The great bulk of the island`s international trade remains seaborne, and the main ports of the Greek Cypriot sector, Limassol and Larnaca, are thoroughly modernized; Vasilikos is a major industrial port. Famagusta is used for delivery in Turkey. Greece's Cyprus sector became a major international communications hub in the 1990s, installing submarine fiber optic cables and satellite interconnect equipment.

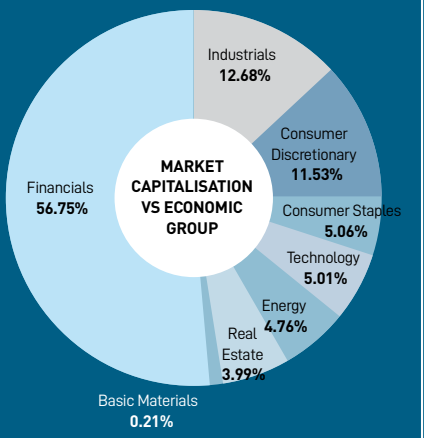
Local government in the Republic of Cyprus is at the district, municipal, rural municipality, and village levels. District officers are appointed by the government; local councils are elected, as are the mayors of municipalities.

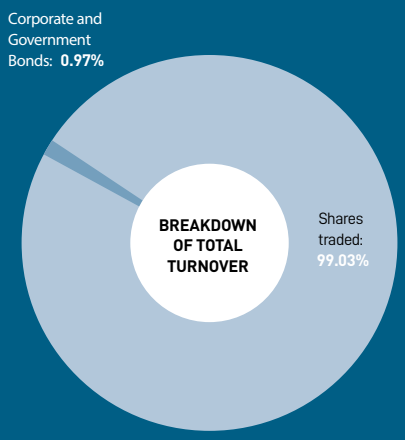
Main sources: Britannica.com, Atlantisnpaphoscruises.com, e-ambasada.pl

Letymbou village, Cyprus. Image: thevivalavita.com

Coral Bay, Cyprus. Image: thevivalavita.com

Industry insights





2019 TOTAL TURNOVER
€85.3 million
(A YEAR-ON-YEAR INCREASE OF 35.4%)

2019 DAILY AVERAGE TURNOVER
€0.35 million
PER TRADING DAY

2019 TOTAL MARKET CAPITALISATION (INCL. BONDS MARKET):
€5.0 billion

EQUITY MARKET CAPITALISATION:
€1.8 billion

FAVOURABLE TAX REGIME

Corporate tax rate
12.5%

No capital gains tax on securities' transactions

No fee (transfer levy on sale) imposed on securities' transactions

No withholding tax for dividends that are paid to non-tax residents of Cyprus

Wide network of Double Tax Treaties

5 TOP SHARES IN 2019 (MOST TRADED SECURITIES BY VALUE):

1. Hellenic Bank Public Company Ltd
2. Bank of Cyprus Holdings Plc
3. Interfund Investments Plc
4. Vassiliko Cement Works Public Company Ltd
5. Logicom Public Ltd

International Memberships

WFE (World Federation of Exchanges)

FESE (Federation of European Securities Exchanges)

ANNA (Association of National Numbering Agencies)

ECSDA (European Central Securities Depositories Association)

FEAS (Federation of Euro-Asian Exchanges)

PUBLIC UNIVERSITIES

The University of Cyprus

The Open University of Cyprus

The Cyprus University of Technology

PRIVATE UNIVERSITIES

European University - Cyprus

Frederick University - Cyprus

Neapolis University - Cyprus

University of Nicosia - Cyprus

University of Central Lancashire - Cyprus

850+ accountancy firms including all major global firms

2,700+ registered lawyers and

160+ law firms provide a competitive market for legal services

Manufacturing accounts for **5.4%** of Cyprus' GDP

Industry accounts for **8.3%** of Cyprus' GDP

6% of the workforce employed in manufacturing and industry

Quality and affordability are the hallmarks of Cypriot-made pharmaceuticals, which are sold in over 100 countries across the globe.

Main destination for Cypriot manufactured exports: European Union over 50% of the market, Middle East 15%

Cyprus Filming Scheme Incentives:

Cash rebate of up to

35%

on qualifying production expenditures

Variety of tax incentives for corporates and individuals

Attractive IP regime

Renewables have the potential to create between 11,000 and 22,000 jobs in Cyprus by 2030

The Cyprus Institute's PROTEAS Facility in Pentkomo

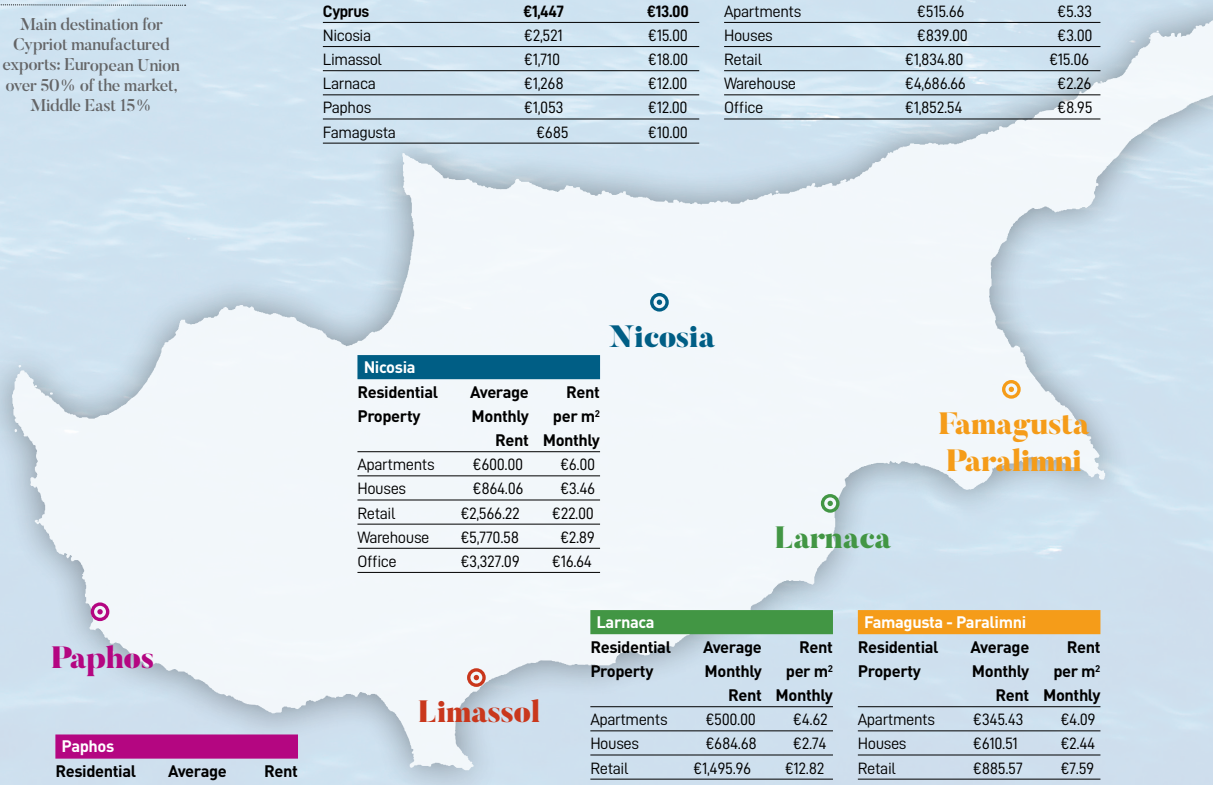
COMMERCIAL AND RESIDENTIAL PROPERTY

Office Rent

	Average Monthly Rent	Rent Per Square Metre
Cyprus	**€1,447**	**€13.00**
Nicosia	€2,521	€15.00
Limassol	€1,710	€18.00
Larnaca	€1,268	€12.00
Paphos	€1,053	€12.00
Famagusta	€685	€10.00

Cyprus Residential Property Rent

	Average Monthly Rent	Rent per m² per month
Apartments	€515.66	€5.33
Houses	€839.00	€3.00
Retail	€1,834.80	€15.06
Warehouse	€4,686.66	€2.26
Office	€1,852.54	€8.95



Nicosia

Residential Property	Average Monthly Rent	Rent per m² Monthly
Apartments	€600.00	€6.00
Houses	€864.06	€3.46
Retail	€2,566.22	€22.00
Warehouse	€5,770.58	€2.89
Office	€3,327.09	€16.64

Larnaca

Residential Property	Average Monthly Rent	Rent per m² Monthly
Apartments	€500.00	€4.62
Houses	€684.68	€2.74
Retail	€1,495.96	€12.82
Warehouse	€4,186.99	€2.09
Office	€1,552.46	€7.76

Famagusta - Paralimni

Residential Property	Average Monthly Rent	Rent per m² Monthly
Apartments	€345.43	€4.09
Houses	€610.51	€2.44
Retail	€885.57	€7.59
Warehouse	€4,206.82	€2.10
Office	€755.77	€3.78

Paphos

Residential Property	Average Monthly Rent	Rent per m² Monthly
Apartments	€346.30	€4.10
Houses	€648.49	€2.59
Retail	€1,318.08	€11.30
Warehouse	€3,590.65	€1.80
Office	€1,158.03	€5.79

Limassol

Residential Property	Average Monthly Rent	Rent per m² Monthly
Apartments	€700.00	€7.87
Houses	€938.18	€3.75
Retail	€2,521.58	€21.61
Warehouse	€4,885.86	€2.44
Office	€2,156.17	€10.78

Sources: RICS 2019 Q4 / Danos International Property Consultants and Valuers

Source: Country Report CYPRUS 2020, Country Profiler October 2020

2.5 Government and society

Local governments in the Republic of Cyprus are organized at the district, parish, provincial parish, and village levels. District officers are appointed by the government.

Justice
District officers are appointed by the government. A city council member is elected, and a mayor is also elected. The legal system of Cyprus is based on Roman law. In the Greek Cyprus zone, judges are appointed by the government, but the judiciary is completely independent of the executive branch. The Supreme Court is the Supreme Court and also serves as the Republic's Final Court of Appeals.
The permanent circuit court has criminal jurisdiction over the entire island, and the district court deals with criminal, civil and admiral matters.

Security
The island of Cyprus is home to a complicated mixture of military forces. The Republic of Cyprus has a small national guard consisting of volunteers and conscripts, and men between the ages of 18 and 50 are required to serve up to 26 months in the military. The army of the TRNC requires 24 months of military service from men within that same age-group. Likewise, both sides maintain close military ties with their respective kinsmen on the mainland; the Republic of Cyprus's national guard has a large number of officers from the Greek army, and Turkey maintains a large garrison in northern Cyprus. In addition, because of the continued tensions between the two sides—which occasionally have flared into violence—the UN has maintained peacekeeping troops in Cyprus (UNFICYP) who police the demilitarized zone that divides the country; the United Kingdom also maintains two sovereign military bases in Cyprus.

Health
Health standards in Cyprus are high because of a favourable climate and wellorganized public and private health services. Since the eradication of malaria shortly after World War II and, later, that of echinococcosis (hydatid disease), the island has been free from major diseases. Life expectancy is about 75 years for men and 80 years for women, and the infant mortality rate is low.

Housing
After the 1974 invasion of Turkey and the subsequent expulsion and resettlement of Greek Cypriots to the southern part of the country, housing became a major concern of the Republic of Cyprus. The government has engaged in a long-term program to encourage the construction of low-cost homes, low to home buyers and temporarily detained refugees in abandoned homes by Turkish Cypriots who fled north during the war. Provided an interest rate loan. The government continues to provide rent subsidies to thousands of refugee families and also provides housing allowances to other low-income families.

Education
The Greek Cyprus sector offers 12 classes of free education for children over 5 years old.
Compulsory education up to the age of 15. You can complete the last three years at a vocational school, vocational school, or Lyceum. The latter offers courses focused on classical studies, natural sciences, or economics. Higher education institutions include schools for teacher training, technical guidance, hospitality training, tourist guides, nursing, public health, and police. The Greek Cypriots opened the University of Cyprus in 1992. However, many students attend overseas universities, especially those in Greece, the United Kingdom, and the United States. The Turkish education system is managed individually, and Turkish Cypriots maintain a good public school system with facilities similar to Greeks and some specialized higher education institutions. As in the Greek sector, many Turkish Cypriots travel abroad (mainly Turkey) for higher education. The excellent educational opportunities offered by both the Greek and Turkish governments are not without their drawbacks, and many of the most qualified Cyprus graduates in both Greece and Turkey seek employment abroad.

Main sources: Britannica.com, Atlantisnpaphoscruises.com, e-ambasada.pl

Modern housing in Nicosia, Cyprus. Image: Georg Gerster—Rapho/Photo Researchers

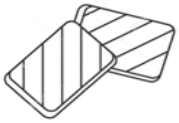
Ochi Day, also known as Ohi Day or Oxi Day, celebrates the Greek resistance movement against Axis powers during WW2. Image: HolidaySmart.com

Exports and costs of living

Star-Performing Exports (Volume / Value 2019)

Potatoes
73,635 tonnes
€48.3 million

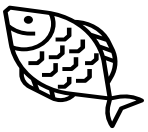
Pharmaceuticals
7,250 tonnes
€300.9 million



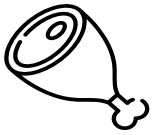
Halloumi
33,437 tonnes
€223.6 million

Citrus Fruit
20,787 tonnes
€11.5 million

Fruit & Veg Juices
€36.3 million



Fish
5,896 tonnes
€34.0 million



Meat
4,086 tonnes
€3.7 million

Mineral Fuels
634,131 tonnes
€345.6 million

Fastest Growing Exports (2015-2019)

Pharmaceutical products
increase by 36%

Halloumi
increase by 117%

Mineral Fuel and Oils
increase by 270%

COST OF LIVING: AVERAGE PRICES

Milk (1ltr)
€1.38

Tomatoes (1 kg)
€1.99

Loaf of fresh white bread (500g)
€1.58

Bottle of mid-range wine
€7.00

Domestic Beer (0.5 l)
€1.18
Imported Beer (0.33ltr)
€2.03

Three-course meal for two in mid-range restaurant
€46.00

AVERAGE RENT PER MONTH (€)	AYIA NAPA	LARNACA	LIMASSOL	NICOSIA	PAPHOS
Apartment (1 bedroom) in City Centre	500.00	516.67	801.85	514.83	404.67
Apartment (1 bedroom) Outside of Centre	375.00	420.83	675.58	450.67	331.15
Apartment (3 bedrooms) in City Centre	1,000.00	869.71	1,408.33	884.48	688.46
Apartment (3 bedrooms) Outside of Centre	850.00	718.38	1,155.36	740.52	583.93
AVERAGE BUY APARTMENT PRICE (€/SQM)					
Apartment in City Centre	1,500.00	1,575.00	2,721.43	1,616.67	1,700.00
Apartment Outside of Centre	1,230.00	1,066.67	2,017.65	1,226.36	1,466.67

Source: Numbeo, September 2020

Total Exports
€3.15 billion

Domestic Exports
€1.31 billion

Re-Exports
€1.84 billion

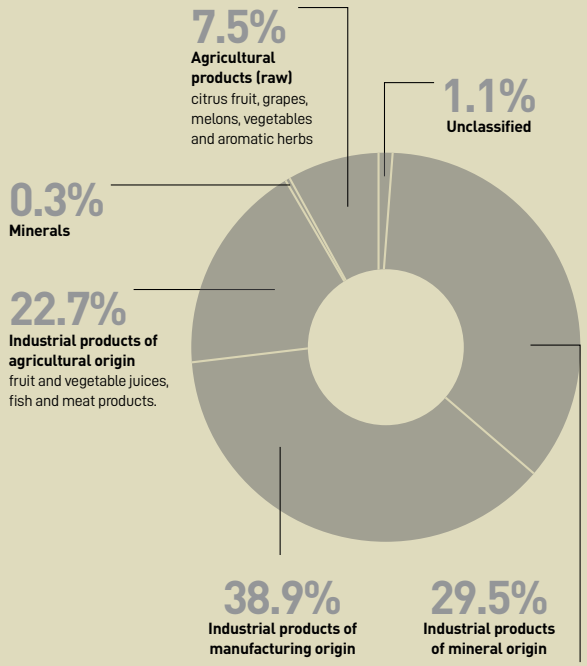
Total Imports
€8.24 billion

Export of Goods (2019):
€3.15 billion

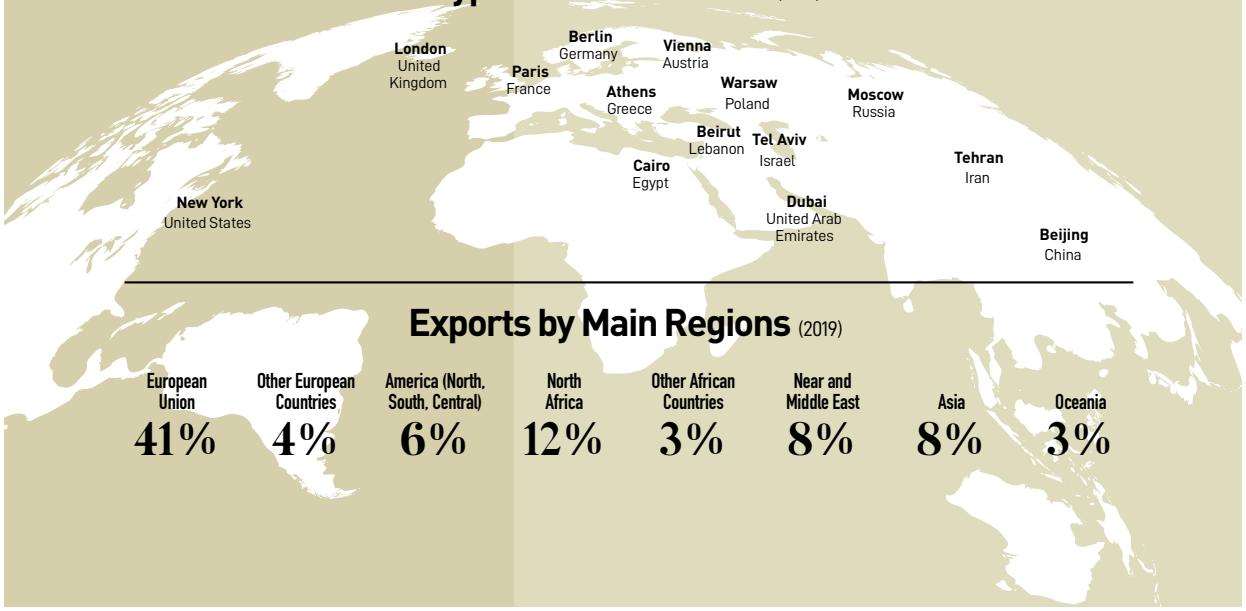
Export of Services (2019):
€12.32 billion

Ratio of Goods and Services Exports to GDP (2019):
70%

Export of Domestically Produced Goods (2019)



Cyprus Trade Centres (2019)



Exports by Main Regions (2019)

European Union	Other European Countries	America (North, South, Central)	North Africa	Other African Countries	Near and Middle East	Asia	Oceania
41%	4%	6%	12%	3%	8%	8%	3%

Source: Country Report CYPRUS 2020, Country Profiler October 2020

2.6 Cultural life

Daily life and social customs

The culture of Cyprus is divided between the northern Turkish and the southern Greek sections of the country. Since 1974 the Turkish community in northern Cyprus has promoted its own Turkish and Islamic culture, supporting its own newspapers and periodicals and changing many place-names to Turkish.

The anniversary of the proclamation of the TRNC (November 15) is celebrated in the north, as are traditional Muslim holidays. Greek Cypriots speak a dialect of Greek and maintain a somewhat ambivalent attitude about mainland Greeks. However, most Greek Cypriots who go abroad for their postsecondary education travel to Greece, and these young people share in the popular culture of Greece, which is itself increasingly cosmopolitan. Nevertheless, Greek Cypriots are careful to preserve traditional culture and celebrate important holidays such as Easter (and the pre-Easter carnival) and the spring flower festival Anthesteria.

Despite the civil war of the 1950s, 60s and 70s, the younger generation of Greek Cypriots is relatively peaceful and calm and rich, incorporating aspects of traditional culture while incorporating global trends in dress and entertainment. I grew up in a new society. These trends were introduced not only by the mass media, but also by the large influx of young travelers who can feel their presence in the dance clubs and bars that currently exist throughout the island. Greek and Turkish Cypriots alike enjoy the rich traditions of handicrafts and folk crafts. Some of the most internationally renowned expressions of this art include lacework in Cyprus (especially made in the town of Lefkara near Nicosia) and silversmithing throughout the island.

Geographically, Cyprus has many culinary traditions. Especially with Levant, Anatolian and Greek traditions, the island's Harumi cheese, Pruguri (a dish made from boiled and cracked wheat), Hiromeri (pressed, smoked, aged pork leg) and sukuk (rich grape juice). And sweets made from almonds) are purely cyprus. As in much of the Mediterranean world, appetizers or mezes play a central role in Cyprus and often replace the main course. Fresh fruits and vegetables are part of every diet, Cyprus has long been famous for its wines, and viticulture has been practiced on the island for thousands of years

The arts

Cyprus has appeared in European literature for thousands of years, from the work of Ionian poets to modern travel memoirs such as Lawrence Durrell's Bitter Lemon (1957). The island itself has a strong literary tradition. Based on oral traditions, classical forms such as Tekerleme (Rigmalol) and Mani (Quatrain), and contemporary style, Turkish Cypriot singers such as Akar Akarin and Nefe Yasin are in mainland Turkey. Developed a series of well-known works. Mainly not translated in other languages. Modern Greek Cypriot poets have been translated into other European languages and are somewhat well known across the islands. Several literary magazines are published, and small publishers publish hundreds of books in Greek and Turkish each year. Poetry is also an important element of the growing "peace culture" movement, which seeks to build social and cultural connections across the island's ethnic divisions. Many painters and sculptors work in Cyprus, and the Ministry of Culture has a permanent exhibition of the state collection of Cyprus contemporary art, sponsoring the annual Cyprus International Music Festival and theatrical performances.

In the village of Remba near Pafos, the Cyprus University of the Arts offers courses for graduate art students. The government supports young composers, musicians and folk dance groups.

Both the Turkish and Greek Cyprus communities have an active film industry, and Cyprus films have won numerous awards in international competitions. Classical and folk music have gained a lot of support among Cypriots of all ages, and the folk music traditions of the Greek and Turkish communities, combined with international style, are combined with native Greek Cyprus. It contributes to the development of the popular music style of Turkish Cyprus.

Main source: Britannica.com

Girls dressed in traditional Cypriot costumes at a festival. Image: © Demetris Vetsikas 1969 / Pixabay

Mosaic floor in the House of Eustolios at Kourion (Curium), near Limassol, Cyprus. Image: © Ron Gatepain (A Britannica Publishing Partner)

Cultural institutions

The tradition of ancient culture in Cyprus is maintained, partly through private companies, partly through government funding, and especially through the Cultural Services Bureau of the Ministry of Education and Culture of the Republic of Cyprus. The Republic of Cyprus publishes books, awards literary awards and promotes Cyprus publications. As with many local communities, cities have public libraries.
The government-sponsored Cyprus theater organization performs plays and classic works by contemporary Cypriot playwrights. Ancient theater of salamis Turkish sleds and Greek kolions (curium) have been restored. Various plays were performed in Clion, and a Greek theater was built in Nicosia. Many notable buildings, especially the Gothic cathedrals of Nicosia and Famagusta, and the Bella Pais Monastery near Kyrenia, have survived the Lusignan family and the Venetian era. There are different Gothic church buildings in the course of the island. Orthodox Christians additionally constructed severa church buildings in a extraordinary fashion that turned into frequently encouraged through the Gothic; the interiors of those illustrate the ongoing improvement of Byzantine art. Cyprus has awesome examples of medieval and Renaissance navy architecture, consisting of the castles of Kyrenia, St. Hilarion, Buffavento, and Kantara and the tricky Venetian fortifications of Nicosia and Famagusta. Additional webweb sites of cultural importance consist of the city of Paphos, held to be the mythical birthplace of Aphrodite, which homes a temple built in her honour courting from the twelfth century BC; the painted church buildings of the Troodos region, a complicated of Byzantine church buildings and monasteries famend for his or her show of work of art in Byzantine and post-Byzantine styles; and the Neolithic settlements at Choirokotia, inhabited from the seventh to the 4th millennium BC.
These sites had been particular UNESCO World Heritage sites in 1980, 1985, and 1998, respectively.

Sports and recreation

Sports have played an important role in the Greek Cyprus community since the classic era when the stadium stood in the center of the island's capital. Through the Cyprus Sports Organization, a public institution founded in 1969, the government built stadiums, gymnasiums and pools and subsidized federations and clubs for a wide range of sports. There are professional soccer leagues and semi-professional basketball leagues. Cyprus athletes, albeit as members of the Greek national team, participated in the 1924 Olympics. In 1978, the National Olympic Committee of Cyprus was incorporated into the International Olympic Committee, and the Republic of Cyprus sent its own national team of athletes from the Greek Cyprus division to Turkish human sports cooperation or competitions. did. Since 1980, the Greek Community and the Global Association of International Sports Federation have not recognized the Turkish Division of Sports Federation in Cyprus.

Media and publishing

Television and radio in the Greek sector are controlled by the state-owned Cyprus Broadcasting Corporation and are funded through state subsidies, taxes and advertising. Greek, Turkish, English and Armenian programs are broadcast throughout the island, and daily and weekly newspapers are published in Greek, Turkish and English. The Turkish sector receives broadcasts from Turkey.

Main sources: Britannica.com, Atlantisnpaphoscruises.com, e-ambasada.pl

Open air dance festival, Salamis Theater, Salamis ruins, Salamis, North Cyprus, Cyprus. Image: © lookphotos / Richter, Jürgen

Cameras roll for Cyprus film industry. Shot of “Man of War”, directed by Demetri Logothetis in Cyprus. Image: financialmirror.com

1 **NICOSIA** is the capital of Cyprus and the main commercial and business centre and the seat of government. It boasts a world-famous archaeological museum, a thriving old city surrounded by fortified Venetian walls and a labyrinth of traditional streets. It is also the last remaining divided capital city in the world following the fall of the Berlin Wall. Visitors are usually couples, families and business people.

2 **LIMASSOL** is the second largest city, situated between archaeological sites, the ancient kingdoms of Amathous, Kourion and Kolossi. The coastal town is also home to the famous Limassol Marina and the city's geographical location provides easy access to mountainous villages and Troodos mountain. The city is a business centre attracting business executives, as well as couples, families and young people. It has developed significantly in recent years, emerging as a business hub as well as a party town with reputable beach bars, Carnival and Wine Festivals. Limassol has the largest port in Cyprus.

3 **LARNACA** is the third largest city in Cyprus and is known for its palm-tree seafront promenade. It is home to the country's primary airport, a seaport and a marina. It has a picturesque old town, salt lakes with flamingos in the winter, and a large marina. There is a wealth of historical interests around the town including the St Lazarus church, the Hala Sultan Tekke Muslim shrine, the historical Kiti church and the monastery of Stavrovouni. The city mostly attracts couples and families.

4 **PAPHOS** is a popular coastal town. Visitors can enjoy spectacular scenery and some of Cyprus' finest beaches, as well as ancient historical sites. Tourist attractions in Paphos include the Paphos mosaics, the Tombs of the Kings, which are UNESCO Heritage sites, the Venetian fortressed harbour and the Pillar of St Paul. The Akamas peninsula is one of the island's residual unspoilt wildernesses and is home to endemic flora and fauna species. Paphos mostly attracts couples and families.

5 The **FAMAGUSTA REGION** consists of Ayia Napa, Protaras, and Paralimni, and has many of the best beaches on the island. Ayia Napa in particular is a reputable party town for twenty-somethings and prime site for nightlife. The area mostly attracts young people, couples and families.

MEDICAL TOURISM

Popular treatments in Cyprus:

- check-ups & diagnostic tests
- elective surgery
- dentistry
- cosmetic & plastic surgery
- fertility treatments
- eye surgery
- rehabilitation

Cyprus ranks

24th

(out of 195 countries) for access to quality health services in Healthcare Access and Quality Index (HAQ)

3.97
million tourists in 2019

€2.683bn
in revenue

Tourism accounts for over

20%

of GDP, directly and indirectly

PRIVATE SECTOR	PUBLIC SECTOR			
75 hospitals and clinics	**5** district hospitals	**1** paediatric/ gynaecological hospital	**3** small rural hospitals	**38** health centres and 230 sub-centres with a touring medical team

258 average number of people per doctor

290 average number of people per bed

187 average number of people per nurse

114 average number of people per ICU bed

Source: Country Report CYPRUS 2020, Country Profiler October 2020

2.7 Policies guiding sustainable development

Sustainable Development Goals Agenda
The Government of Cyprus has strongly supported the process of developing the Post-2015 Sustainable Development Agenda and has repeatedly expressed its commitment to the implementation of the Sustainable Development Goals (SDGs). However, it has not yet adopted a comprehensive policy framework for implementing goals in the context of the country. Cyprus' laws, strategies and policies on sustainable and inclusive development are relevant to the European Union member states of the country [6].
As already mentioned, there is no formal government strategy for the 2030 Agenda.

However, there are ongoing initiatives to promote sustainable development at both national and international levels. Cyprus has achieved its European 2020 goals to varying degrees. In some areas it's seen vital progress towards its 2020 targets, akin to in education and energy consumption, whereas in alternative areas such as employment, greenhouse emission emissions and economic condition reduction there are still significant challenges. Cyprus supported the method resulting in the world 2030 Agenda for Sustainable Development and demonstrated a commitment to figure towards the implementation of the SDGs, each at the national and international levels. The Republic of Cyprus' economy has adult powerfully in recent years (4.2% in 2017), at rates well higher than the EU-28 average (2.4% in 2017) (EC, 2019a). Despite this, value per capita in 2017 was 15% below the EU-28 average (EuroStat, 2017). Since the 2012 money crisis, Cyprus has been underneath monetary fund constraints, with high reliance on funding from, and financial management by, the EU Commission (EC), European financial institution and also the International financial Fund[7].

Climate change
Cyprus - the third largest island within the Mediterranean - is one amongst the foremost water-scarce countries in the world with a semi-arid climate and restricted natural water resources. The present population of Cyprus is 1,196,000 and is predicted to extend steady to 2050. The share of population residing in urban areas is 67% and is projected to extend to 74.5% by 2050 (UN, 2019). Within the past thirty years, the economy has shifted from agriculture to light-weight producing and services.

Agriculture is answerable for <3% of GDP[8]; potatoes and citrus are the principal export crops. each the agriculture and commercial enterprise sectors consume massive volumes of water (64% and 5% respectively) and there's area for potency enhancements (Marin et al., 2018). Rain is very variable and sequent years of drought are common. Temperature change is already felt acutely, with a 20% reduction in average rainfall, and 40% reduction in water runoff into reservoirs, since the first Nineteen Seventies (EC, 2009).
This has crystal rectifier to unsustainable levels of groundwater abstraction, and not substantial infrastructure investments in dams, water chemical process and waste apply to maintain water security.

[6] Statistical Service of Cyprus, "Cyprus in the EU Scale", Republic of Cyprus, 2016.
[7]Statistical Service of Cyprus, "The European Union Towards 2020", 9 May 2017, available at: http://www.mof.gov.cy/mof/cystat/statistics.nsf/All/19D61CBA26661E93C22 5811B00308976/$file/EU_2020-EN-090517.pdf?OpenElement accessed on 8 June 2017.
[8] The agricultural sector, while contributing less to overall GDP (due to the rapid growth of the services sector), is still important for the Cypriot economy in terms of social cohesion, countryside and local tradition, and employment. The Cypriot food industry generates 3.6% of GDP contributes 3.7% to total employment and provides 15.9% of total export value.

DEVELOPMENTS IN SDGs 2017-2020	2017	2020	2017-2020 Growth
2020 SDG INDEX SCORE	**70.60**	**75.21**	**6.54%**
RANK (WORLD)	**50**	**34**	
SDG01 – NO POVERTY	99.93	99.88	-0.04%
SDG02 – ZERO HUNGER	55.43	53.88	-2.80%
SDG03 – GOOD HEALTH & WELL-BEING	92.43	90.84	-1.72%
SDG04 – QUALITY EDUCATION	93.28	97.11	4.11%
SDG05 – GENDER EQUALITY	67.75	72.17	6.52%
SDG06 – CLEAN WATER & SANITATION	89.85	77.31	-13.96%
SDG07 – AFFORDABLE & CLEAN ENERGY	85.92	92.40	7.54%
SDG08 – DECENT WORK & ECONOMIC GROWTH	73.75	81.13	10.00%
SDG09 – INDUSTRY INNOVATION & INFRASTRUCTURE	39.64	71.93	81.46%
SDG10 – REDUCED INEQUALITIES	74.94	81.83	9.19%
SDG11 – SUSTAINABLE CITIES & COMMUNITIES	92.81	77.34	-16.67%
SDG12 – RESPONSIBLE CONSUMPTION & PRODUCTION	39.62	54.61	37.85%
SDG13 – CLIMATE ACTION	68.07	66.14	-2.83%
SDG14 – LIFE BELOW WATER	43.68	59.72	36.70%
SDG15 – LIFE ON LAND	81.64	84.66	3.70%
SDG16 – PEACE, JUSTICE & STRONG INSTITUTIONS	75.06	81.23	8.22%
SDG17 - PARTNERSHIP FOR THE GOALS	26.37	36.47	38.30%

Figure 1. Cyprus development in SDGs over the period 2017-2020.
Source: Second voluntary national review of Sustainable development goals of Cyprus.

Blue Growth and Entrepreneurship

Following the UN Sustainable Development Summit (Rio+20), which adopted 17 Sustainable Development Goals (SDGs) since 2012, the European Commission has Blue Growth Strategy. Blue Growth is a long-term European strategy to support sustainable development of the maritime and maritime sectors (Figure 2).

This strategy recognizes that the seas and seas are levers of the European economy with great potential for innovative growth. This is the contribution of an integrated maritime policy to achieve the goals of the Europe 2020 Strategy for Smart, Sustainable and Inclusive Growth. This strategy was adopted at the ministerial level through the Limassol Declaration in October 2012. The Blue Economy emphasizes conservation and sustainability management based on the belief that healthy marine ecosystems are the basis of a more productive and sustainable marine economy. This includes the same desirable consequences inherent in the previous notions of the green economy and the recent notions of the circular economy[9].

"Blue Growth" consists of three pillars or components:
1. Targeted approach to specific activities such as aquaculture, coastal tourism, marine biotechnology, marine energy and seabed development.
2. Specific integrated maritime policies such as improving knowledge and access to maritime information, maritime space planning for efficient and sustainable management of maritime activities, and integrated maritime surveillance.
3. Ways for individual sea basins aiming at making certain most applicable combination of sustainable development measures that see of native climatic, oceanographic, economic, cultural and social factors, admire those that are nearest to America of the Mediterranean Sea, the sea Sea, the Ionian Sea and therefore the Black Sea.

Regarding employment, Spain (691,000 workers), Italy (390,000), UK (384,000), Greece (334,000) and France (279,000) are the largest economies in Europe. In summary, the first four member countries offer more than half of all work related to the blue economy. In Cyprus, the blue economy sector employs primarily about 26,000 workers, or about 7.4% of the total workforce, with the support of small family businesses. 73% of them are employed in coastal tourism, contributing to a total value added of 732 million, which is equivalent to a 4.6% share of the total economy [10]. Salaries in 2016 were € 15,400, 13% less than in 2009, primarily in the warehousing and transportation sector. In contrast, the average salary in the shipbuilding and repair sector, which has seen significant employment growth since 2009, has risen by 32%.

[9] Statistical Service of Cyprus, "The European Union Towards 2020", 9 May 2017, available at: http://www.mof.gov.cy/mof/cystat/statistics.nsf/All/19D61CBA26661E93C22 5811B00308976/$file/EU_2020-EN-090517.pdf?OpenElement accessed on 8 June 2017.
[10] Kontakos, P. (2021). Blue Growth and Entrepreneurship: Opportunities and Challenges in Cyprus. May.

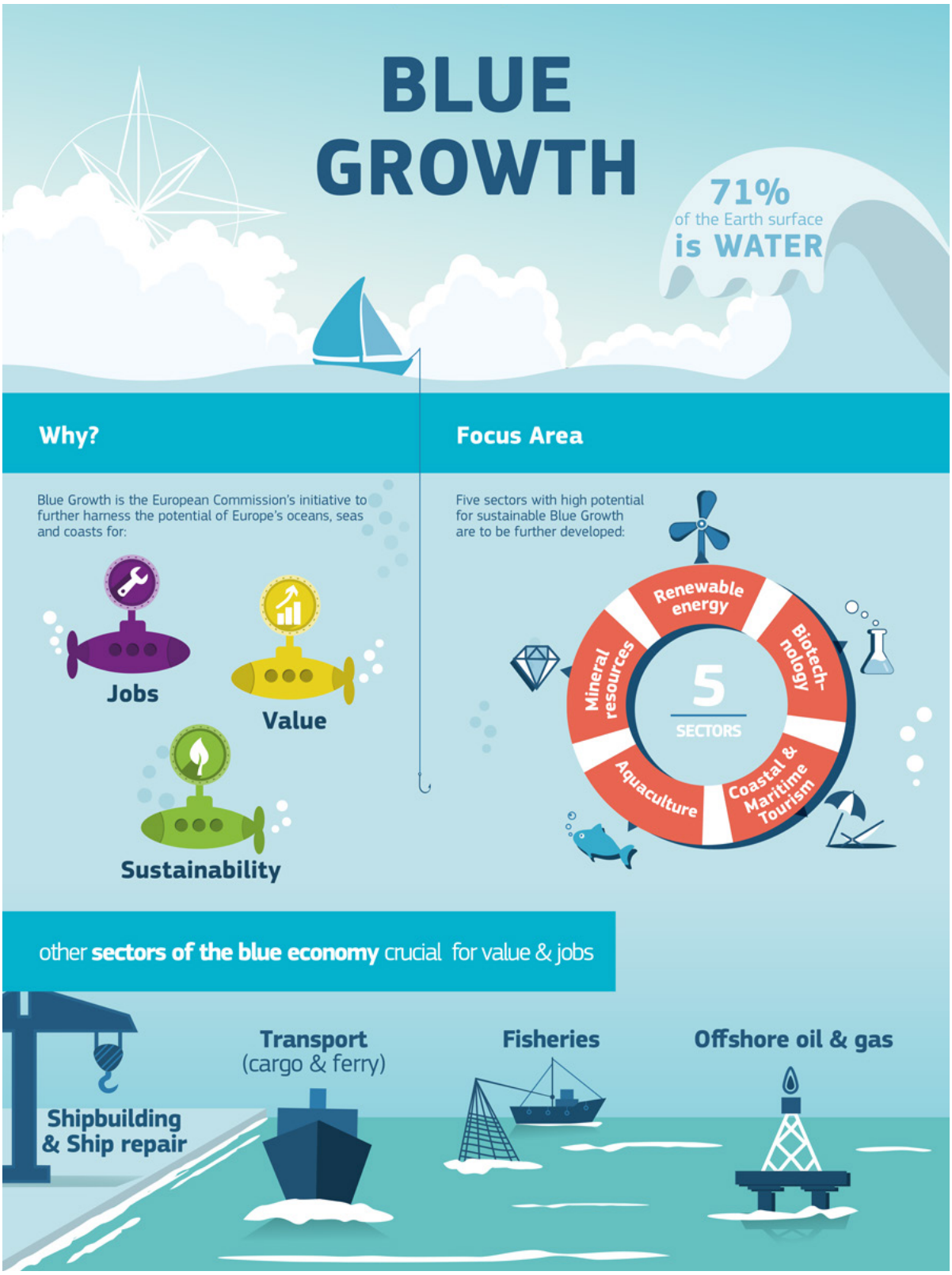


Figure 2. Blue Growth infographic by the European Commission

2.8 Key challenges

Green transition
The need to focus resources on other reform areas and the development of specific sectors to achieve economic growth has adversely affected the environment over time and has hampered the country's contribution to climate neutrality. Cyprus has more than 400,000 residential and 30,000 non-residential buildings. Almost half of the homes are single-family homes [11]. The architectural stock in Cyprus is relatively new. However, because there are no energy policy measures in the construction of these buildings, most existing buildings have low energy efficiency classes, which is reflected in the last sharp increase in final energy consumption in the building sector in the 1990s. According to the available statistics, 49% of households do not take energy conservation measures.

Most companies state that energy efficiency is their number one priority. However, SMEs face the challenge of identifying and / or implementing reasonable energy-saving opportunities due to lack of expertise on this subject and/or high cost and lack of funding. It is important to note that Cyprus electricity is expensive compared to the EU average, despite the relatively low percentage of taxes and VAT that affect business competitiveness.
The investment required to significantly improve energy efficiency requires a high upfront investment, and finding the right financing solution is a current challenge. Upfront investments are paid off by the energy and resource savings achieved, but the payback period is often too long.

There is high dependency on non-public vehicles associated high levels of aging vehicles not yielding with current EU emission standards. At identical time, there's an absence of property quality and different surroundings friendly fuel infrastructure. Eurostat's Water Exploitation Index shows that Cyprus has the best rate of water exploitation within the EU, i.e. the highest rate of water abstraction, as a share of its long-run average offered water from renewable fresh resources. Cyprus supplements its low natural water with desalinated H2O to fulfill drink needs and. This can be an energy-intensive process, expensive and polluting, looking forward to fossil fuels and causative to greenhouse emission emissions. temperature change is intensifying the country's have to be compelled to improve the water management processes.

Digital transformation
In terms of digital transformation, Cyprus is ranked 24th out of 28 EU member states based on the 2020 edition of the European Commission's Digital Economy and Society Index (DESI).
The latest available data (pre-pandemic) show that Cyprus has improved scores on all DESI dimensions, but still below the EU average, but scores especially on connectivity and internet utilization is improving [12].
Also note that Cyprus is above the EU average for mobile broadband use, but well below the EU average for high speed broadband use. More than 10% of Cyprus have never used the internet and one in two lacks basic digital skills. Despite rising demand for the labor market, the supply of ICT professionals is still below the EU average.

[11] Cyprus Recovery and Resilience Plan 2021-2026, Republic of Cyprus, European Union
[12] Cyprus Mail (https://cyprus-mail.com)

Smart, sustainable and inclusive growth

In line with the Union's objective for smart, sustainable and inclusive growth, it's necessary to target measures that may result in fast, strong and inclusive recovery and an accelerated value growth on a sustainable basis through real increase in output. Since 2015, Cyprus has created a powerful recovery, experiencing a number of the quickest economic process within the EU over the past 5 years. GDP growth has averaged 4.5% per annum, compared to a EU27 average of 1.7% per annum. However, in 2018, Cyprus' GDP per capita in Buying Power Standards (PPS), indexed to the EU27 average was still below the EU average (at 91%) and compared to the Eurozone countries, the gap is greater at 85%. Cyprus' underperformance in terms of economic process is in the main a results of low competitiveness, investment gap and a less diversified economy. One of the long-standing challenges of the Cyprus economy is that economic growth has been dependent on specific sectors.

Particularly construction, realty services, travel and tourism, and wholesale and retail trade frame 70% of the country's GDP. while this is often expected in a little and service-orientated economy, and despite the very fact that some new sectors such as the ICT sector are growing, the shortage of adequate diversification is combined by the very fact that the majority of those sectors are dependent on external demand and are coupled to international businesses and investments thereof. This makes Cyprus prone to external shocks and incorporates a negative impact on the economy's overall resilience. At a similar time, the outlook of a number of the standard sectors in terms of their potential for property growth is currently less positive than before.
These facts purpose to the necessity for further diversification of the Cyprus economy.

Service exports are key to the Cypriot economy in terms of their contribution to value and are driven by four key sectors, particularly travel and business, transport, finance and insurance, and ICT every of that accounts for around 20-25% of service exports, indicating a comparatively focused market. Cyprus's travel and tourism sector is presently dependent on international guests and specifically the tourism receipts from two countries which account for common fraction of total visitors. The shortage of diversification within the variety of states that trip Cyprus may expose the country to a demand shock thanks to economic, social and political developments.

The coronavirus pandemic may be a placing example of this; whereas the quantity of business numbers has continuing to grow in recent years, growth in international tourism revenue has been stagnant, driven by a decline within the average expenditure per person/trip. This, combined with the very fact that tourists are getting ever additional value conscious, assisted by the abundance of on-line price comparison websites, reliance on "sun and sea" tourism might leave the island prone to competition elsewhere, particularly from neighbor Mediterranean countries [13].

[13] Profile, E. I. O. C. (2019). Eco-innovation in Cyprus.

Furthermore, reliance on "sun and sea" because the main providing ends up in overcrowding throughout peak periods associate degreed an underuse of business infrastructure in off-season periods. Finally, Cyprus' travel and tourism sector is dependent on the island's natural capital and is to blame for the degradation of this same natural capital. Overexploitation of attractions and oversaturation of traveler areas and peaks of demand for water and energy, combined with Cyprus' poor water and waste management and reliance on fossil fuels are reducing the property of the commercial enterprise sector. There's a requirement for decisive efforts to shift towards eco-friendly tourism services, cherish agrotourism, and to limit the flow of investment in accommodation and infrastructure, so as to handle the chance of losing the sector's attractiveness and profitability. Furthermore, Cyprus may well be promoted as a secure and safe destination (taking advantage of the great medicine conditions). Cyprus scores low on problems that relate to ICT and digital, yet as innovation indicators, cherish entrepreneurial culture. Business potency measures such as productivity and management also apportion Cyprus a lower score. Weaknesses in establishments are apparent across each, specifically efficiency within the judiciary and also the readiness of the country for future change. Cyprus is additionally punished for the dimensions of its economy as well because the high levels of liability – both public and private.

Another challenge that must be self-addressed is that of skills mismatch. Proof suggests that instructional outcomes in Cyprus don't seem to be absolutely aligned to businesses' needs. For example, whereas the utilization rate of recent graduates has steady exaggerated since 2013, growing virtually 8% between 2017 and 2018 to 79%, around a 3rd of graduates are utilized in occupations that don't need tertiary education. This proportion has remained comparatively stable over the past decade, indicating persistent structural challenges within the matching of labour market participants to acceptable employment relevant to their capability and skills.
This might additionally indicate that the Cypriot economy lacks the capability to form high-wage, high-productivity jobs. Supported Eurostat data, Cyprus also seems to possess a considerably higher skills couple in the areas of that need high levels of technical competence together with computing, science and mathematics.
Cypriot businesses also are strained by an absence of diversity in sources of investment finance.
there's a comparatively inactive and little stock market. Three-quarters of external investment finance comes within the style of bank loans (excluding subsidized bank loans, overdrafts and alternative credit lines).
Cyprus has one amongst the very best borrowing prices for non-financial firms at 208% of the Eurozone average throughout the primary eleven months of 2020.

Health, and economic, social and institutional resilience
Measures to form additional resilient economies which will be able to (i) cut back vulnerability to shocks; (ii) increase shock absorption capacity; and (iii) improve ability to recover quickly when a shock.
At the beginning of the twentyfirst century, the share of over sixty five years olds in Cyprus' total population was 10%, increasing to around 15% at the moment and expected to rise to around 25% by 2050.
Ageing population poses varied economic, social and political challenges and amongst others they place important resource pressure on health and social care. On its own this challenge incorporate actions to confirm the adequacy of the care system to upset the rising demographics. Additionally, within the space of public health, the COVID-19 pandemic disclosed some structural failures on the coordination of police investigation actions, long coming up with associate degreed watching techniques.

Social and territorial cohesion

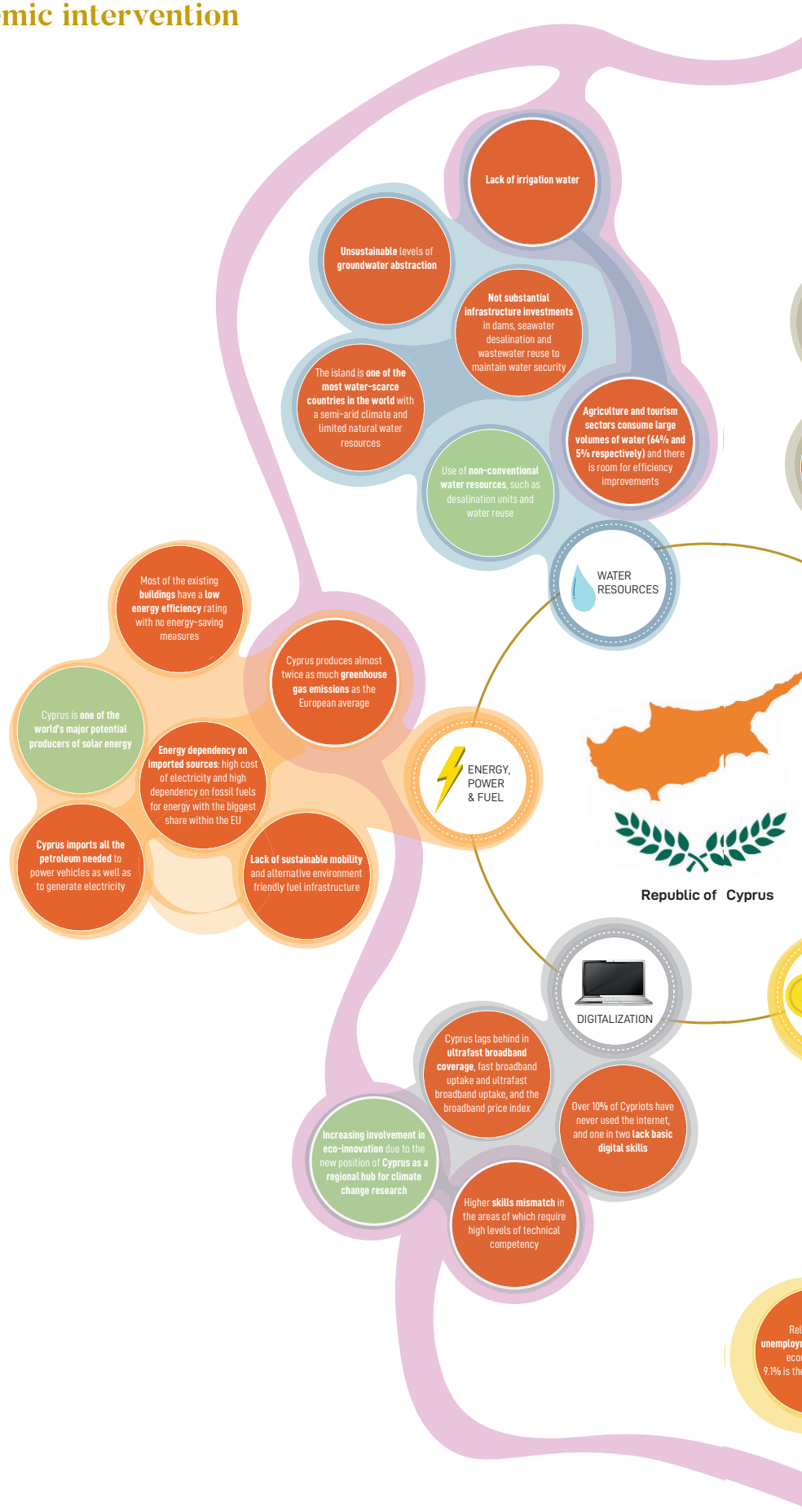
In line with the Union's objective for social and territorial cohesion, it's necessary to target measures which will cause enhancing cohesion, considering regional and national disparities, together with the rural-urban gaps. Whereas the social welfare theme covers mandatorily all and sundry gainfully occupied in Cyprus either as an used person or as a freelance person, staff operating with new varieties of employment similar to zero- hour contract staff and digital platform workers don't get pleasure from a similar protection as regular employees.

The labour market state of affairs in Cyprus has deteriorated since the occurrence of COVID-19 pandemic as a results of the economic contraction (negative rate of -5,1% in 2020) leading to an upward trend of unemployment, particularly amongst the foremost vulnerable. The pct (15+ years old) multiplied to 7,6% in 2020 from 7,1% in 2019. Youth unemployment rate (15-24 years old) increased to 18,2% in 2020 from 16,6% in 2019. State of ladies within the age bracket 25-64 was above that of men of a similar age bracket (7,3% vs 6,5% in 2020). Reach to children Not in Employment, Education or coaching (NEETs) continues to be one among the key problems because the Cyprus efforts to strengthen outreach activities by mapping and identification the population of NEETs and by building partnerships with native actors are interrupted thanks to the pandemic. According to the Cyprus Country Report published in February 2020, education and care gap is higher for kids below the age of three. In keeping with the same report, Cyprus depends heavily on informal settings or private institutions.

Promoting policies for the next generation

Because the Republic of Cyprus is facing an increasing migration flow, the amount of unaccompanied minors coming into the Republic has multiplied considerably and Cyprus faces a significant downside since the structures and programs presently operative to serve them are overloaded. Additionally, the Cyprus labour market is defined by ability shortages and an outsized digital and entrepreneurship skills gap.

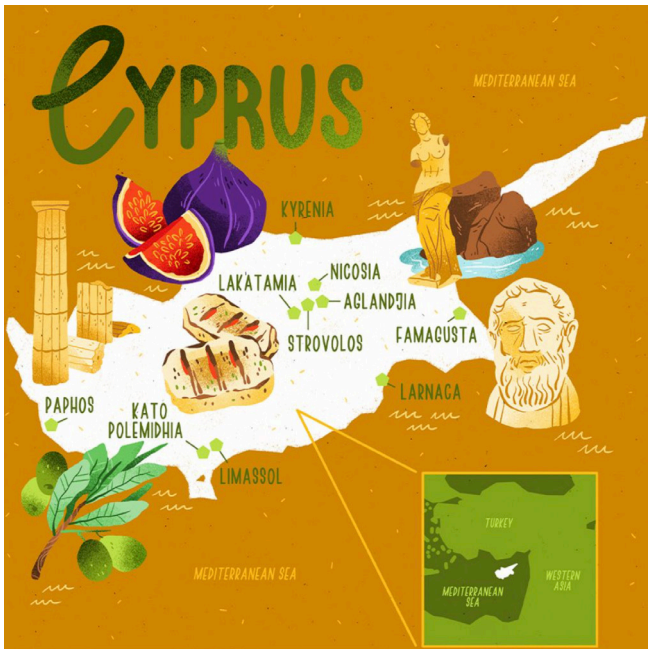
Crosscut: challenges & opportunities of the territory to define the sector for systemic intervention



challenges of the island

opportunities for the island


AGRI-FOOD SECTOR
PRIMARY SECTOR
Manufacture of food products is the activity with the highest share of persons engaged in the industrial sector (33,5%)
Manufacture of food products is the main activity contributing to the added value of industrial sector (22,1%)
Relatively high R&D expenditure to promote sustainable agricultural production
The agri-food trade balance in Cyprus is negative
Drawbacks of the fresh produce supply chain, especially regarding traceability
Cyprus has the most sales of veterinary antibiotics in the entire European Union
In Cyprus the total number of farms declined between 2005 and 2016 as well as the agricultural area
Cyprus has the lowest share of young farmers in the total number of farm managers in the EU in 2016 (1.3%)
The fishing industry is small, indeed most fish is imported
The number of livestock decreased so the livestock density per unit increased
Cyprus ranks in the lowest positions among EU countries in relation to sustainable agriculture
Large increases in the exports of dairy products and preserved fruit and vegetable products
WASTE MANAGEMENT
In Cyprus the solid waste in general contributes around 14% of the national GHG emissions
The majority of the country's waste (approx. 80%) is landfilled
The Cypriot production of household waste per capita is the 3rd highest in Europe (640 kg per capita)
The Republic of Cyprus, ranks 3rd amongst the highest food-wasters in the EU (327kg/person per annum)
ECONOMY & SOCIETY
Landholdings are small, highly fragmented, and dispersed under traditional laws of inheritance
Strategic location and favourable tax regime allow Cyprus to retain its long-standing position as a premier ranking international financial centre
Star-performing exports are pharmaceutical products (34.6%), and food products (32.2%)
There is a missing link between research and the introduction of innovations at operational level
The government passed the 'Production and Trade of Industrial Hemp Law' which allows for the licensed production and export of Industrial Cannabis
High public debt: 108.1% forecast for 2022
The operation of SMSs is characterized by the lack of cooperation with other enterprises as well as research centers
Dependency on limited and vulnerable sectors of economic activity (eg. tourism)
Tourism accounts for over 20% of GDP directly and indirectly; 340/365 sunny days, 24°C average temperature
High dependency on private vehicles and high levels of aging vehicles
Systematic corruption
Very high overweight and obesity levels among Cypriot children (20% obese, 45% overweight)
First per capita among EU members competing for funds from Europe's largest research and innovation programme, Horizon 2020


CYPRUS
MEDITERRANEAN SEA
KYRENIA
LAKATAMIA
NICOSIA
AGLANDJIA
STROVOLOS
FAMAGUSTA
LARNACA
PAPHOS
KATO POLEMIDHIA
LIMASSOL
MEDITERRANEAN SEA
TURKEY
MEDITERRANEAN SEA
WESTERN ASIA

Cypriot agri-food sector

Cyprus ranks withinside the lowest positions amongst EU nations in terms of sustainable agriculture. It is significantly tormented by weather change, **placing at danger each the protection and adequacy of locally produced meals and cattle production. Rising temperatures, declining rainfall and severe climate occasions are the primary threats confronted with the aid of using farming today**. In addition, the **dearth of irrigation water** and new illnesses exert detrimental pressures on agricultural development, at the same time as extensive cultivation outcomes withinside the sizeable degradation of agricultural land, posing a hazard on biodiversity. In general, **Cyprus` agriculture** quarter is **characterized with the aid of using low productivity, accelerated fragmentation, an getting old populace of farmers, and a restricted use of technology.** Obesity is a developing difficulty for kids and teens because of dangerous habits. **One in seven adults (approximately 14 %) have been overweight** in 2017 – a proportion just like the **EU average.**
Very excessive obese and weight problems ranges amongst Cypriot kids are a great deal extra concerning, with statistics displaying that amongst six-to nine-yr old kids, approximately 20% have been overweight in 2015-17, and 43% have been overweight or obese, those figures practice to each boys and girls.
(WHO Regional Office for Europe, 2018).

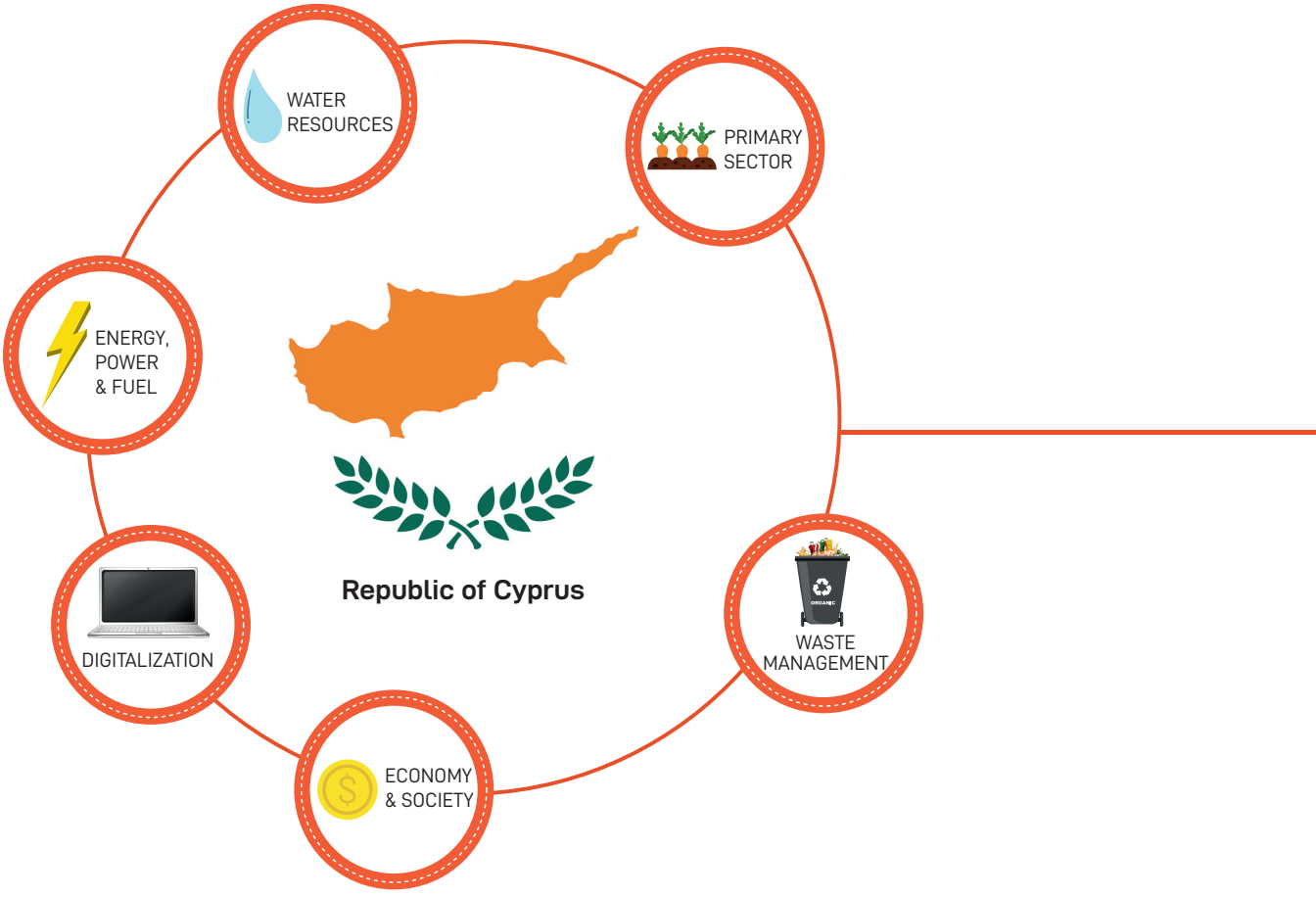
3.1 Why agri-food?

Water resources
The island is one of the maximum water-scarce nations withinside the global with a semi-arid weather and restrained herbal water sources main to a unsustainable tiers of groundwater abstraction, loss of irrigation water and to the importation of huge quantities of potable water while this isn't always acquired via desalination units (virtually excessive electricity expenditure). Agriculture and tourism sectors devour huge volumes of water (64% and 5% respectively) and there may be room for performance improvements.

Primary sector
Cyprus has the maximum income of veterinary antibiotics withinside the whole European Union. The island ranks withinside the lowest positions amongst EU nations when it comes to sustainable agriculture. Drawbacks of the clean produce deliver chain are noticed, specially concerning traceability. The agri-meals exchange stability in Cyprus is negative, in truth Cyprus nonetheless imports extra merchandise no matter a developing export market

Waste management
Cyprus household waste production per capita is the third highest in Europe (640 kg per capita).
Most of the country's waste (about 80%) is sent to landfills, and solid waste generally accounts for about 14% of the country's greenhouse gas emissions. About half of the waste generated in Cyprus is food waste, and in fact, the Republic of Cyprus is the third largest food waste in the EU at 327 kg/person per year.

Main challenges to face for island sustainability



Economy and society
Dependency on restricted and vulnerable sectors of economic activity (eg. tourism). The operation of SMSs is characterised by the dearth of cooperation with alternative enterprises still as analysis centers. comparatively high pct once the economic crisis: 9.1% is that the forecast for 2021and High public debt: 108.1% forecast for 2022. High dependency on non-public vehicles and high levels of aging vehicles, terribly high overweight and blubber levels among Cypriot youngsters (20% obese, 45% overweight).

Digitalization
Cyprus lags behind in ultrafast broadband coverage, over 10% of Cypriots have not used the internet, and one in 2 lack basic digital skills driving to higher skills twin within the areas of that need high levels of technical digitalisation competency.

Energy, power and fuel
Energy dependency on foreign sources since Cyprus imports all the crude oil required to power vehicles still on generate electricity. the dearth of property quality and various surroundings friendly fuel infrastructure, contributes to the assembly of just about doubly the maximum amount greenhouse emission emissions because the European average. No energy-saving measures are taken in 49% of the homes.

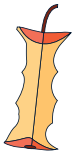
Agri-food sector is related to all the main challenges pointed out, therefore a systemic intervention in this sector can affect the island sustainability.

Agri-food, the linking sector

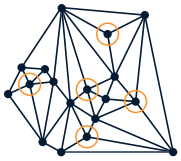
In Cyprus the agricultural sector, whereas tributary less to overall value (due to the zoom of the services sector), continues to be vital for the Cypriot economy in terms of social cohesion, country and native tradition, and employment. The Cypriot food trade generates 3.6% of GDP contributes 3.7% to total employment and provides 15.9% of total export value, noticing an oversized will increase within the exports of farm merchandise and preserved fruit and vegetable products. what is more the ecu Union is supporting a comparatively high R&D expenditure to market property agricultural production. Cyprus' agri-food sector may be a promising field for a general intervention since it permits to cope many of the challenges we tend to saw. After all the island agriculture system is characterised by low productivity, magnified fragmentation, associate degreeof aging population of farmers, and a restricted use of technology.

Agri-food sector is a prominent domain for application of circular schemes

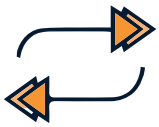
Has potential for limitation of waste through repurposing



Generates marginally toxic by-products and end-of-life products



Utilizes different inputs and create value chains of diverse linearity (circularities)



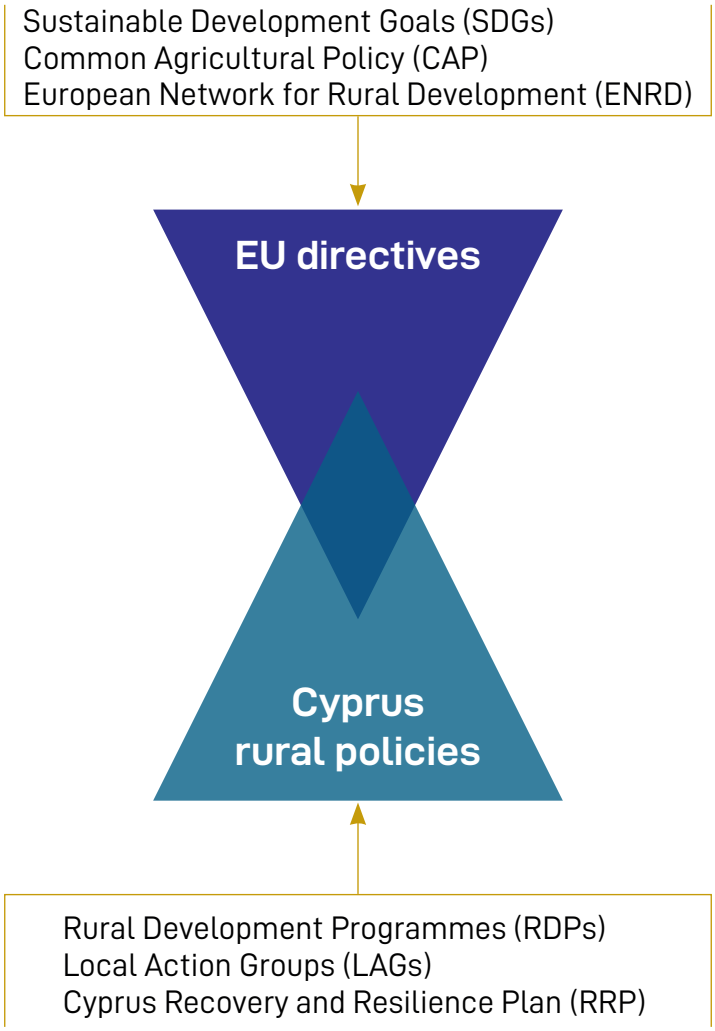
Shifts in input volumes

May easily use renewable energy for its day to day needs

Is scalable and replicable

Agri-food policy framework

"The government has invested with heavily in modernizing and reorganizing the agricultural sector with the assistance of generous EU funds and provided extra support to the world through varied programmes and subsidies" (www.cyprusprofile.com). Over the last 2 years, Cyprus has introduced variety of initiatives to spice up the agri-food sector in areas equivalent to water and waste management, good farming, environmental protection, protecting associate degreed promoting quality ancient merchandise worldwide, new varieties of business and higher animal welfare. The event of applicable tools for the correct management of the surroundings essentially passes through the mixing of ecological, economic and socio-political components among an knowledge domain framework equivalent to the scheme Services scheme, permitting to spot and quantify ecosystem functions, product
and services.



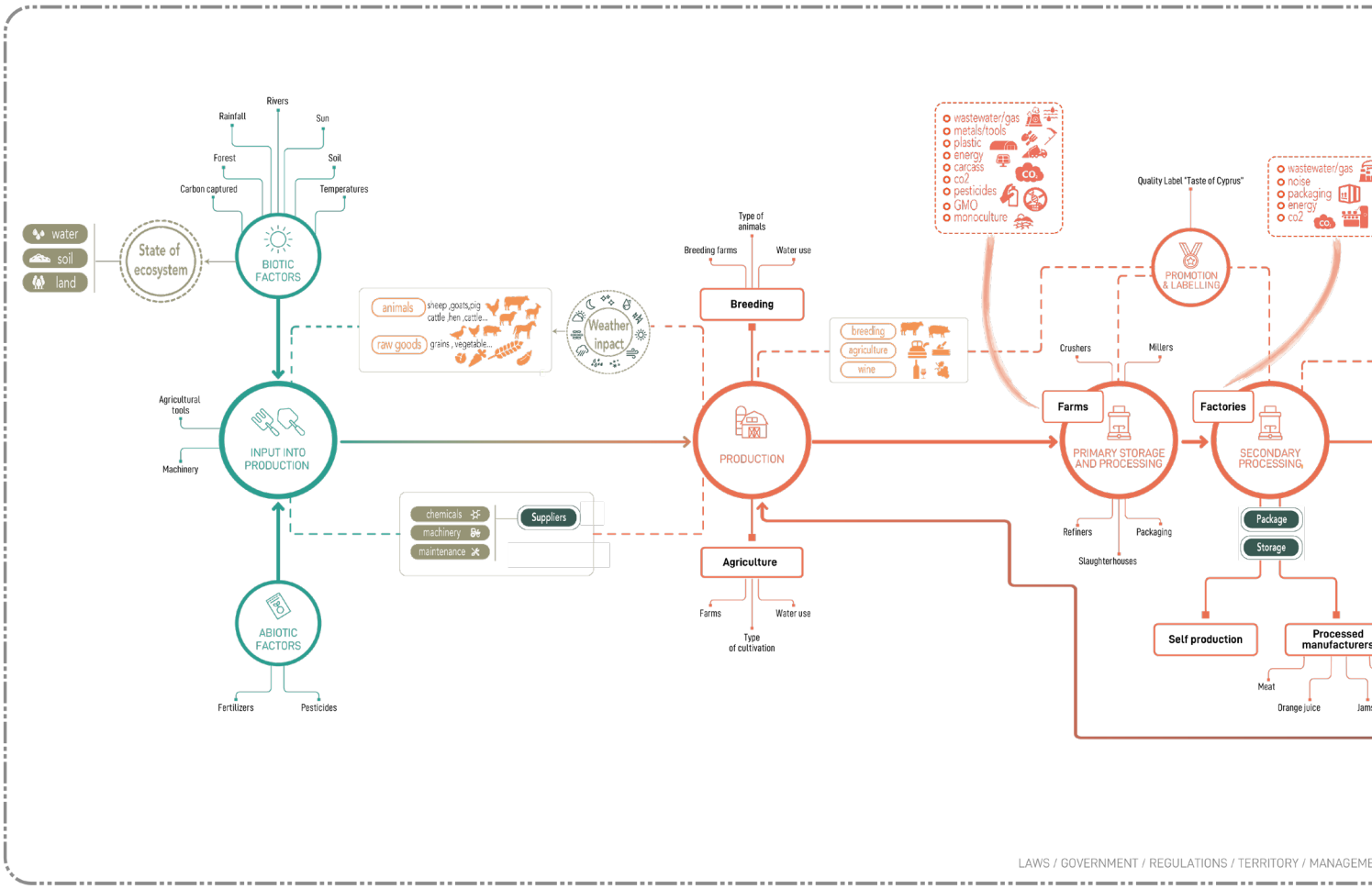
3.2 Agri-food system map

There are many actors in the agri-food chain who ensure our food moves from "farm-to-fork".

Primary Producers
The first stage of the food chain is the primary production of flora and fauna from agriculture and harvesting of fish and shellfish from wild fishing or aquaculture. When plants, animals, and their by-products are harvested, collected, or slaughtered, they are treated with care and transported to the next party or stage in the food chain.

Processors and Packaging
Food process refers to the stages where raw ingredients go through preparing and preserve phase or change it into something new for human consumption. This could embody a mixture of varied processes.
There are various styles of processors within the food chain.

Primary processors: flip raw materials, comparable to wheat kernels or eutherian into a type that is safe for human consumption. Primary processing includes: cutting, cleaning, packaging, storage and refrigeration of raw foods. For example: gutting, grading and icing of fish; or cutting and trimming animals for meat.



main stages of the system

key factors

principal actors

supply chain flow

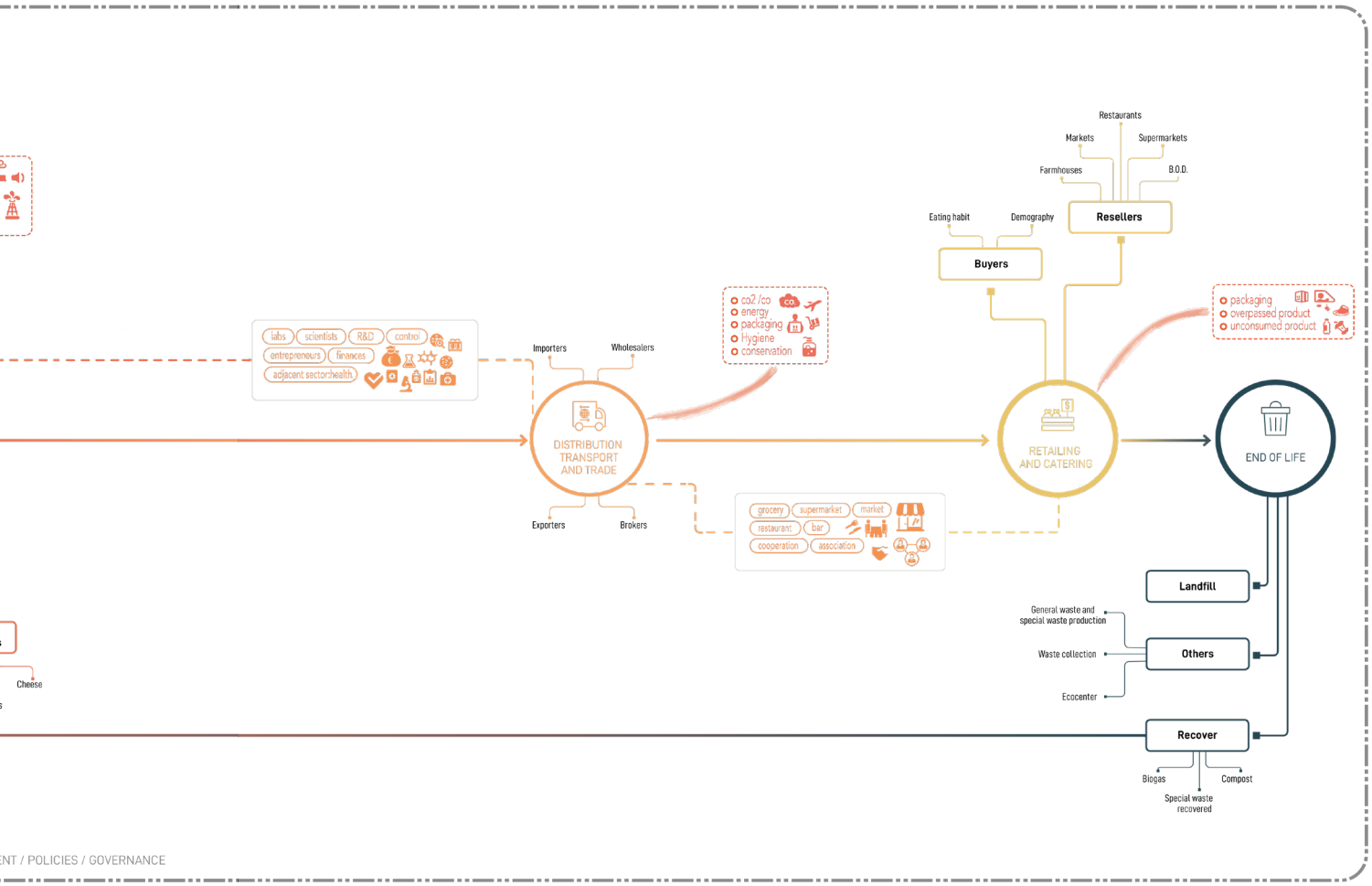
noxious outputs/waste

system of laws

These minimally processed foods retain the initial properties of their unprocessed form, i.e. nutritional, physical, sensory and chemical properties.

Secondary processors: flip the minimally processed product into additional helpful or edible forms. Secondary food product are refined, purified, extracted or remodeled from minimally processed foods, for instance cheese, flours, edible oils, sugars/sweeteners and starches. Secondary process includes: physical processes comparable to pressing, edge and dehydration; and chemical processes such as hydrolysis, chemical action or victimization enzymes.

Ultra-processed foods: made by combining primary food products and different secondary food products to form a ready-to-eat food and drink product with high sensory appeal, e.g. cakes, sweets, jams, soft drinks and prepared meals. Some secondary foodstuffion processes, comparable to heat treatment, fermentation and packaging, could also be accustomed extend the shelf-life of the first food ingredient. Packaging is additionally vital to safeguard the food product and delay physical, chemical and biological deterioration.



Agri-food system map explaining main steps, input and outputs of the system

Waste Streams
Waste will currently derive a value. It's more and more used as an alternate product stream to reinforce the potency and profit of a production system. For example, the edible and non-edible elements of slaughtered food (e.g. meat, internal organs, bloods and soft tissues) are usually used for further processing of both edible and non-edible products. These by-products will be sold as raw materials to producing sites to produce:
- edible products as well as fish sauce, fish oil, metallic element and macromolecule powder, dried fish heads and fish frames for the assembly of flavour in different fish products;
- non-edible products comparable to organic for cultivation or agriculture; bait; pet food; liquid fertilizer; a supply of carboxylic acid or plastic production.

Distributors
Distributors permit to move food safely across the world from one node within the food system to another. This technique involves an advanced network of infrastructure and transportation covering each the physical movement of goods and therefore the processes concerned in composition these product movements.
It's composed of a spread of steps as well as the gathering of food or raw materials from the farmer, storage and warehouses, and the distribution to food manufacturers, grocery stores, restaurants and houses before consumption by the ultimate consumer.

Markets
Worldwide customers purchase food made both across the country and internationally.
These customers will receive products directly from primary producers or fishers, primary or secondary producers or wholesalers, retailers and food service companies.
- Collectors and auction markets used for the first-hand sales.
- Distributor business merchants to purchase product in bulk from producers, wholesale marketers, primary processors, secondary processors and importers who afterward subdivide the product and provide retailers and food service institutions across the country and export to foreign markets available to the patrons.
- Retailers show the shop prepared product to the shoppers within the desired storage cabinets; or, as recent fillet products were the consumer chooses the specified product before packaging. These retailers are more and more dominated by large, centrally managed retailers comparable to grocery store chains or web-based retailers
- Food service to buy, prepare and sell the merchandise to the top shopper as a part of meals.

Consumers
Consumers mark the end of the agri-food chain. They have an influence on the agri-food chain through their purchasing choices, powerfully influenced by food availability, financial gain and their culture, religion, physical, social and economic surroundings.

Main source: Future Learn (https://www.futurelearn.com)

A young client in one of the Papantoniou Supermarket store, Cyprus; Source: www.papantoniou.com.cy

3.3 Ecosystem services

The development of appropriate tools for the proper management of the environment necessarily passes through the integration of ecological, economic and socio-political elements within an interdisciplinary framework. The underlying structure constitutes a general conceptual framework, within which it is possible to reach the identification and quantification of ecosystem functions, goods and services [14].

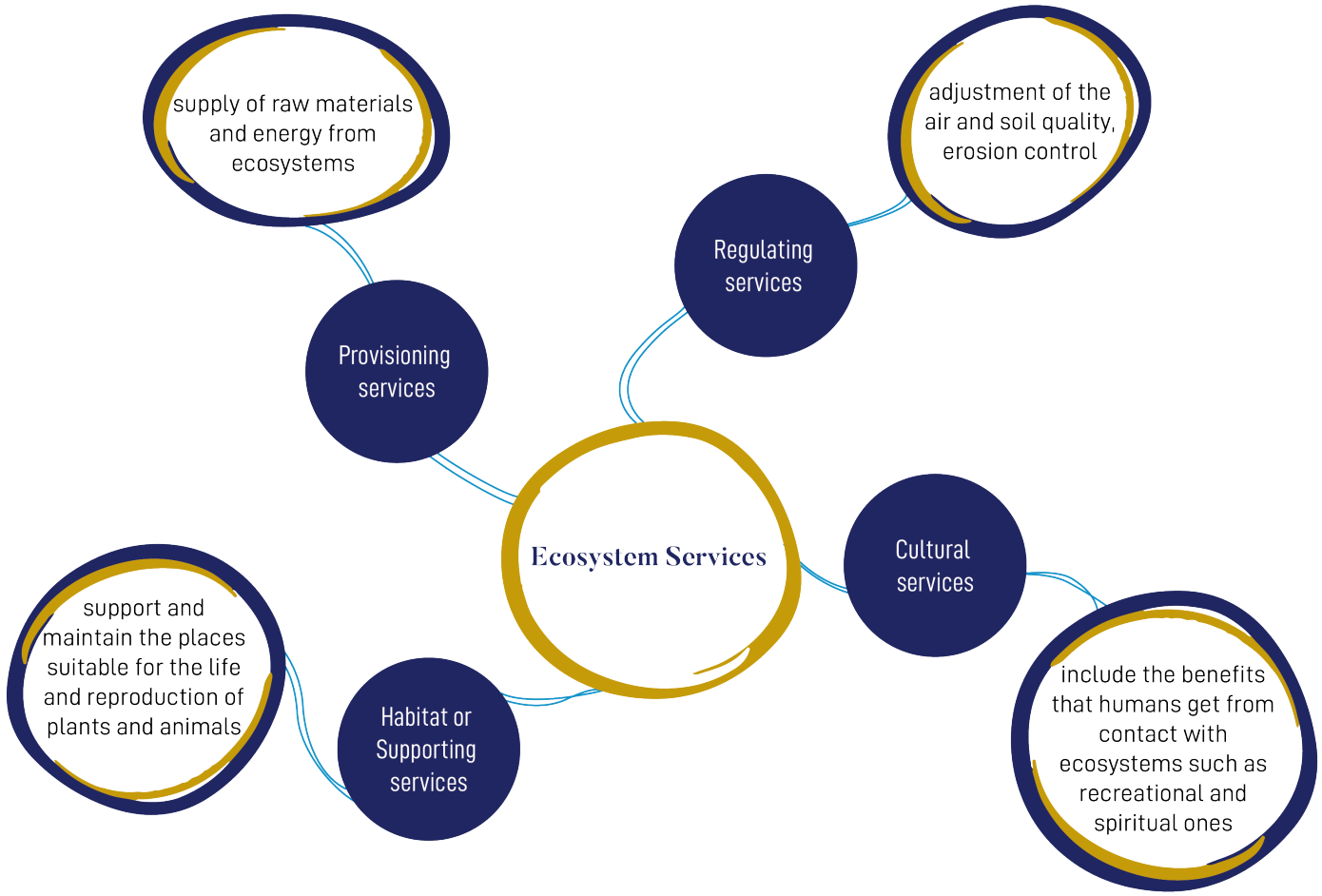
The Millennium Ecosystem Assessment (2005), the most extensive and in-depth systematization of the knowledge acquired so far on the state of the world's ecosystems, has provided a useful classification dividing the ecosystem functions into 4 main categories:
1. Life support (Supporting): these features collect all the services needed for the creation of all the other ecosystems services, contributing to the conservation of biological and genetic diversity and evolutionary processes (within habitats).
2. Regulation (Regulating): in addition to maintaining the health and functioning of ecosystems, regulatory functions collect many other services that bring direct and indirect benefits to man (such as climate stabilisation, waste recycling), usually not recognised until they are lost or degraded;
3. Supply (provisioning): these functions collect all those resource supply services that natural and semi-natural ecosystems produce (oxygen, water, food, etc.).
4. Cultural (Cultural): natural ecosystems serve an essential "advice" function and contribute to maintaining human health by providing opportunities for contemplation, mental affluence, cognitive development, recreation and aesthetic experiences.

These ecosystem functions include the goods and services that human society uses for its own well-being. On the basis of these functions, the Millennium Ecosystem Assessment identified the (potential) useful aspects of natural ecosystems for mankind in the form of goods and services, defining them under the general term ecosystem services: the multiple benefits provided by ecosystems to mankind.

Agricultural systems
Ecosystem functions are defined as the ability of natural processes and components to provide goods and services that meet, directly or indirectly, the needs of man and ensure the life of all species.
Agricultural systems as well as other ecosystems generate ecosystem services that have benefits for the entire society from ecological processes. The five ecosystem services that we chose related to agri-food sectore, are the following: food, soil formation, water regulation, water purification and waste treatment and air quality regulation.

Provisioning service
Food in the ecosystem service approach is a provisioning service, as are water, clean air and wood. Nowadays, the world produces enough food in order to feed all the human beings, which represent around 7 billion of people. In the latest years there was an increasing of food production as well as a fast and increased growth rate of the population. Nonetheless, all foods interact with and can affect the environment, which is detrimental to the environment. Those impacts, negative or positive, act on natural resources, climate, animals and plant organisms. Consequently, food can jeopardize its productive potential in the future (FAO, Food and agriculture organization of the United Nations)[15].

[14] Life+mgn (http://www.lifemgn-serviziecosistemici.eu)
[15] Power, A. G. (2010). Ecosystem services and agriculture: Tradeoffs and synergies. Philosophical Transactions of the Royal Society B: Biological Sciences, 365(1554), 2959–2971. https://doi.org/10.1098/rstb.2010.0143



Ecosystem Services, the multiple benefits provided by ecosystems to mankind; Source: The Millennium Ecosystem Assessment (2005)

3.4 Ecosystem services provided by agri-food sector

As well explained in the article Ecosystem services and agriculture: tradeoffs and synergies (A. G. Power, 2010), agricultural ecosystems provide humans with food, forage, bioenergy and pharmaceuticals and are essential to human wellbeing. These systems suppose scheme services provided by natural ecosystems, as well as pollination, biological blighter control, maintenance of soil structure and fertility, nutrient sport and hydrological services. Preliminary assessments indicate that the worth of those ecosystem services to agriculture is big and sometimes underappreciated. Agroecosystems also manufacture a spread of ecosystem services, comparable to regulation of soil and water quality, carbon sequestration, support for multifariousness and cultural services.
Counting on management practices, agriculture can even be the supply of diverse disservices, including loss of life habitat, nutrient runoff, alluviation of waterways, greenhouse emission emissions, and poisoning of humans and non-target species. The tradeoffs which will occur between provisioning services and alternative scheme services and disservices ought to be evaluated in terms of spacial scale, temporal scale and reversibility.
As simpler strategies for valuing ecosystem services become available, the potential for 'win–win' eventualities increases. Below all scenarios, acceptable agricultural management practices are essential to realizing the advantages of ecosystem services and reducing disservices from agricultural activities.

Food
The ecosystems provide conditions for growing food. Food comes principally from managed agro- ecosystems but marine and freshwater systems or forests also provide food for human consumption.

Raw materials
Ecosystems provide a great diversity of materials for construction and fuel (including wood, biofuels and plant oils that are directly derived from wild and cultivated plant species).

Soil formation
Soil is a precious resource on an ecological and economic level, limited and non-renewable. In its common meaning, soil is the natural medium for the growth of plants. It is a natural body consisting of layers that are composed of mineral materials, organic matter, air and water. Soil formation is a mix of different factors that are combined together. It is influenced by climate (temperature and moisture influence the speed of chemical reactions), by topography (the shape of land and its direction change the quantity of sunlight and the water the soil gets), by organisms (like fauna, flora, humans), by parent materials (every soil "inherits" traits from the parent material from which it formed), and also by time because all of these factors work together over time.

Water regulation
Water is becoming, year after year, an increasingly rare commodity. Too much water is used and the waste is enormous. The only solution is to learn how to save this irreplaceable commodity. Water is not only used by humans to quench their thirst. 70% of a country's water resources are used for agriculture and livestock, 20% for industry and only 10% for housing. Water is then indispensable to improve hygiene and health of humans.
In the last 50 years, water resources all over the world have been depleted and many wells have dried up. Intensive exploitation has reduced the flow of rivers and dried up many aquifers. The natural renewal is not able to rebuild them and their level is lowered.

Water purification and waste
Water purification is that the method by that unsought chemical compounds, organic and inorganic materials, and biological contaminants are far from water. In this process is also included distillation that is the conversion of a liquid into vapour to condense it back to liquid form and the deionization which consist in removing ion through the extraction of dissolved salts.

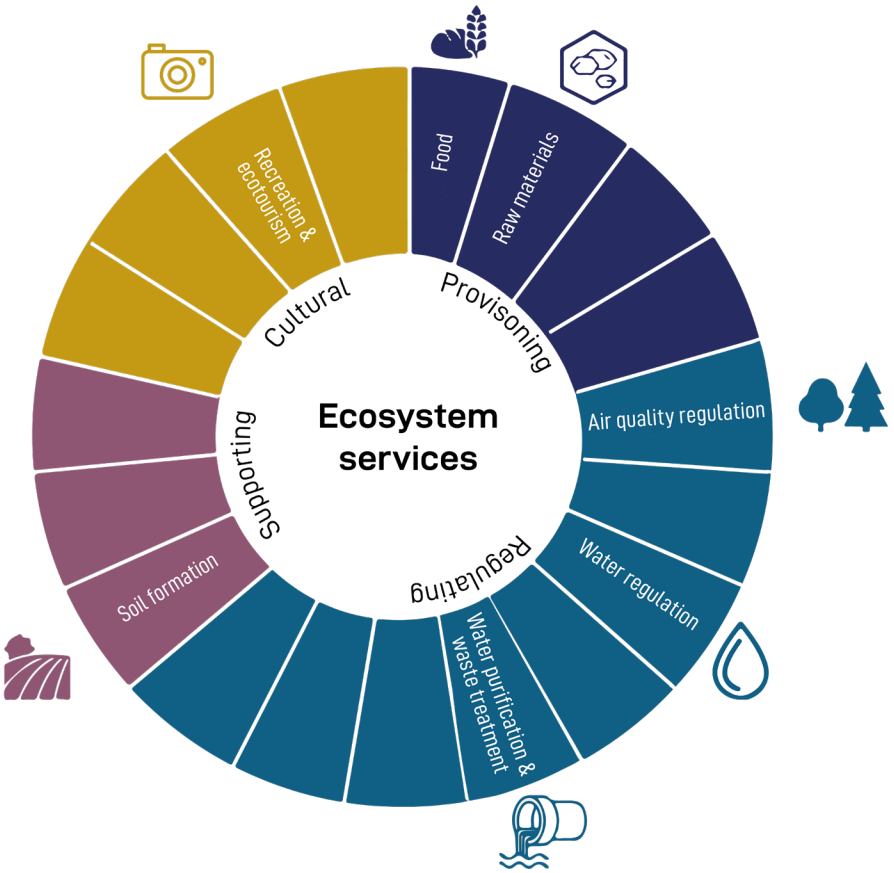
[16] D'Auria, A., De Toro, P., Fierro, N., & Montone, E. (2018). Integration between GIS and multi-criteria analysis for ecosystem services assessment: A methodological proposal for the National Park of Cilento, Vallo di Diano and Alburni (Italy). Sustainability (Switzerland), 10(9). https://doi.org/10.3390/su10093329

Air quality regulation
Air quality is a measure of how much air is free from air pollution and harmless if breathed in by man. If air is good, it means that it is clear from pollutants like smoke, dust and smog among other gaseous impurities in the air. There are a lot of factors and indicators that determine the quality of air. Good air quality is a requirement for preserving the exquisite balance of life on earth for humans, plants, animals and natural resources.

Recreation and mental and physical health
Walking and enjoying sports in inexperienced area isn't solely an honest sort of physical exertion however also lets people relax. The role that green space plays in maintaining mental and physical health is progressively being recognized, despite difficulties of measurement.

Tourism
Ecosystems and biodiversity play a vital role in many styles of tourism that successively provides considerable economic advantages and could be a vital supply of financial gain for several countries. Cultural and eco-tourism may also educate folks concerning the importance of biological diversity.

Aesthetic appreciation and inspiration for culture, art and design
Language, food culture, data and also the natural setting are intimately connected throughout human history. Biodiversity, ecosystems and natural landscapes have been the supply of inspiration for abundant of our art, culture and progressively for science.



Ecosystem Services provided by agri-food sector

3.5 Agri-food: understanding the system

Agri-food is an umbrella term that includes different actors: direct food producers (farmers and breeders), food processors, stocking companies, resellers, exporters, restaurants, bars, shops, ecc...
Together with agri-food there are many sectors such as the food transportation sector, machinery, chemistry, energy and many others. To understand the system of agri-food secror it is important to see how the different variables and interactions influence the dynamics and emergent behaviour.

The system map aims to identify the leverage points to work with. A technique for visualising the system, its structure and the interrelations between its elements. Mapping the system helps to develop shared understanding between the stakeholders about its complexity and interdependencies.

The holistic diagnosis of the territory allows to retrace and map the dynamics of the sector, understanding which are the main actors involved in the processes, the major companies and to highlight the most relevant quantitative and qualitative data of agriculture and breeding production.

The food industry is usually considered to be an industry with low research intensity (C. M. Galanakis, 2016). Farmers and food companies are slow to adopt digital technologies compared to other sectors and are beginning to implement and standardize digitization at scale. Innovation and investment in technology and ICT are interpreted differently depending on the size of the company and the tendency of the owner. Nevertheless, the agri-food sector (from fields to shop and supermarket counters to catering) is still one of the most important sectors of the modern economy and fundamental to addressing future food security challenges[17].
For this reason, the agri-food sector cannot allow itself to lose the opportunities offered by digitalisation.

Agriculture's contribution to EU GDP in 2018 was 1.1% (Eurostat) and according to Data & Trends 2019 (FoodDrinkEurope, 2019) the EU food industry employs 4.72 million people and generates sales of 1.2 trillion euros and 236 euros. It has created $1 billion in added value, making it the largest manufacturing industry in the EU, half of the 27 EU member states and the largest manufacturing employer in the UK.

Agricultural land area in Cyprus is approx. 50% of the island and the Republic of Cyprus controls all its management (CYGCA). Because no data were available for the northern part of the island, mapping was limited to this region (CYGCA). Over the past 40 years, Cyprus' agricultural land use (UAA) has declined sharply from about 180,000 hectares in 1975 to 115,000 hectares in 2012 (Cyprus Statistical Service 2012).
The largest reductions in crop area were observed in cereals and vineyards, two broad crops that could potentially meet the definition of high natural value (HNV) farmland[18]. Grain (mainly rain-fed barley decreased from 73,000 hectares in 2003 to 38,000 hectares in 2012, and vineyard area decreased from 35,000 hectares in 1975 to 7,000 hectares in 2012.

"Carob groves, another extensive crop and an important feature of the island's landscapes, have also seen a dramatic reduction from 7,000 ha in 1985 (earliest available data) to 1,700 ha in 2012" (ktisis.cut.ac.cy).

Approximately 10% of the UAA of Cyprus is used for growing intensive crops, mainly vegetables, potatoes, citrus and other fruits. Extensive grazing (area under grazing livestock production below 1LU/ha of forage area) is not present in Cyprus. The use of renewable energy in agriculture and forestry in Cyprus in 2015 is 9%.

[17] Keith, H., Czúcz, B., Jackson, B., Driver, A., Nicholson, E., & Maes, J. (2020). A conceptual framework and practical structure for implementing ecosystem condition accounts. One Ecosystem, 5, 1–54. https://doi.org/10.3897/oneeco.5.e58216
[18] Zomeni, M., Martinou, A. F., Stavrinides, M. C., & Vogiatzakis, I. N. (2018). High nature value farmlands: Challenges in identification and interpretation using Cyprus as a case study. Nature Conservation, 31, 53–70. https://doi.org/10.3897/natureconservation.31.28397

Negative aspects of the Agro-Industrial model; Source: Pettenati & Toldo, 2018

Ensuring the sustainability of food production

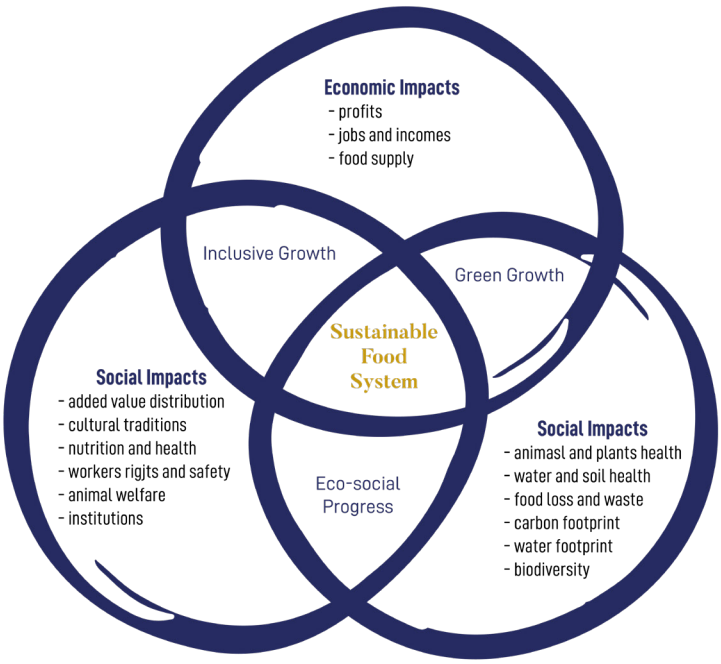
The Food and Agriculture Organization (FAO) states that the concept of a food system (FS) encompasses the full spectrum of actors and associated value-added activities related to the production, aggregation, processing, distribution, consumption and disposal of food resulting from: agriculture, forestry or fisheries, as well as parts of the broader economic, social and natural environment in which they are included. The Food and Agriculture Organization states that the food system is made up of subsystems and interacts with other core systems. Thus, structural changes in the food system can result from changes in other systems. On the other hand, the Sustainable Food System (SFS) is a food system that ensures food security and nutrition for all in a way that does not compromise the economic, social and environmental basis for food security and nutrition for future generations (FAO, 2018)[19]. Therefore, according to this statement, the SFS generates profitable economic, social and environmental sustainability [20].

Processed food and human's health

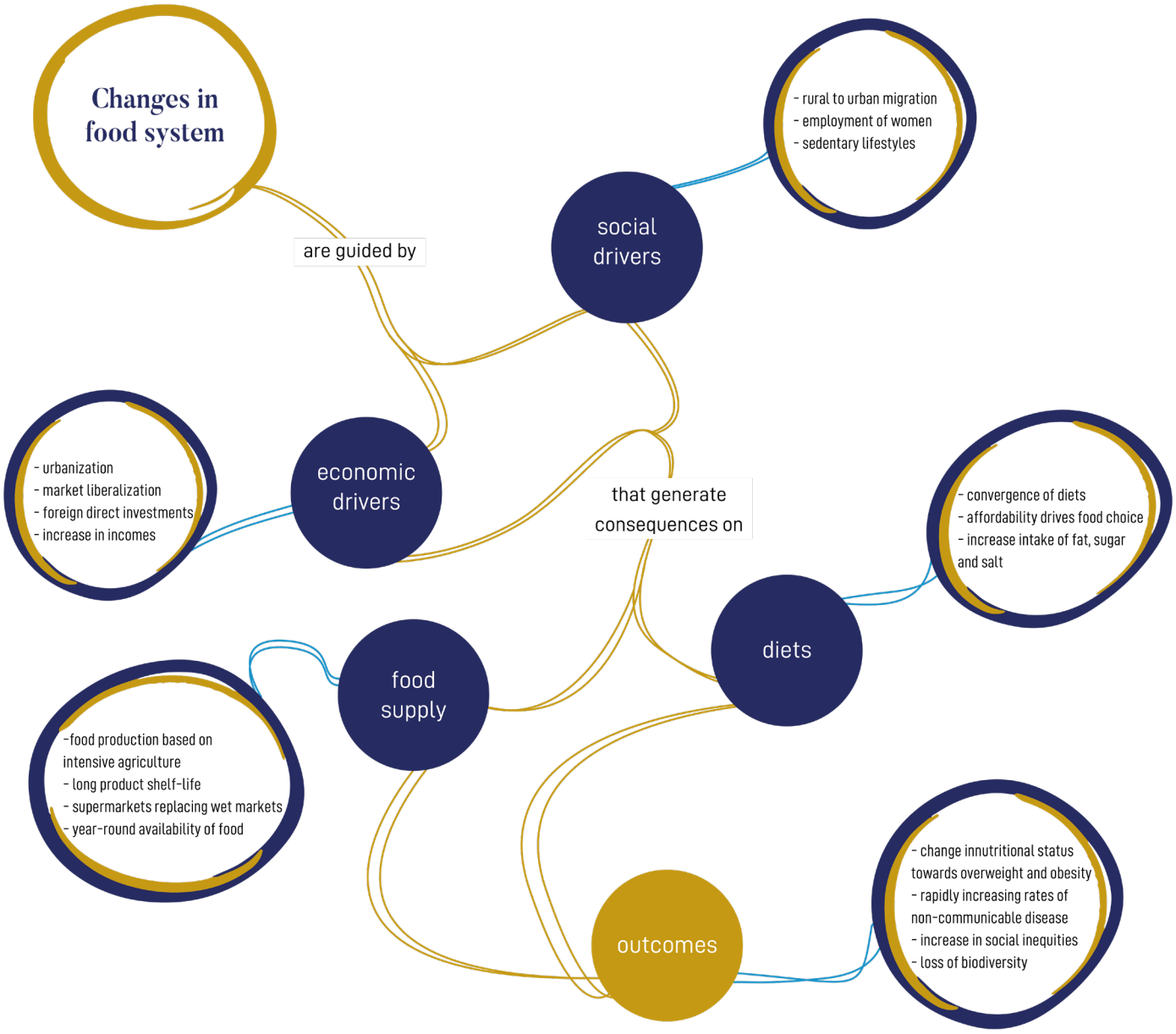
The birth of de-territorialized food systems, guided by mainly economic logics less and less linked to the social, cultural and environmental realities in which they are articulated, can be attributed to three different prevailing forces:

1. disconnection between producers and consumers increasingly distant from the places of production and who have increasingly formalized and anonymous relationships with those who produce food;
2. separation of food from their respective places of production;
3. disarticulation between the stages of the supply chain (Wiskerke, 2009).

The changes that have influenced the global food system on the one hand, and the different diets it contains on the other, have not occurred instantaneously but are the result of gradual shifts over the years in government investment, trade, infrastructure, international relations, urbanization and changes in production systems (Black, 2016). The most important change occurred within the food system, was designed to make calories from staples, such as wheat, corn and rice, cheaply available, in order to simultaneously address hunger in low and middle-income countries, and national food insecurity in high-income countries (Anand, et al., 2015).



Negative aspects of the Agro-Industrial model; Source: FAO 2018; The food system from a territorial perspective: policy framework, planning tools and practices at global, Riccardo Pietro Camporelli, 2021

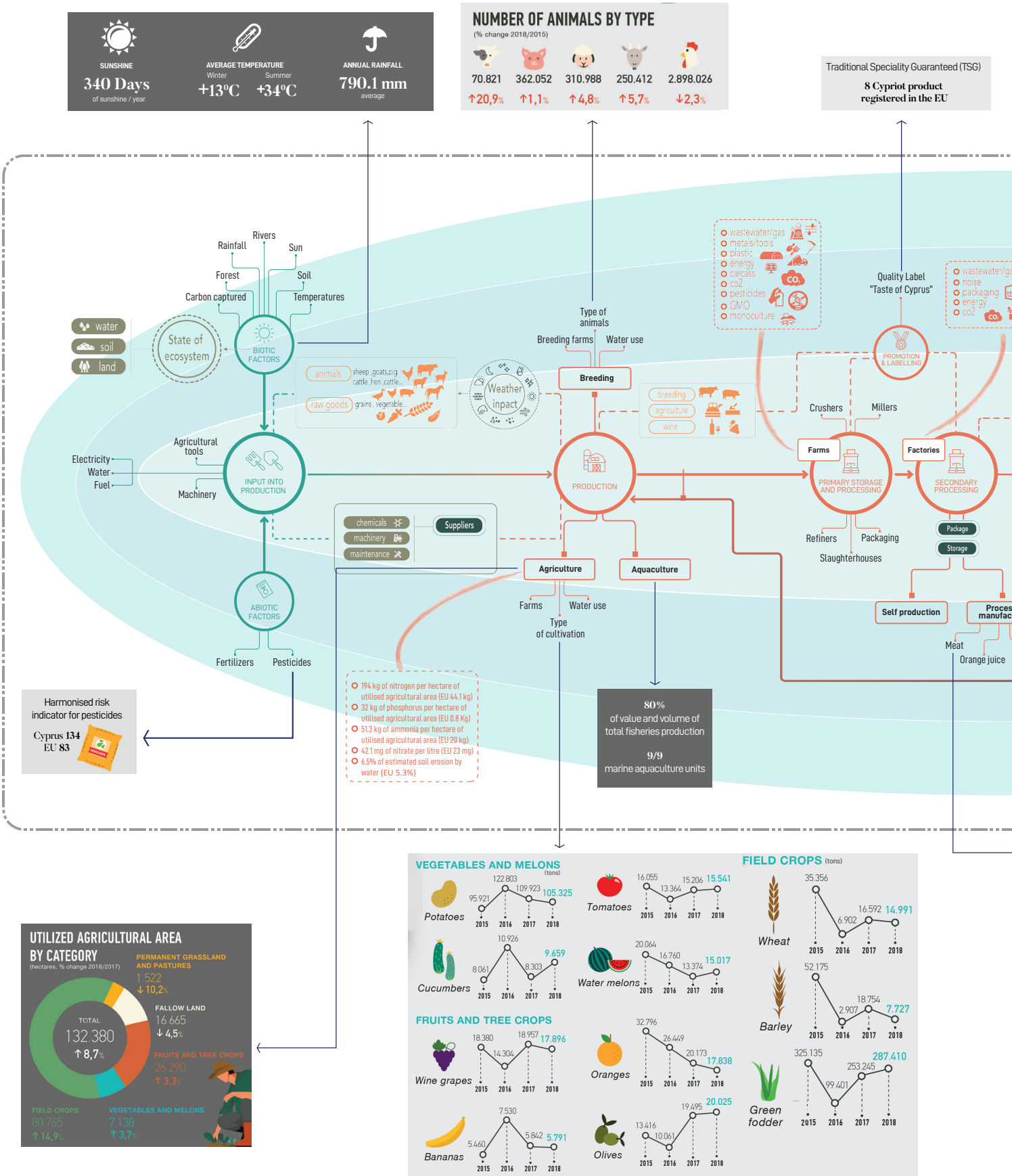


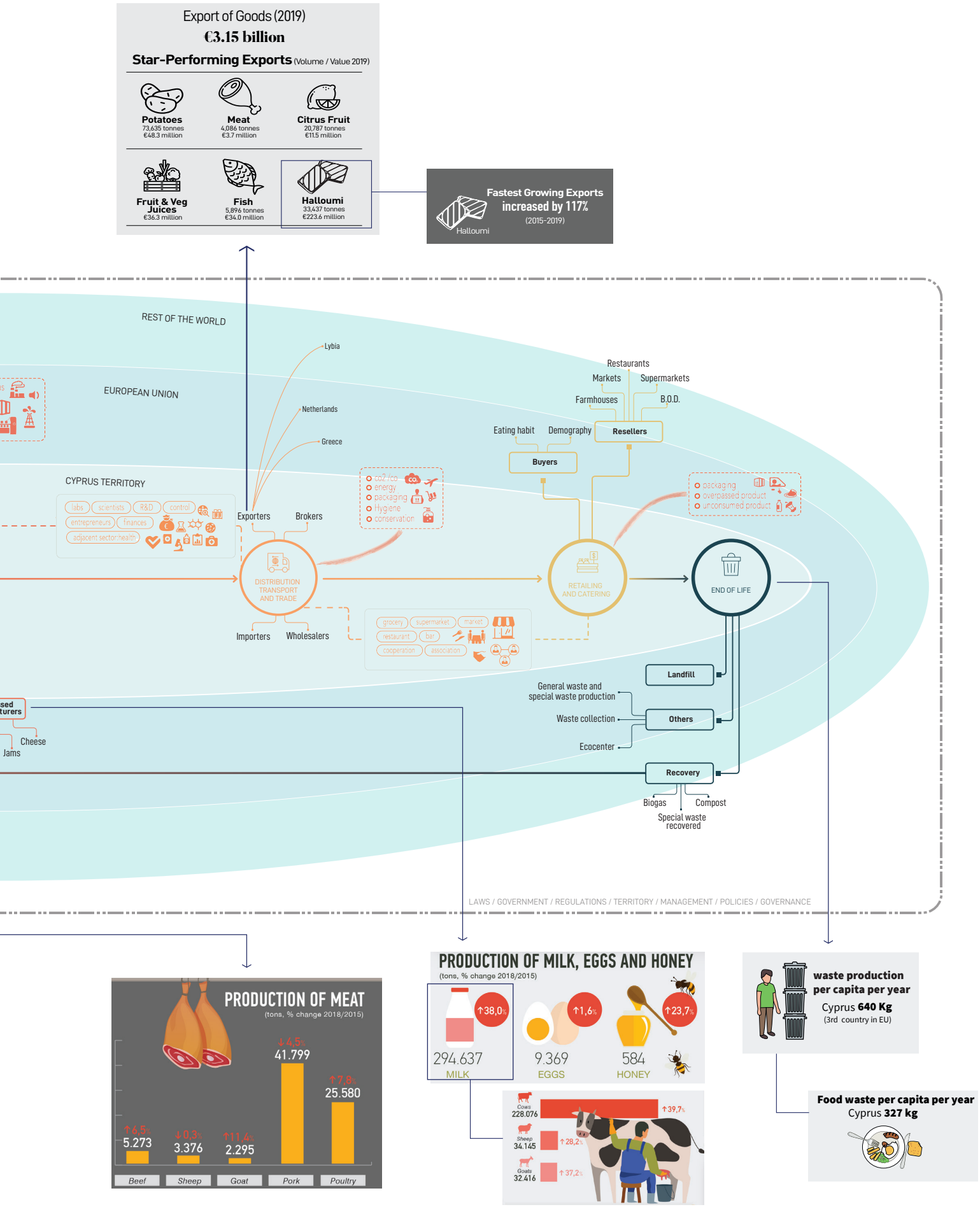
Changes in Food System; Source: Kennedy, et al., 2004; The food system from a territorial perspective: policy framework, planning tools and practices at global, Riccardo Pietro Camporelli, 2021

[19] FAO (2018) 'Sustainable Food Systems: Concept and Framework.' Available: http://www.fao.org/3/ca2079en/CA2079EN.pdf Date Visited: 28th May 2021

[20] EAT (2019) 'EAT-Lancet Commission brief for Everyone' Available: https://eatforum.org/content/uploads/2019/01/EAT_brief_everyone.pdf Date Visited: 3rd August 2021

3.6 Cypriot agri-food system map





Agri-food system map explaining main steps, input and outputs of the system

3.7 Food culture in Cyprus

Cyprus cuisine
The ritual of sharing delicious fresh local cuisine is an important part of the island's culture and is unique to every social event, from family celebrations and special occasions to religious festivals... each unique.
From delicious meats and cheeses to specialty carob and grape desserts, Cyprus is an exotic blend of Greek and Middle Eastern cultures, studded with remnants of ancient civilizations such as ancient Roman root vegetables and ancient Phoenician dishes; moreover the Cyprus cusine has also been affected by the British conquerors, who occupied Cyprus until 1960.

The "Mediterranean Diet" is one of the healthiest diets because the heart is rich in healthy olive oil, legumes, lean meats, local herbs, fresh fruits and vegetables. On top of that, the favorable climate, which gives fresh ingredients its intense flavor and every corner of the feast, is complete with special sweets. "Meze" is synonymous with Cypriot cuisine. This is a good starting point for combining different small plate dishes to feast and getting used to the following regional dishes: local freshly caught fish, legumes from a variety of sauces, cheese specialties and delicacies, as well as rare appetizers are all authentic dishes. Also, to commemorate the occasion when visiting the island during the festive and holiday seasons, the event's unique treats and dishes are often prepared for family women gathering on a particular day to attend the celebration. It shows a tradition that has been passed down from generation to generation and continues to this day, both locals and visitors continue to enjoy, enjoy and share the delicious and appetizing, fragrant and rich everyday experiences of Cyprus cuisine.

Cypriot cuisine is very similar to southern cuisine. This is due to the fact that the countries shared a common history before the invasion of Turkey in 1974. The main impact on Cypriot cuisine after the invasion was the removal of the western food chain, which was replaced by the influx of Turkish-influenced restaurants throughout the island. As mentioned earlier, the people of Cyprus love their food, but more importantly, they love the social aspects that come from sharing and being together. Since it is common for large families to eat together on weekends, meze-style dishes made up of a variety of foods that everyone can share are popular.

Cypriots generally prefer long lunches and late suppers when temperatures drop to more comfortable levels. Restaurants (depending on location) are usually not open until 7pm and most guests arrive at 8am or 9am. Due to the climate of Cyprus all year round, it is not uncommon to enjoy outdoor dining in taverns and outdoor courtyards. Most of them are beautifully decorated with vines and flowers, and in some cases traditional Cypriot music is played live. Experienced local musician[21].

[21] Tradiflavours.eu (http://tradiflavours.eu/index.php/component/k2/item/22-cyprus-food-drink)

Dishes of Cyprus

The main ingredients in Cyprus cuisine are pork, lamb, chicken, fresh fish, fruits, vegetables, wild greens, yogurt, cheese and herbs. Fruits and vegetables are always fresh and most of them come from Cyprus produce grown in all villages on the island. Cyprus is always known for its citrus fruits, oranges, tangerines, grapefruits, strawberries, apples, pears, watermelons, melons, grapes and fig trees. Traditional Greek dishes include souvlaki (grilled meat), shaft rear (grilled sausage), afera (pork marinated in coriander), fried halo mi cheese, olives, flat bread, korokashi (root vegetables), lamb, artichokes, chick beans, and rabbit stews (stiffads).
Traditional dips include tzatziki made with yogurt seasoned with peppermint and cucumber, and tarama salata made with pink cod eggs, mashed potatoes, lemons, onions and oil.

Unique flavours & tastes

At breakfast you will find that most dishes are quite similar to the rest of Europe. A "continental breakfast" consisting of bread, eggs, fruits and a variety of meats and cheeses is widely available. If you need a light meal while exploring the busy streets and markets, you'll find a common stall called Ciropitte, a cheese-stuffed puff pastry, or a similar spinach-stuffed spanakopitte. Other traditional street food options include panicle corn and roasted meat souvlaki wrapped in flatbread. In general, Cypriots prefer well-seasoned but not spicy foods and eat fruits (both dry and fresh) with many dishes. You`ll also find that fresh fruit is available everywhere from restaurants and cafés, to street stands and markets. For those with a sweet tooth, there`s the familiar baklava (puff pastry filled with nuts and soaked in syrup), loukoumi (known more commonly around the world as `Turkish Delight`), and a ringshaped cookie called koulourakia. Most desserts contain nuts and dried fruits, and cake and ice cream is also very popular – people often head out late to a gelato café for something sweet.

What to wash it all down with

What to wash it all down with. In terms of what to drink, visitors to Cyprus can enjoy an abundance of choice of both alcoholic and non alcoholic beverages. Coffee is very popular and is served with milk and either a little sweet ("metrio") or black ("sket"). The island has a large selection of both local and imported wines, as well as beer. If you're looking for something a little stronger, ouzo is probably the best-known apéritif after dinner.
The drink is served in ice-cold water and has a strong anise flavor[22].

[22] CyprusIsland.net (https://www.cyprusisland.net/cyprus-cuisine)

Quality label

To promote the quality of Cyprus agricultural products, the government has pushed for the registration of more PDO and two more international quality logos, certifying specific traditions and qualities of food, agricultural products and wine. The PGI shows how the PDO indicates a specific reference to a product from the region, while the third logo, the guaranteed traditional specialty (TSG), indicates a traditional manufacturing process[23].

In the wine category, Cyprus boasts the famous Commandaria, which is said to be the first well-known wine brand in the world. In addition, zivania and ouzo are strong spirits that have been listed as PGI products since 2004. There is growing interest in these unique quality badges as they add value to any product, especially as European consumers are willing to pay more for quality food and ingredients. Achieving further certifications for Cypriot products is a good opportunity to support Cyprus in rebranding and its agriculture[24].

"In the culinary culture of the island, goat dairy products are widely consumed, in fact halloumi cheese as well as being the most consumed cheese is also the most exported Cypriot PDO product (www.cyprusprofile.com)". The name 'halloumi' is now registered in the European Union as a Community Collective Trade Mark, meaning that no other product can be marketed within EU borders under this name.

The 8 Cyprus products registered in the EU

Kolokasi Sotiras or Kolokasi-Poulles Sotiras

PDO

Glyko Triantafyllo Agrou

PGI

Koufeta Amygdalou Geroskipou

PGI

Pafitiko Loukaniko

PGI

Loukoumi Geroskipou

PGI

Lountza Pitsilias

PGI

Loukaniko Pitsilias

PGI

Halloumi or Hellim

PDO

PGI: Protected Geographical Indication

PDO: Protected Designation of Drigin

[23] CyprusProfile.com (https://www.cyprusprofile.com/sectors/agriculture-and-food) OPENDEI (https://www.opendei.eu/agri-food-sector/)
[24] OPENDEI.eu (https://www.opendei.eu/agri-food-sector/)

Local recipes: Grilled Halloumi. Image: visitcyprus.com

3.8 Food waste

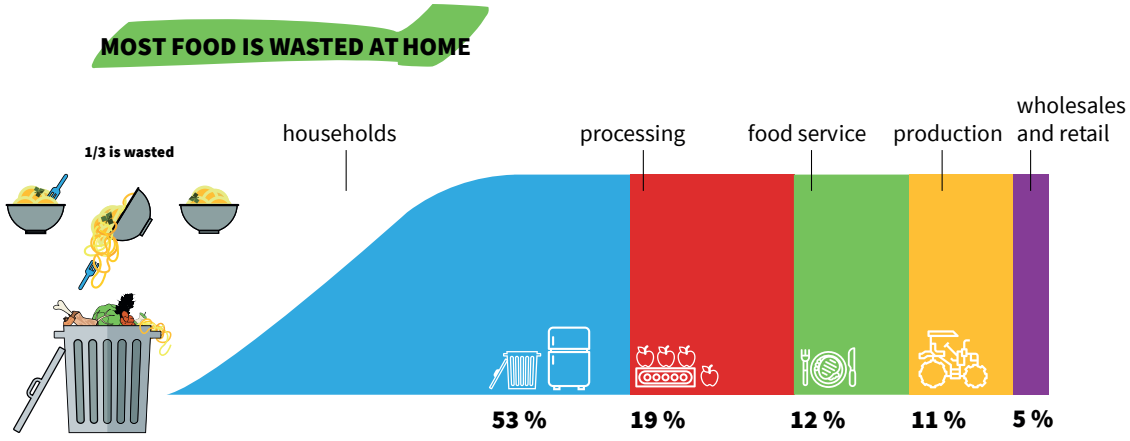
A definition

The FUSIONS3 framework defines food waste as "*food and inedible parts of food removed from the food supply chain" that is to be disposed of* (e.g. crops ploughed back into the soil, left unharvested or incinerated, food disposed of in sewers or landfill sites, or fish discarded at sea) *or used for nutrient recovery or energy generation* (e.g. through composting, or anaerobic digestion and other bioenergy pathways) (FUSIONS, 20144).

Inedible parts of food are bones, skins, pips / stones, and other parts that are not intended for human consumption. However, there is no universal definition of the inedible rate of food waste. This includes cultural customs (eg chicken feet are more commonly consumed in some countries than in others), socio-economic factors, food availability and price, technology and much more. Variables affected progress, international trade and geography. Therefore, food waste includes some foods intended for consumption and some foods not intended for consumption (EC, 2019). On the other hand, food waste does not include:
- pre-harvest loss incurred before the raw material is ready for harvest or slaughter like weather-related damage to crops (described as agricultural waste);
- by-product, edible or non-edible materials resulting from the manufacture and processing of food products, such as skins, bones and trimmings. These are used for non-food purposes (cosmetics, adhesives, pet food, etc.).
- food packaging such as boxes, wrapping paper, plastic containers (although edible packaging is considered food because it is intended for human consumption).

Household waste in Cyprus

The per capita production of household waste in Cyprus is one of the highest in Europe. According to the Statistics Bureau of the Republic of Cyprus, per capita waste generation reached 640 kg in 2018, ranking third after Denmark and Malta. In the European Union as a whole, the average per capita is 482 kg, one-third (that is, 88 million tonnes) of food waste. It also means that one-third of the food produced for human consumption around the world is lost or wasted, and one in nine people around the world is malnourished[25]. Based on the available data, considering that an estimated 60% of biodegradable waste is food waste, it can be estimated that about 155,000 tonnes of food waste was generated in Cyprus in 2017. This represents 28.2% of the total urban solid waste of the same year. As a result, almost one-third of Cyprus' waste management infrastructure and operating costs are spent on food waste treatment. Food waste is not only an ethical and economic issue, but also depletes the environment of limited natural resources. In Cyprus, it is generally estimated that solid waste accounts for about 14% of Cyprus' greenhouse gas emissions (National Plan for Energy and Climate 2021-2030). Therefore, minimizing food waste has a significant positive impact on greenhouse gas emissions [26].



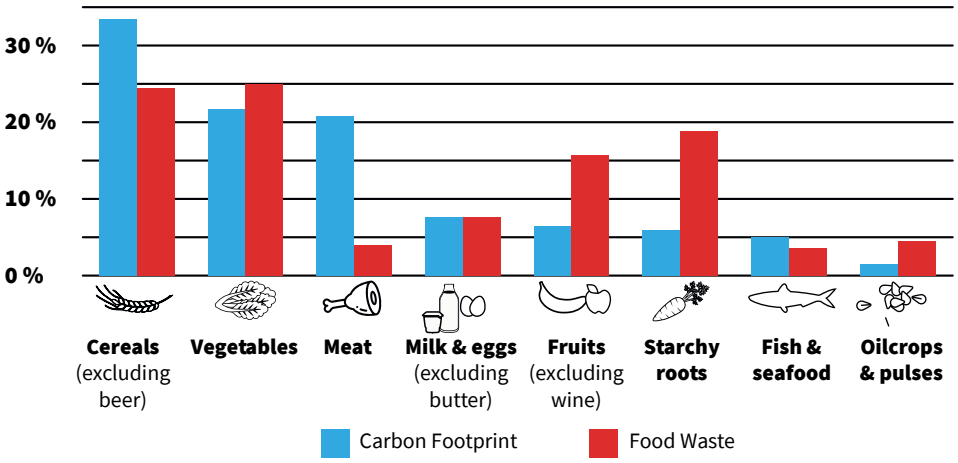
Source: SINCERELY FOOD, A useful little book about food waste and how to avoid it, EU publication, 2018

[25] Nattrass, L. (2013). Food waste in the European Union. RSC Green Chemistry, 25–37. https://doi.org/10.1039/9781849737326-00025
[26] Uncrcpc.org (https://blog.uncrcpc.org/articles/esc-20-21/food-waste-in-cyprus/)
[27] Animated Reduce Graphic Videos household, Andria Christou, Limassol, 2017 (https://ktisis.cut.ac.cy/handle/10488/18619)

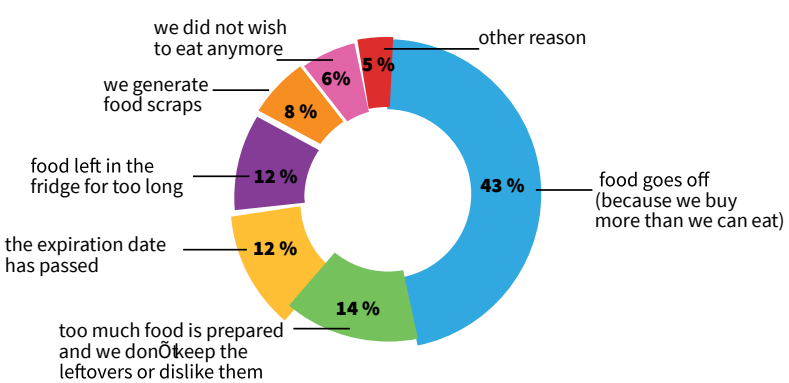
Food waste in Cyprus

According to the European publication "Food Waste: EU Issues in Number Infographics", the Republic of Cyprus is ranked third among the largest food wastes in the EU, with an average person weighing 327 kg per year.
In small countries like Cyprus, there is a large amount of food waste, especially in household units.
This is due to the Cypriot way of life and culture. Countries in the Mediterranean region of the world are likely to be close to their families because they live in small communities (Zorpas, et. Al, 2015).
As a community, Cypriots do not know how to reduce household food waste beacuse of their lifestyle (Zorpas, Lasaridi, Voukkali, Loizia & Chroni, 2015). Cooking is vital for Cypriot families as it is the main way of coming all together, although this is how food leftovers start off: cooking large amounts of food, 3-4 different meals a day and then throwing it away (A. Christou, 2017)[27]. Cyprus is one of the EU's largest producers of food waste, to some extent due to the tourism nature of the country. In fact, Cyprus (before the pandemic) received about 4 million tourists annually. This is a very large number compared to the local population of 850,000.
These tourists have a clear impact on the overall production of food waste. Therefore, the calculation of production per capita is bloated.

CEREALS AND GRAINS INCLUDING RICE HAVE THE BIGGEST CARBON FOOTPRINT AND AT THE SAME TIME ARE ONE OF THE MOST WASTED TYPES OF FOOD

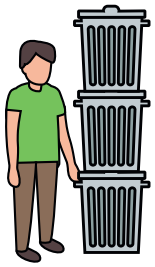


THE MAIN REASONS BEHIND FOOD WASTE ARE



Food waste per capita per year

327 kg



Cyprus

3.9 The goal: SDG 2 - zero hunger

End hunger, achieve food security and improved nutrition and promote sustainable agriculture
Goal 2 seeks sustainable solutions to end all forms of hunger and achieve food security by 2030.
The goal is to ensure that everyone, wherever they are, has food of sufficient quality to lead a healthy life.
Achieving this goal requires better access to food and widespread promotion of sustainable agriculture. This includes improving the productivity and income of smallholders by supporting equitable access to land, technology and markets, sustainable food production systems and resilient agricultural practices.
In addition, it is necessary to increase investment through international cooperation in order to strengthen the agricultural production capacity of developing countries.

Analysis
Cyprus faces significant challenges in promoting sustainable agricultural production. This country is the last ranked EU country in almost all relevant indicators. In particular, the harmonized risk index for pesticides in Cyprus was 134, but in the EU it was 83, remaining low throughout (see Figure 4). Another concern is that Cyprus is the last EU country to be ranked as a measure of nitrogen and phosphorus in agricultural land.
This causes pollution of the surface and of groundwater. In particular, Cyprus has 194 kg of nitrogen and 32 kg of phosphorus per hectare of farmland, and the EU equivalent is 44.1 kg of nitrogen and 0.8 kg of phosphorus.

It is clear that Cyprus' policies need to be significantly improved in order for the country to protect its precious natural resources. Cyprus is also one of the last countries in the EU due to its indicators of the environmental impact of agricultural production. Specifically, in Cyprus, 51.3 kg (20 kg - EU) of ammonia per hectare of farmland, 42.1 mg (23 mg- EU) of nitrate per liter, and 6.5% of (estimated) soil erosion by water is observed (5.3% - EU). The silver lining mentioned here is the fact that Cyprus ranks seventh among EU countries in terms of government support for agricultural research and development. The Cyprus government has spent 6.6 euros per inhabitant against the EU average of 6.5 euros (see Figure 5). This relatively high R&D cost should improve Cyprus' position in promoting sustainable agricultural production. In addition, the Common Agricultural Policy (CAP) promotes Cyprus towards sustainable food production, sustainable agricultural management, and environmental and climate-friendly practices and methods. Water scarcity has always been a major challenge for Cyprus, one of the EU member states with the lowest per capita water availability.
A small island, Cyprus faces additional challenges compared to mainland countries and is more vulnerable to climate change. Cyprus has a semi-arid climate and has limited water resources that depend primarily on rainfall.

However, rainfall varies widely from region to region, is unevenly distributed, lacks water resources, is expensive to use, and drought is common. Climate change has already affected Cyprus in many ways. Cyprus seems to be suffering from water utilization efficiency. It comes from the Water Use Index, which is a measure of total freshwater consumption as a percentage of renewable freshwater resources.
In Cyprus, the Water Utilization Index (WEI) is 70.3% of the long-term average water availability (compared to the EU average of 84%), making Cyprus the last of the EU countries.

[28] Nicosia. (2021). REPUBLIC OF CYPRUS SECOND VOLUNTARY NATIONAL REVIEW Sustainable Development Goals (SDGs) REPUBLIC OF CYPRUS (Issue June).

DEVELOPMENT IN NUMBERS	VNR 2017	VNR 2020	2017-2020 Growth
SDG02 – ZERO HUNGER OVERALL IMPLEMENTATION LEVEL (%)	**55.43**	**53.88**	**-2.80%**
Obesity Rate - Obese: BMI ≥ 30 (% of population aged 18 or over)	14.5	14.7	1.4%
Government Support to Agricultural Research and Development (Euro per inhabitant)	7.0	6.6	-5.7%
Area Under Organic Farming (% of total utilised agricultural area)	3.7	5.0	33.9%
Gross Nutrient Balance on Agricultural Land – Nitrogen (kg per hectare utilised agricultural area)	194.3	194.0	-0.2%
Ammonia Emissions from Agriculture (kg per hectare utilised agricultural area)	59.5	51.3	-13.8%

Figure 3: Green shows an improvement of the indicator, while red shows a decline in progress. White colour shows a stable performance.
Source: Second voluntary national review of Sustainable development goals of Cyprus.

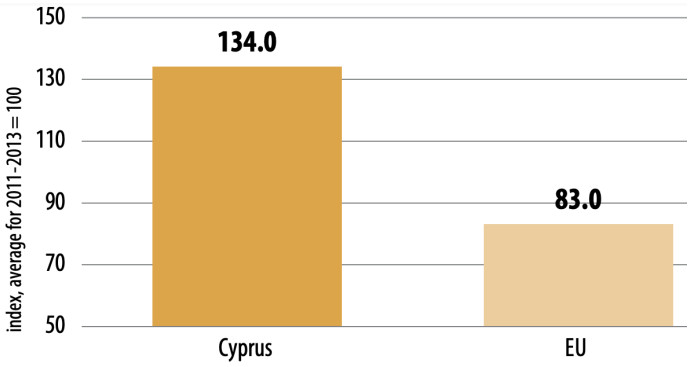


Figure 4: Harmonised risk indicator for pesticides, for all groups of active substances.
Source: Second voluntary national review of Sustainable development goals of Cyprus.

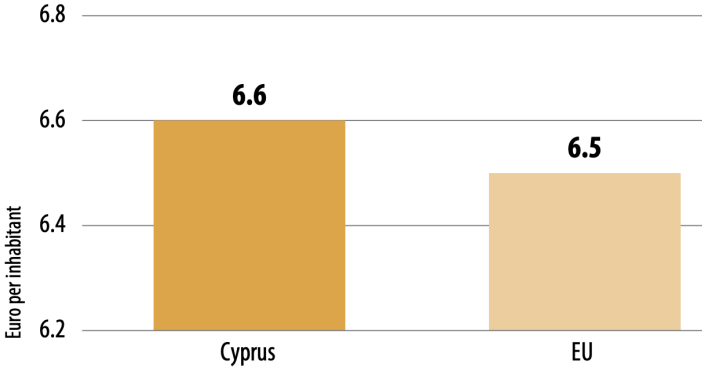


Figure 5: Government support to agricultural research and development.
Source: Second voluntary national review of Sustainable development goals of Cyprus.

Highlights – 2020

• Cyprus faces great challenges in the area of food security and nutrition, with the overall implementation of this SDG being one of the lowest in implementation, falling to 53.88% in 2020 from the already low 55.42% in 2017.
• Agricultural Production is severely affected by climate change.
• Intensive cultivation results in the substantial degradation of agricultural land.
• While adult obesity is consistent with EU levels, the overweight and obesity level among six to nine-year-olds is extremely high, with about 43 % of children falling in this category.
• Cyprus has one of the lowest per capita water volumes in the EU and is vulnerable to climate change caused by drought and water scarcity.
• Government initiatives aim to continuously improve the reliability of domestic and irrigation water sources.
• The use of non-traditional water resources, such as desalination plants and water reuse, is encouraged to solve problems and improve the reliability of domestic and irrigation water sources.

Covid-19 Response

• Hunger occurred due to a decrease in income and reduced food availability, especially among the self-employed.
• Poorer nutrition among children from vulnerable groups due to the interruption of the school meals Scheme.
• Lower demand for food due to the disruption of the tourist sector activities.

Looking Ahead

• Substantial investments have been included in the RRP and the Agricultural Plan aiming to improve the uniqueness and competitiveness of the primary sector, and improving the yield, efficiency and profitability of the sector.
• Efforts are being made to modernise and expand the infrastructure supporting the agriculture, farming, horticulture, and aquaculture of Cyprus.
• Additional efforts to reduce agricultural contribution to greenhouse gas emissions through the development of innovative practices and an efficient monitoring system.
• Climate change exacerbates the need for countries to improve water management processes.
• Major projects are underway: two domestic water projects, two recycled water projects and three master plans or subsequent extractions for irrigation use as a sustainable resource for irrigation and aquiferrecharge to control seawater intrusion.
• The Government has prepared a national plan to introduce healthy eating courses for school-aged children.
• Cyprus is currently updating its "Strategy for the sustainable development of rural communities and municipalities" in an effort to assess the needs and challenges of rural communities, and identify their assets and potential for development including agrotourism activities.

Cypriot agricultural sector keypoints

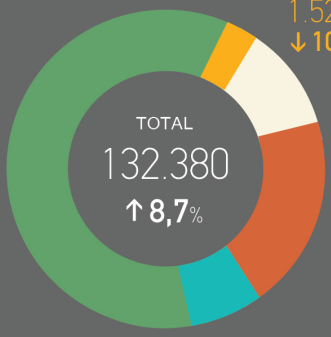
• 2% to Gross Domestic Product.
• 4% of labor force.
• Area: 2.79 (1000 ha).
• Agricultural holdings: 4.28 (1000 holdings).
• Product value at base price: 84.3 million euros.
• Fruit consumption (at least once a day) 58.4%.
• Vegetable consumption (at least once a day) 51.2%.
• Main crops: potatoes, citrus fruits, vegetables and grapes.
• Main structural problems: small and fragmented farm holdings.
• High input costs.
• Ageing for rural population.
• Land degradation and water scarcity.
• Marketing problems.

[28] Nicosia. (2021). REPUBLIC OF CYPRUS SECOND VOLUNTARY NATIONAL REVIEW Sustainable Development Goals (SDGs) REPUBLIC OF CYPRUS (Issue June).

AGRICULTURE-LIVESTOCK 2018

UTILIZED AGRICULTURAL AREA BY CATEGORY

(hectares, % change 2018/2017)



PERMANENT GRASSLAND AND PASTURES
1.522
↓10,2%

FALLOW LAND
16.665
↓4,5%

FRUITS AND TREE CROPS
26.290
↑3,3%

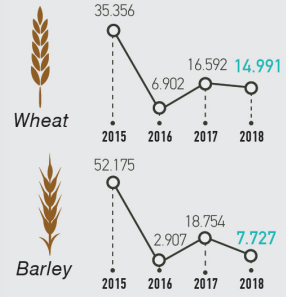
FIELD CROPS
80.765
↑14,9%

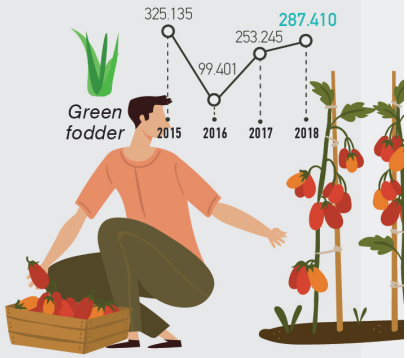
VEGETABLES AND MELONS
7.138
↑3,7%

PRODUCTION OF MAIN AGRICULTURAL PRODUCTS

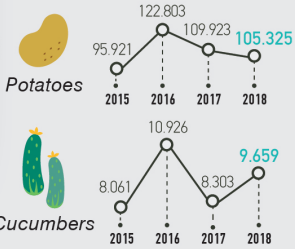
(tons)

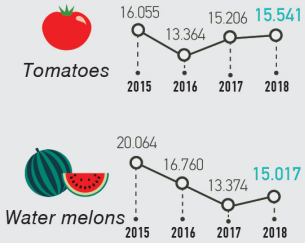
FIELD CROPS



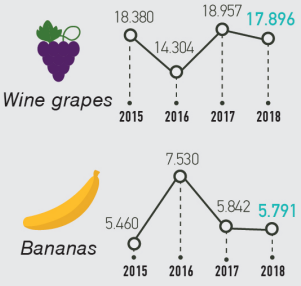


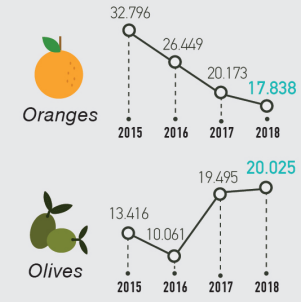
VEGETABLES AND MELONS





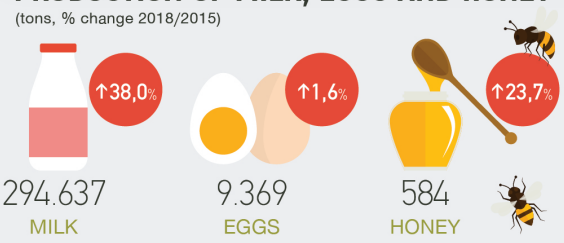
FRUITS AND TREE CROPS

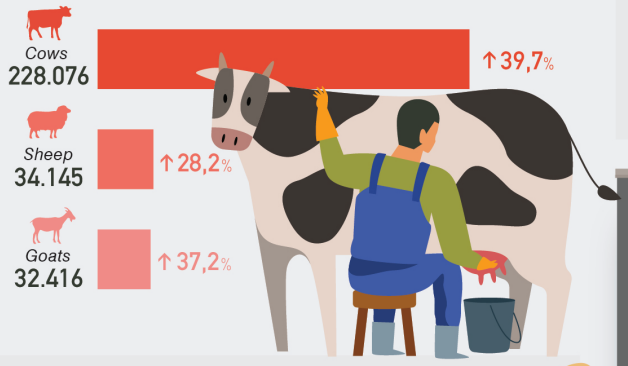




PRODUCTION OF MILK, EGGS AND HONEY

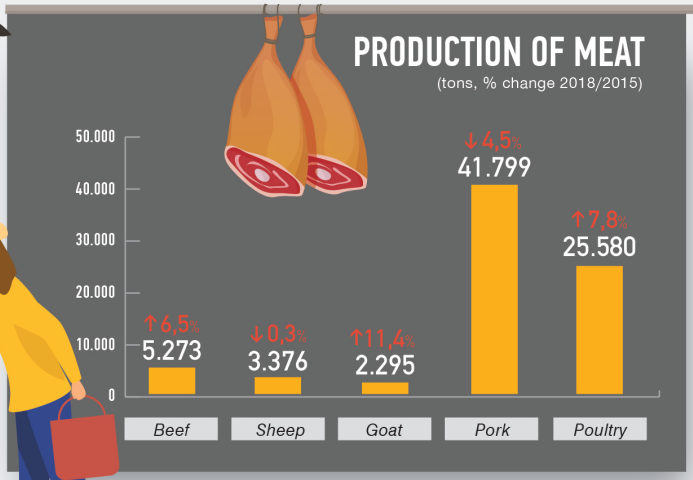
(tons, % change 2018/2015)





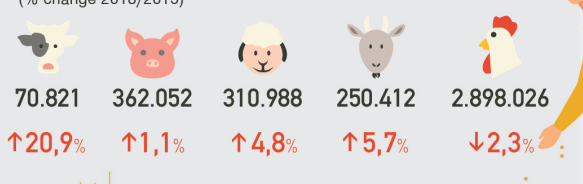
PRODUCTION OF MEAT

(tons, % change 2018/2015)



NUMBER OF ANIMALS BY TYPE

(% change 2018/2015)



ΣΥΣΤΑΤ
STATISTICAL SERVICE OF CYPRUS

24 September 2020

Source: Agricultural Statistics – Main Results, 2018

SUMMERCLIFF

3.10 State of the art of the sector in Cyprus

Main numbers

In Cyprus the total number of farms declined between 2005 and 2016 from about 45 200 to 34 900 farms. The average farm size remained between 3 and 4 hectares in the same time period. The agricultural area declined in the same time period from 166 000 hectares in 2005 to 112 000 hectares in 2016. Arable land declined by 32% between 2005 and 2016, permanent crops declined by 37%. The number of livestock in Cyprus decreased from 243,900 in 2005 to 172,000 in 2016. The livestock density (calculated as total number of livestock units/total utilised agricultural area) increased from 1.47 in 2005 to 1.53 in 2016.

Reducing income disparities

In Cyprus, the agricultural income per worker is on average about 61% of the average wage in the whole economy between 2005 and 2018. This share ranges from 52% in 2006 to 78% in 2018, and is above the EU-average. At EU level, the gap between the agricultural income per worker and the average wage in the economy seems to be closing over time. The same trend is visible in Cyprus. Close over time. The same trend is observed in Cyprus. The convergence is due to increased agricultural income in Cyprus (see Figure 9).

Supporting viable farm income

The income per worker is above average for granivores (not reported as there are too few farms in FADN - Farm Accountancy Data Network), however, there are only 50 specialist pig farms in Cyprus, producing 16% of the total SO in Cyprus (EUROSTAT, 2013). Income is around average for mixed crops, other field crops and sheep and goat farms. Income per worker is on average lower for farmers with permanent crops (olives, orchards, combined). About 60% of all farms in Cyprus produce olives, (citrus) fruits or has permanent crops combined. Cyprus uses 8% of their direct payment envelope to provide coupled support to sheep and goat (meat and milk) and citrus plantations in buffer zones (see Figure 10). Income per worker increases with farm size in Cyprus. In addition, the share of direct payments in income increases with farm sizes of up to 30 hectares. 85% of Cyprus farmers have less than 5 hectares[29].

Increase farm productivity

Total factor productivity (TFP) increased in Cyprus between 2005 and 2016. Productivity of land, labor and capital decreased between 2005 and 2014, while productivity of intermediate consumption (not shown in Figure 10) increased significantly. The return on assets is the return on investment. Land productivity reflects changes in yield and rent. The increase in labor productivity from 2014 to 2015 is mainly attributable to a decrease in the agricultural labor force, that is, a 23% decrease from 2005 to 2017[30].

[29] Analytical factsheet for Cyprus: Nine objectives for a future Common Agricultural Policy, version: September 2019, European Commission

[30] Analytical factsheet for Cyprus: Nine objectives for a future Common Agricultural Policy, version: September 2019, European Commission

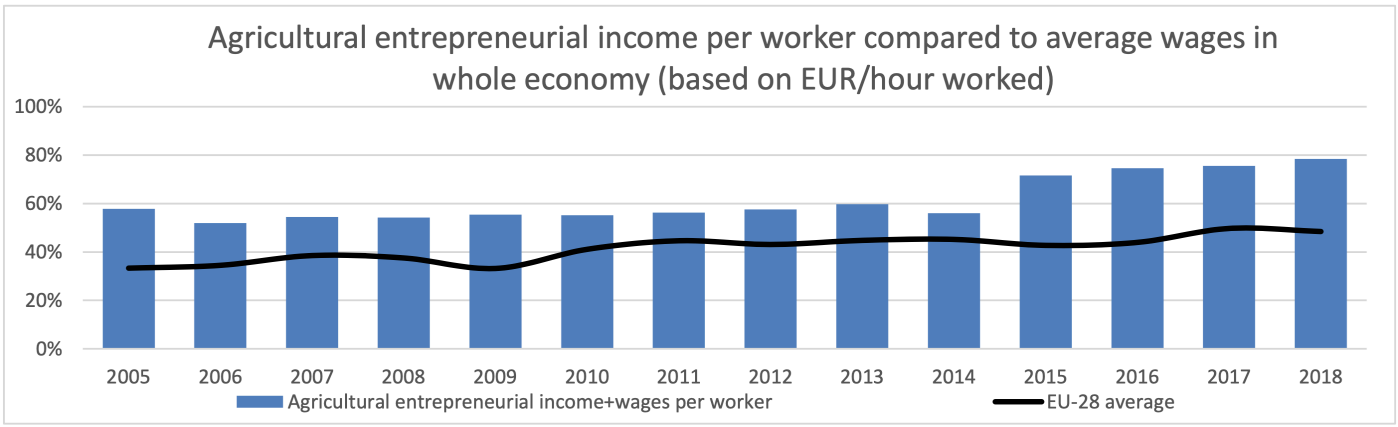


Figure 9: Evolution of agricultural income compared to general economy. Source: DG AGRI - EUROSTAT

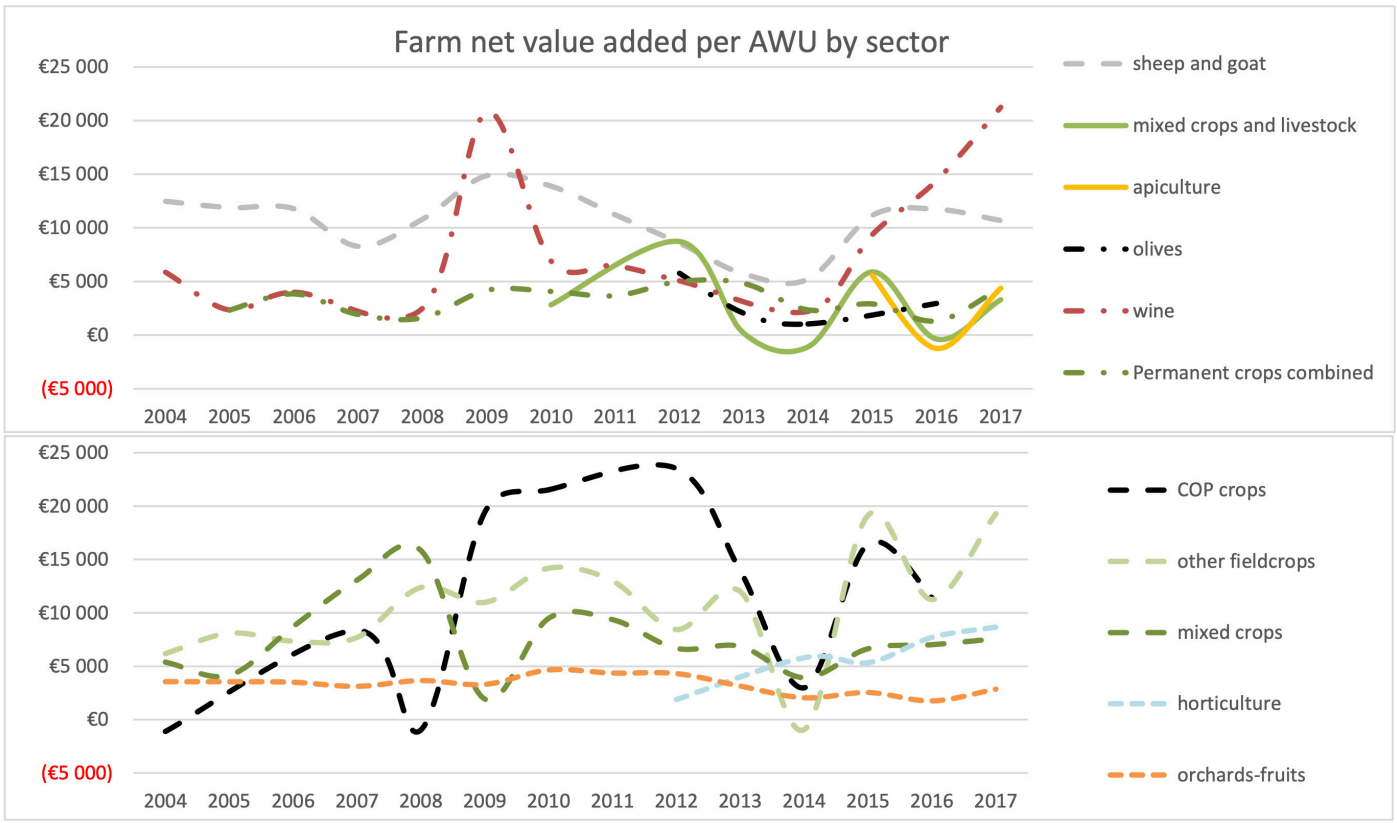


Figure 10: Evolution of agricultural income level by sector (AWU, Annual working unit). Source: DG AGRI - EUROSTAT

Harness Agri-food trade

As shown in Figure 11, Cyprus' agricultural and food trade balance was negative from 2008 to 2017. The main export products are cheese (47.7% of 2018 sales), vegetables (14.1%) and fruit juices (10.3%). Grains and cakes are the main products imported by Cyprus from non-EU countries.

Improving the farmers' position in the value chain

The share of the value added in the food chain for primary producers, represented in Figure 12, increased in Cyprus from 19.3% in 2008 to 21.8% in 2013, before it declined to 19.8% in 2016.
The share to primary producers in Cyprus is below the EU- average. Despite the downward trend in the total value added in the food chain in Cyprus as of 2012, the total value added for food and beverage distribution increased a little over time. The share and total value added for food and beverage manufacturing decreased between 2009 and 2016.

Agricultural output per sector

Pie chart of figure. 13 provides an overview of the importance of different sectors based on output in terms of value. Dairy products (26%), pork (12%), vegetables and horticulture (11%) are the main products produced in Cyprus, followed by poultry (9.4%) and fruits (8.8%). According to Eurostat data for 2013, around 50 specialized pig farms (0.14% of all Cyprus farms) produce 16% of the total standard production. About 180 specialty dairy farms (0.5%) also produce 16% of the total standard production.

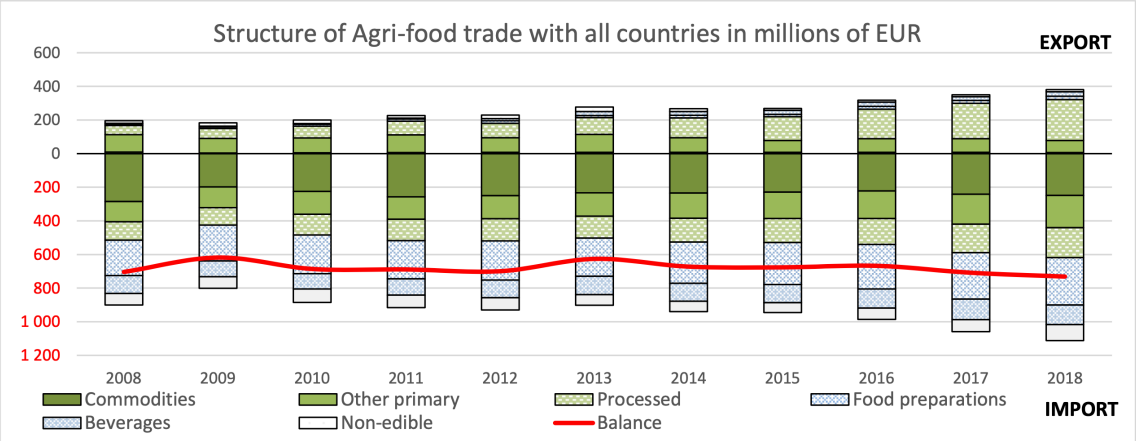


Figure 11: Agri-food trade imports and exports. Source: COMEXT

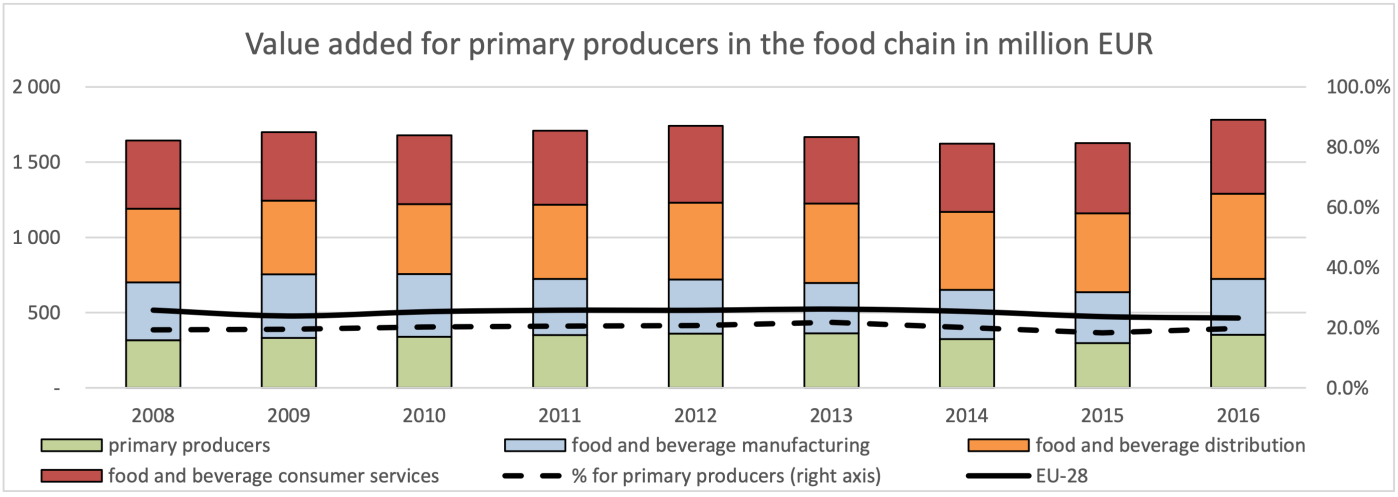
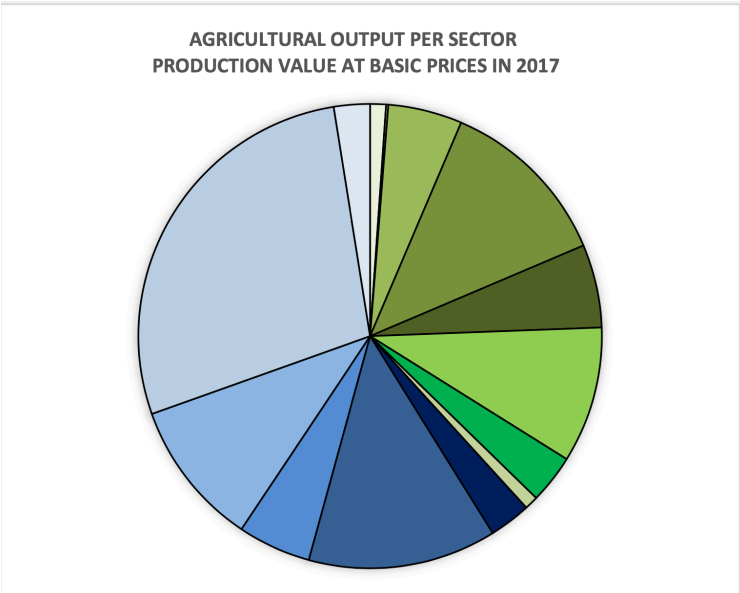


Figure 12: Value added for primary producers in the food chain. Source: EUROSTAT



PRODUCTS	% in MS	% of EU-28
Crop output, of which:	**39.2%**	0.1%
Cereals (including seeds)	1.0%	0.0%
Industrial crops	0.1%	0.0%
Forage plants	4.8%	0.1%
Vegetables & horticulture	11.3%	0.1%
Potatoes (including seeds)	5.4%	0.3%
Fruits	8.8%	0.2%
Wine	3.2%	0.1%
Olive oil	0.9%	0.1%
Animal output, of which:	**60.8%**	0.2%
Cattle	2.7%	0.1%
Pigs	12.2%	0.2%
Sheep and goats	4.7%	0.6%
Poultry	9.4%	0.3%
Milk	25.9%	0.3%
Eggs	2.3%	0.2%

Figure 13: Agricultural output per sector. Source: EUROSTAT

Attracting young farmers

Under the CAP, under 40 is considered a young farmer, but before 2013 Eurostat divided the age category into 35 years. Cyprus has the lowest percentage of young farmers in the EU's total number of farm managers in 2016 (1.3%). Like the EU, the proportion of young farmers in Cyprus decreased between 2010 and 2016. Additionally, the proportion of young and older managers decreased in Cyprus between 2005 and 2016, and was the lowest in the EU in 2016 (see Figure 14). Furthermore, out of the total number of farm managers below 35 years in 2016, 11% is female. This ranks Cyprus in the bottom 6 in the EU.

Figure 15 shows the share of farm managers below 35 years of age with at least a basic level of agricultural training (24%) and this is slightly lower than the share of total farm managers in Cyprus (28%) in 2016. The share of 'young' farm managers with at least a basic agricultural training in Cyprus is above the EU average. The average economic size of Cyprus farms is highest among the 25 - 44 age group.
Therefore, most farmers have limited education and adhere to the traditional practice of learning from their parents and passing it on to their children. The Ministry of Agriculture and Forestry is doing its best to educate young farmers by hiring young farmers.
They also report the largest growth in standard output over time (see Figure 16).
Many young people are leaving farms, but those who remain tend to work closely with their parents.
So that the majority of farmers have limited education, and stuck to traditional practices which they learned from their parents, and which they are passing on to their children. The agriculture ministry is doing its best to recruit young farmers, and to train them in the ways of Smart Agriculture. The institute is in near contact with Horizon, and the opposite EU studies programmes which might be engaged in modern-day paintings for agriculture. So there's no lack of information in Cyprus; it`s the know-how switch this is the issue. The ministry has had a few fulfillment in making that switch. Sources near the ministry factor out that they have got had ninety in step with cent fulfillment amongst Cyprus farmers with pressurised water era to manipulate water use in irrigation.
The method saves massive quantities of water. But, even wherein younger humans may be skilled withinside the use of Smart Agriculture, while they are attempting to persuade their households of its use, they run into horrible resistance. Farmers, with confined education, are scared of attempting new things.

Stakeholders' involvement

High Nature Value (HNVf) cropland systems in Europe are recognized for their importance for biodiversity conservation and their extent is one of the impact indicators in the CAP Monitoring and Evaluation Framework for the 2014-2014.2020 cycle. Due to differences in agricultural typologies and the availability of data between countries, there is no common method for identifying HNVf, nor is it considered adequate.
Fourteen organisations represented the major stakeholders in land management in Cyprus, i.e. Government, NGOs, Universities and farmers' associations. Amog them we can mention: Departments of Environment, Agriculture, Forests, Water Development, the Game and Wildlife Service, Birdlife Cyprus, Terra Cypria, Cyprus Federation of Environmental and Ecological Organisations, Management Authority for the Cyprus Rural Development Programme, Cyprus Agricultural Payments Organisation - CAPO, Cyprus University of Technology - Department of Agricultural Sciences, Open University of Cyprus - Terrestrial Ecosystem Management Lab (www.cyprusprofile.com). In Cyprus, 43% of the total public 2007–2013 RDP expenditure of 282 million Euros was paid for agri-environmental commitments. However, most of the funding allocated did not target biodiversity conservation directly and included measures on financial support for certification schemes, such as GlobalCAP, in intensive citrus crops and potatoes. A measure specifically targeting HNVf conservation was included in the 2014– 2020 RDP after the mid-term evaluation of 2017, just after the adoption of the current HNVf map.
This measure targets cereals and tree crops: olive, carob and hazelnut.
The high percentage of HNVfs in Cyprus may be good news for conservationists but disquieting for farmers unless they are somehow convinced that HNVfs have real benefit for them [16].

[31] Cyprus Mail, article "Farming faces a critical phase of adaption to technology", by Andrew Rosenbaum, August 1, 2021
[32] Chapter 10 Use of IoT technologies for irrigation and plant protection the case for Cypriot fruits and vegetables; Book: Bio-Economy and Agri-production; Author: Theocharis Moysiadis, George Adamides, Andreas Stylianou, Nikolaos Zotos,Marianthi Giannakopoulou-George Alexiou; Publisher: Elsevier;Date: 2021

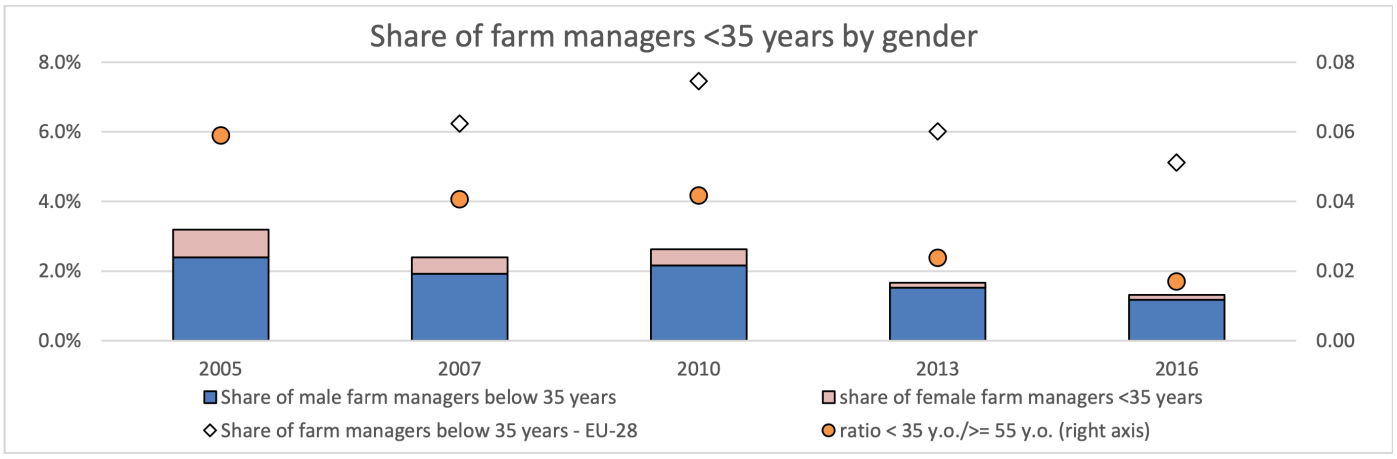


Figure 14: Age structure of farm managers by gender. Source: EUROSTAT

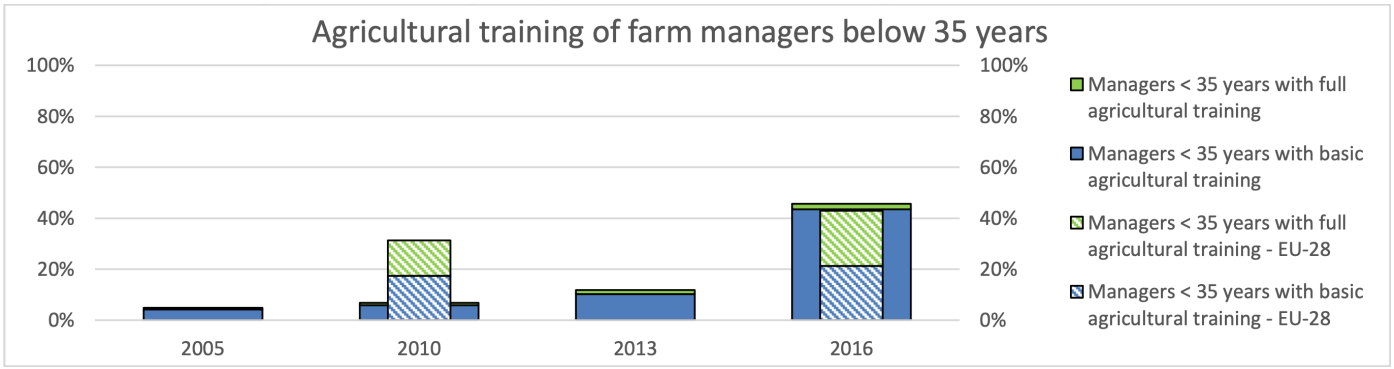


Figure 15: Agricultural training of farm managers. Source: DG AGRI - EUROSTAT

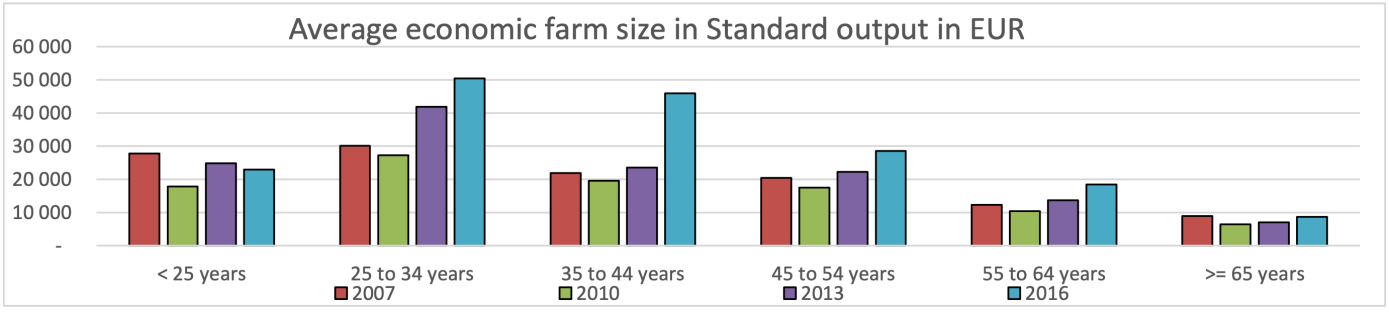


Figure 16: Economic farm size by age class. Source: DG AGRI - EUROSTAT

Rural Development

The agricultural food sector on the border between Greece and Cyprus is characterized by many unique economic, environmental, cultural and social elements that, by making effective use of them, can transform it into one of the most dynamic sectors of economy. Local products are seen as an integral part of the local development strategy as they contribute to the adoption of the region's unique identity by associating the product with the local culture and thereby preserving the local "agricultural heritage". The regional economic structure of the North Aegean region and Cyprus is dominated by the agrifood sector, a sector that traditionally has low internal R&D costs and limited operational use of scientific tools and findings. Most SMEs are very small and serve as a continuation of the family tradition. The most important issue is related to it, but a significant proportion (40%) reach markets outside the region. The operation of SMS is characterized by the good luck of working with other companies and research centers, but cooperation and networking activities will have a positive impact on the market position. Thus, there is a missing link between research and the introduction of innovations at operational level [33].
Rural Development in Cyprus is managed nationally through one Rural Development Programme (RDP), funded under the European Agricultural Fund for Rural Development (EAFRD) and national contributions (see Figure 17). The RDP sets out priority approaches and actions to meet the needs of the specific geographical area it covers; the strategy for Cyprus is shown in Figure 18.

Cypriot Local Action Groups (LAGs)

Funding for rural development through the EAFRD is part of a broader framework of European Structural and Investment Funds(ESI Funds), which also includes regional development, social, cohesion and fisheries funds. These are managed at national level by each EU Member State on the basis of association agreements and strategic plans that outline the country's goals and investment priorities. LEADER (EU project), meaning 'Links between the rural economy and development actions', is a local development method which has been used for 30 years to engage local actors in the design and delivery of strategies, decision-making and resource allocation for the development of their rural areas. It is implemented by around 2800 Local Action Groups (LAGs) across Europe, covering 61% of the EU rural population, bringing together public, private and civil society actors in a given area (as of end 2018 EU28).

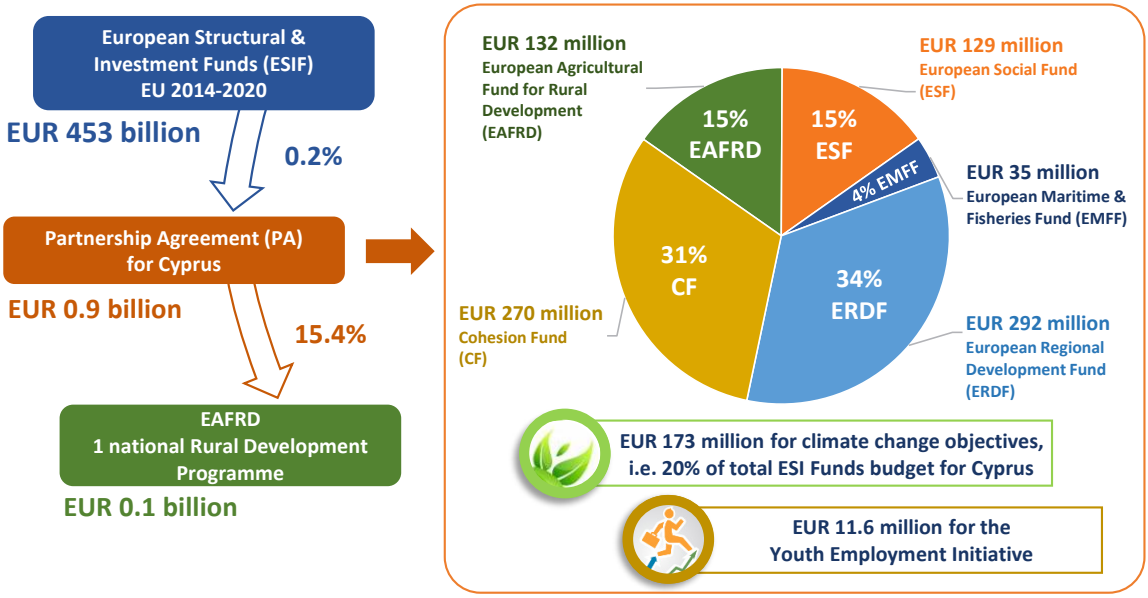


Figure 17: Partnership Agreement 2014-2020: Key facts & figures, Cyprus. Source: The European Network for Rural Development. Source: enrd.ec.europa.eu

[33] Agri-innovation and authenticity of local products: identifying challenges and opportunities for smss using a bottom up approach, Conference: 13th Chemistry Conference of Cyprus-GreeceAt: University of Cyprus, Nicosia, Cyprus.
[34] European Network for Rural Development (https://enrd.ec.europa.eu/leader-clld/lag-database/_en)

In the context of rural development, LEADER is implemented within the national and regional Rural Development Programs (RDPs) of each EU Member State, co-financed by the European Agricultural Fund for Rural Development (EAFRD). Four are the Cypriot Local Action Groups (LAGs) funded by the European Agricultural Fund for Rural Development (EAFRD) under the Rural Development Programme:
- Larnaca & Famagusta District Development Agency Ltd.
- Development Agency of Lemesos Ltd.
- Troodos Development Company Ltd.
- Development Agency of Paphos "Aphrodite" Ltd [34].

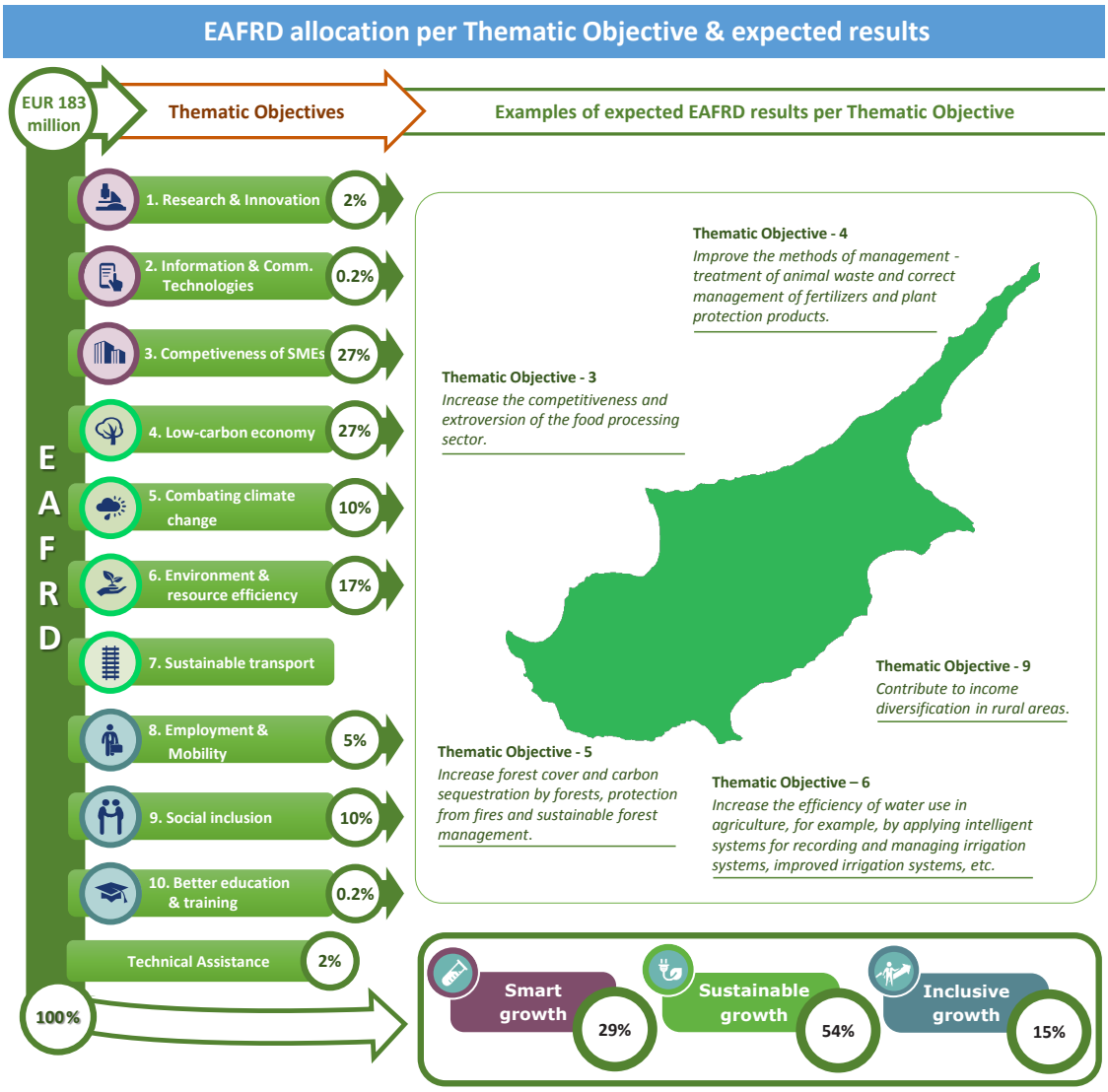
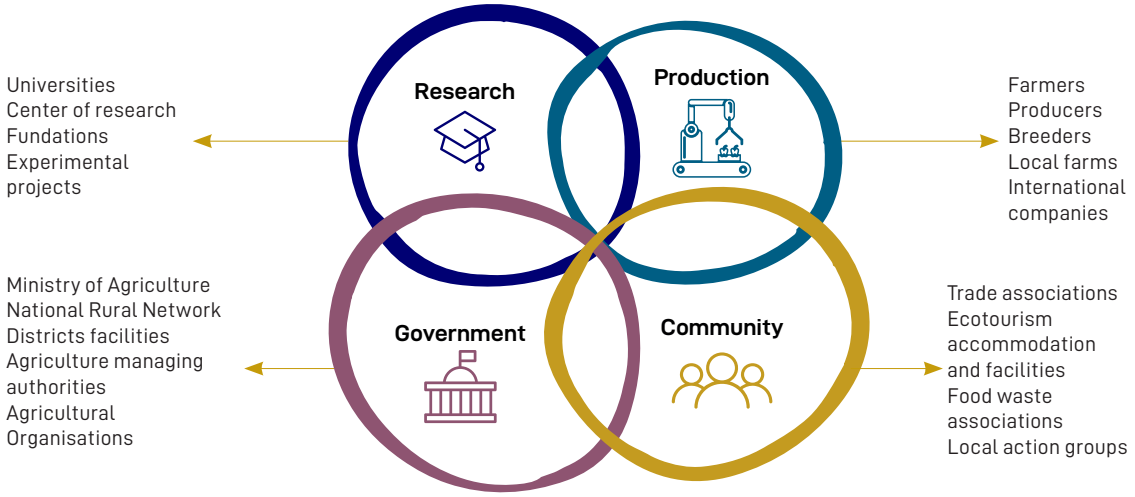


Figure 18: Partnership Agreement 2014-2020: Key facts & figures, Cyprus. Source: The European Network for Rural Development. Source: enrd.ec.europa.eu

3.11 Agri-food sector stakeholders

The Cypriot agri-food stakeholders involvement and presence on the territory has been categorized according to a quadruple helix, representing four main typology of actors: research, production, government and community. Thus allowed us to map the main realities that are already fostering a greener sector.
Each player has been investigated, located in the territorial map and characterized by its useful features important for a greener system (www.learnaboutcap.com).



3.12 Local players for a sustainable sector

Cypriot ENRD Projects & Practice
The European Network for Rural Development (ENRD) serves as a hub for exchange of information on how Rural Development policy, programmes, projects and other initiatives are working in practice and how they can be improved to achieve more. The ENRD is not a membership organisation. Its work aims to engage and reach anyone with an interest in and commitment to rural development in Europe. Cyprus Rural Network (NRN) wants to highlight the benefits of networking for rural stakeholders; its main objectives are to increase participation, improve the quality of the rural development policy and increase awareness on the programme opportunities. In the next page are listed the three projects carried out in Cyprus under the ENRD programme during the period of time 2014-2020.

Projects funded through the Common Agricultural Policy (CAP)
The Rural Development Programme (RDP) is one of the pillars of the Common Agricultural Policy.
It includes a series of measures aimed at enhancing the competitiveness of agriculture, ensuring the sustainable management of natural resources and the development of Europe's rural areas, including job creation measures.
The program is aimed at a wide range of beneficiaries, such as farmers, companies, individuals, local authorities, ministries and other interested parties (www.learnaboutcap.com). In Cyprus, between 2007-2013 and 2014-2020, some of the projects co-funded by the rural development program were co-funded.

Cyprus and the New Cap
Cyprus has the lowest share of young farmers in the European Union with a percentage not exceeding 1.5% of the total number of people employed in agriculture (www.learnaboutcap.com). The New CAP will goal on the renewal of generations in agriculture assisting younger farmers creating a good working environment and good living conditions in rural areas.

Cyprus has the maximum income of veterinary antibiotics withinside the complete European Union. The New CAP will assist all Member States withinside the combat towards antibiotics, aiming at secure and pleasant meals via the adoption of practices that admire the surroundings, appropriate fitness and animal welfare. Cyprus produces nearly two times as a lot greenhouse fueloline emissions because the European average, in spite of the development made over the past decades. The New CAP targets to mitigate weather alternate via the use of latest technology and appropriate agricultural practices, the discount of waste of agricultural merchandise and using renewable power sources.

1 Upgrading the facilities of a camp site in Cyprus

Location: 'Polycarpos Vlachos' camp site, Troodos National Forest Park (Limassol District)

Keywords: Forestry, Protected areas, Tourism, Youth

Website: http://www.osgdel.com

Brief description
A camp site used Rural Development Programme (RDP) support to increase its capacity to accommodate visitors and upgrade its infrastructure and improving accessibility.

2 Aeroponics Mediterranean Ltd. – 'Planty'

Location: Planty Facilities, Psematismenos, Larnaca

Keywords: Agriculture, Entrepreneurship, Innovation, Market development, Product quality, Sustainability

Website: http://www.planty.eu

Brief description
'Planty' have built a state-of-the-art greenhouse, that uses environmentally friendly techniques and covers the complete production cycle from seed to market.

3 Zacharias Symeou Sheep Farm

Location: Aradippou Municipality, District of Larnaca

Keywords: Animal husbandry, Farm restructuring/ modernisation, Job creation, Organic farming, Product quality, Renewable energy

Contact: sugarsymeou@gmail.com

Brief description
A family farm used investment support to set up a state-of-the-art sheep farm for the production of high-quality sheep milk.

4 HerbanLeaf Farms Ltd.

Location: Parekklisia, District of Limassol

Keywords: Agriculture, Entrepreneurship, Innovation, Market development, Product quality, Sustainability

Contact: https://www.herbanleaffarms.com

Brief description
HerbanLeaf offers clean, premium grown leafy greens and herbs grown inside a controlled hydroponic farm. All grown without the use of soil, GMO, pesticides & herbicides. HerbanLeaf Farms Ltd. is a sustainable hydroponics farming company that produces fresh produce for the hospitality and retail industry.

Source: https://enrd.ec.europa.eu/projects-practice_en

Business Support

Riverland Bio Farm
Riverland Bio Farm is located in the village of Kambia and is a farm of organic farming, production of organic products and activities. The project has won the First Prize for Best Investment in the European Rural Development Programme 2007-2013.

Dymatou Estate
Dymatou Estate is located near the village of Dimes and includes lands with fruit trees, apple trees, gold mills, pears, quinces, raspberries and tomatoes. The fruits are processed into excellent products found on the market.

Dodoni Agricultural Dairy Industry
Dodoni Dairy has a state-of-the-art Halloumi and Anari cheese production plant in Limassol. The new Cyprus factory produces authentic Cypriot cheeses that are available both in the Cypriot market and in foreign countries.

Source: https://www.learnaboutcap.com/kapcyprusENG.html

Rural Development

Athienou Youth Centre
Athienou Youth Centre was created to address the need for adequate infrastructure to accommodate young people's creative work activities in Athienou.

Dali Municipal Amphitheatre
Dali Municipal Amphitheatre was completed in 2015. The study and design of the amphitheatre was done with respect to the morphology and character of the space. The amphitheatre hosts many cultural events catering to the needs of the wider area.

Nature Trail & Excursion Area in Kato Milos
The nature study trail and the excursion site in Kato Milos village were designed to contribute to the wider rural tourism development of the area by taking advantage of the natural environment.

Source: https://www.learnaboutcap.com/kapcyprusENG.html

Environment and climate change

Biogas Production Andreou & Kosti Farm
The production of biogas by anaerobic fermentation is environmentally friendly as it produces energy instead of consuming energy. The farm has sewage treatment plants with biogas, electricity and thermal energy production.
80% of the electricity produced is surplus and available to the EAC Network as green energy.

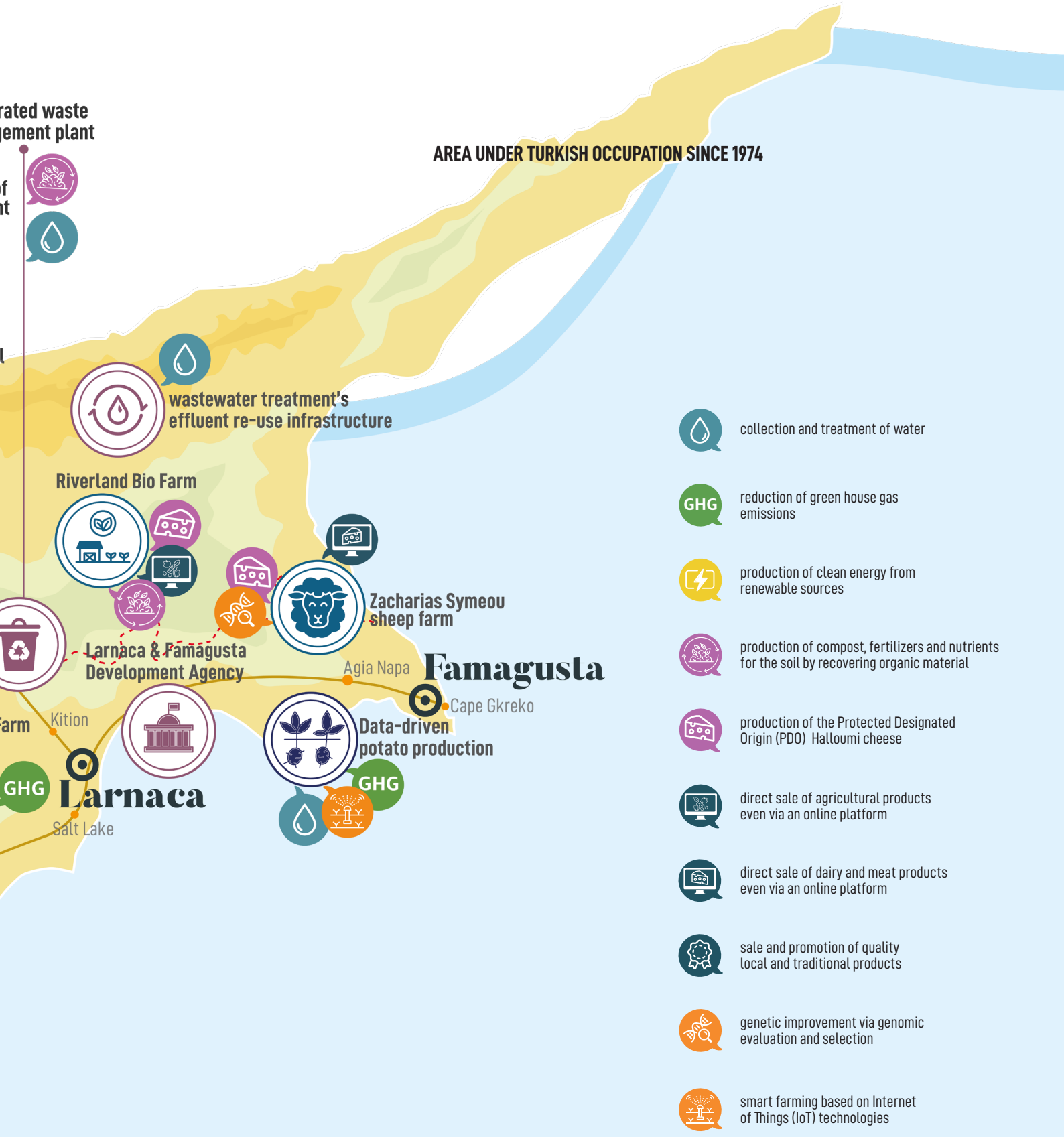
Greenhouse Cultivation with NFT Aeroponics Mediterranean
With this innovative method of greenhouse cultivation, plants are grown outside the natural soil either on inert substrates or in nutrient solutions (NFT). This method achieves significant water savings and contributes to improving food quality and safety and protecting the environment.

Use of recycled water in agriculture Water Development Department
The project was created to utilize recycled water in agriculture by constructing a clay tank for the storage of excess recycled water from the sewage treatment plant in Anthoupolis and the establishment of a primary and secondary distribution network.

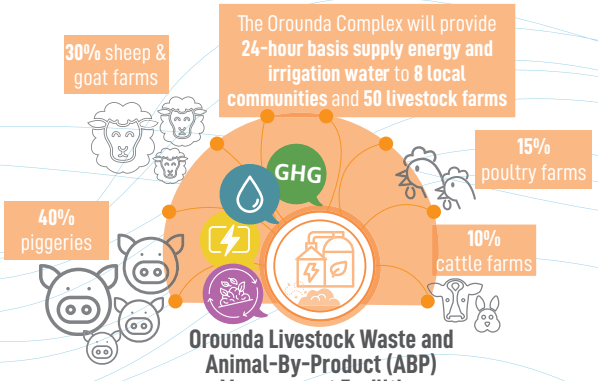
Source: https://www.learnaboutcap.com/kapcyprusENG.html

Cypriot players for a sustainable agri-food sector

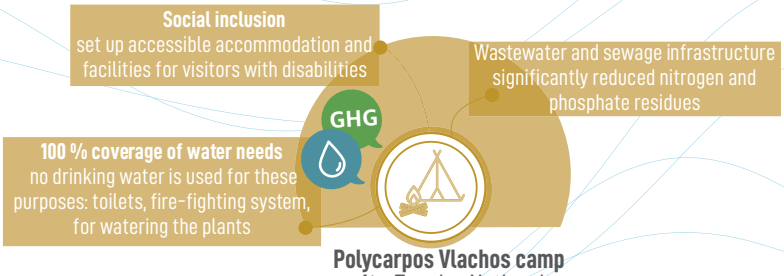
Research, Production, Government, Community


rated waste
gement plant
AREA UNDER TURKISH OCCUPATION SINCE 1974
wastewater treatment's
effluent re-use infrastructure
Riverland Bio Farm
Zacharias Symeou
sheep farm
Larnaca & Famagusta
Development Agency
Agia Napa
Famagusta
Cape Gkreko
Kition
Data-driven
potato production
GHG
GHG
Larnaca
Salt Lake
collection and treatment of water
reduction of green house gas
emissions
production of clean energy from
renewable sources
production of compost, fertilizers and nutrients
for the soil by recovering organic material
production of the Protected Designated
Origin (PDO) Halloumi cheese
direct sale of agricultural products
even via an online platform
direct sale of dairy and meat products
even via an online platform
sale and promotion of quality
local and traditional products
genetic improvement via genomic
evaluation and selection
smart farming based on Internet
of Things (IoT) technologies

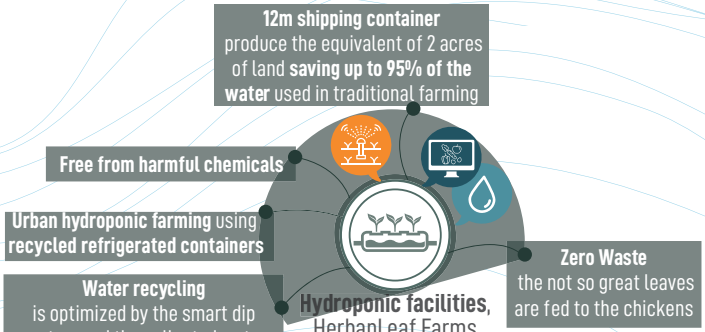
Cypriot players for a sustainable agri-food sector



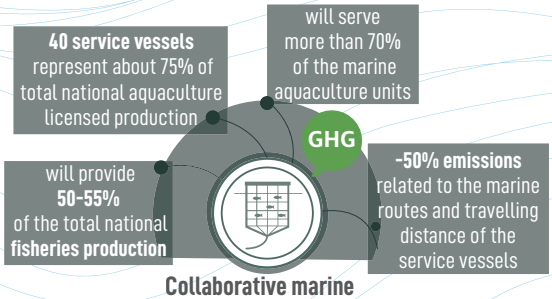
Orounda Livestock Waste and Animal-By-Product (ABP) Management Facilities



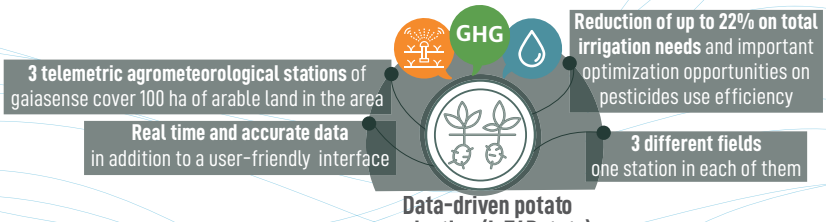
Polycarpos Vlachos camp site, Troodos National Forest Park



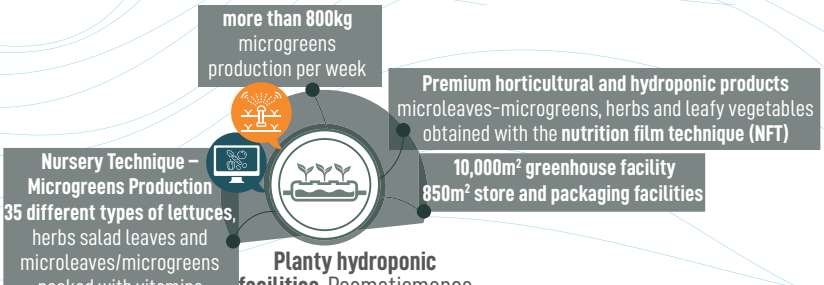
Hydroponic facilities, HerbanLeaf Farms Ltd., Parekklisia



Collaborative marine aquaculture infrastructure, Pentakomo coastal area



Data-driven potato production (IoT4Potato), Lipetri, EU project Internet of Food and Farm 2020 (IoF2020)



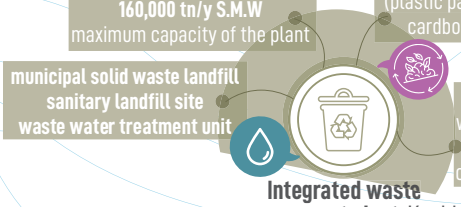
Planty hydroponic facilities, Psematismenos

To divert at least **45% of the input waste into valuable products** (plastic packaging material, mixed paper and cardboard, glass, metals and compost)

160,000 tn/y S.M.W maximum capacity of the plant

municipal solid waste landfill
sanitary landfill site
waste water treatment unit

10 bioreactors with a capacity of 270-300tn each for the production of compost from organic waste



Integrated waste management plant, Koshi

700 milk producing sheep to produce sheep milk to be used in the production of **Halloumi cheese** and other sheep milk products

Electronic monitoring system the sheep pens are fully equipped with the necessary drinking and feeding troughs, manure cleaning paths and ventilation

4 silo mixing mill to ensure animals are fed the highest quality of food

Artificial insemination with high quality sperm to improve the animals' genes

No food waste modern feeding belts has made sure that food is always available, reducing costs and increasing utilisation

High-quality sheep milk production, Zacharias Symeou sheep farm, Aradippou

0 disposal of treated wastewater full utilisation of treated effluent quantities produced from the Vathia Gonia WWTP

3 municipalities will benefit of irrigation water for new high efficiency crops (mainly livestock plants) and traditional agriculture

1.5mln m³ winter storage tank capacity

2,280,000 m³ total system capacity

Eastern Nicosia infrastructure for **wastewater treatment's effluent re-use**

High quality organic product higher quality fruits & vegetables, milk and bio eggs, goat and sheep products like **Halloumi cheese**, honey & herb

Fully organic greenhouse no pesticide residues, hormones, and antibiotics

Modern integrated organic farm animal and plant production

Organic Compost made in the farm is used to fertilize the fields

Organic farming, Riverland Bio Farm, Kampia

Recreational activities private events, farm tours, milking, organic breakfast, kids farm games, camping, pony riding, hiking, kayak, summer school, archery, wall climbing

1MWe and 1MWth plant capacity electrical and thermal energy

80% of produced electricity exported to the Grid as green energy

2 waste treatment plants biogas, electricity, heat generation

25000t feed mill yearly capacity

Smart piggeries farming, Andreou & Kosti Farm, Tersefanou

establishment of a **primary and secondary distribution network**

clay tank for the **storage of excess recycled water**

utilize recycled water in agriculture

Sewage treatment plant, Anthoupolis

3.13 Government initiatives

Research and development

According to the European Innovation Scoreboard, Cyprus has a fascinating research system with numerous international scientific co-publishings and foreign PhD students. The Cyprus government doubled expenditures in their 2019-2023 national strategy on research and Innovation [35].
The project named "Innovate Cyprus" then established a national council of Research and Innovation, and a deputy Ministry for Research Innovation and Digital Governance, providing funding of EUR 60 million.
Despite significant improvements, Cyprus remains poor in eco-innovation performance. The country has only scored 62 points in the 2018 rating (EU average = 100).

Eco-innovation

The country has only scored 62 points in the 2018 rating (EU average = 100). Cyprus eco-innovation is primarily created by a single party (research institutes and companies), with no clear and mature eco-innovation sector.
In Cyprus, the main hub for eco-innovation research consists of the local European Institute of Innovation and Technology (EIT) Climate Knowledge Innovation Community (KIC) Hub [36], hosted by the Cyprus University of Technology with the participation of the Cyprus Energy Agency and the Chrysalis Leap. The funding of their research in circularity of production and digitalisation amounted to EUR 400,000 of additional EIT funds (see Figure 7). Given the country's rich natural capital, new developments in renewable energies could also promote eco-innovation activities. Eco-innovation in the field of energy is also driven by efforts to increase energy efficiency; in fact, Cyprus is ranked first in solar DHW per capita. The agricultural food industry is also contributing to eco-innovative solutions in waste disposal olive oil production. The need for both more drinking water and more water for irrigation will result in a growing demand for additional seawater desalination plants and an emphasis on enhancing water-use efficiencies. These climate pressures placed on the society and the well-being of its population can be counteracted with a systemic transformation of production models, implementing core principles of a circular economy.

Circular economy

For Cyprus, circular economy is both a challenge and a solution as its island character can create difficulties but also give advantages. This increasing involvement in eco-innovation is due to the new position of Cyprus as a regional hub for climate change research. In June 2018, the government announced the creation of an initiative to coordinate action against global warming across the Mediterranean and support the creation of a EUR 30 million climate-change research centre at the Cyprus Institute in Nicosia , the nation's leading multidisciplinary research institution. This initiative will also create a comprehensive plan to reduce Cyprus's greenhouse-gas emission in line with the 2015 Paris climate accord. A major initiative was established following the 1st International Conference "Climate Change in the Mediterranean and the Middle East: Challenges & Solutions", organised by the Cyprus Institute in 2018 in Nicosia and attended by eminent scientists and policy makers from 30 countries as well as leaders of global stature.

Agriculture and biodiversity

The agricultural and food industries are also contributing to eco-innovative solutions: waste treatment in olive oil production; compost from recycled plants (lawn, garden waste, leaves, vine leaves, etc.); biological waste treatment (that turns biodegradable waste into either high-quality compost or Solid Recovered Fuel); advanced glasshouse for producing exotic flowers; organic and energy efficient production of wine and olive oil, etc. (EIO, 2016). The Life+ EU program also supports the protection of biodiversity with the establishment of plant reserves, protection of Natura 2000 sites and awareness-raising. Governmental measures are also put in place for the promotion of anaerobic digestion for the treatment of animal waste, thus aiming to reduce greenhouse gas emissions[37].

[35] National Board for Research and Innovation Republic of Cyprus (2019), Innovate Cyprus, available at: https://chiefscientist.gov.cy/wp-content/uploads/CYRI_STRATEGY_FRAMEWORK_2019V8-Pillars.pdf
[36] https://www.climate-kic.org/programmes/deep-demonstrations/resilient-net-zero-emissions-maritime-hubs/publications/
[37] Directorate General European Programmes, Coordination and Development, 2019, Europe 2020, Cyprus National reform Programme 2019. Available at https://ec.europa.eu/info/sites/info/files/2019-european-semester-national-reform-programme- cyprus-en.pdf

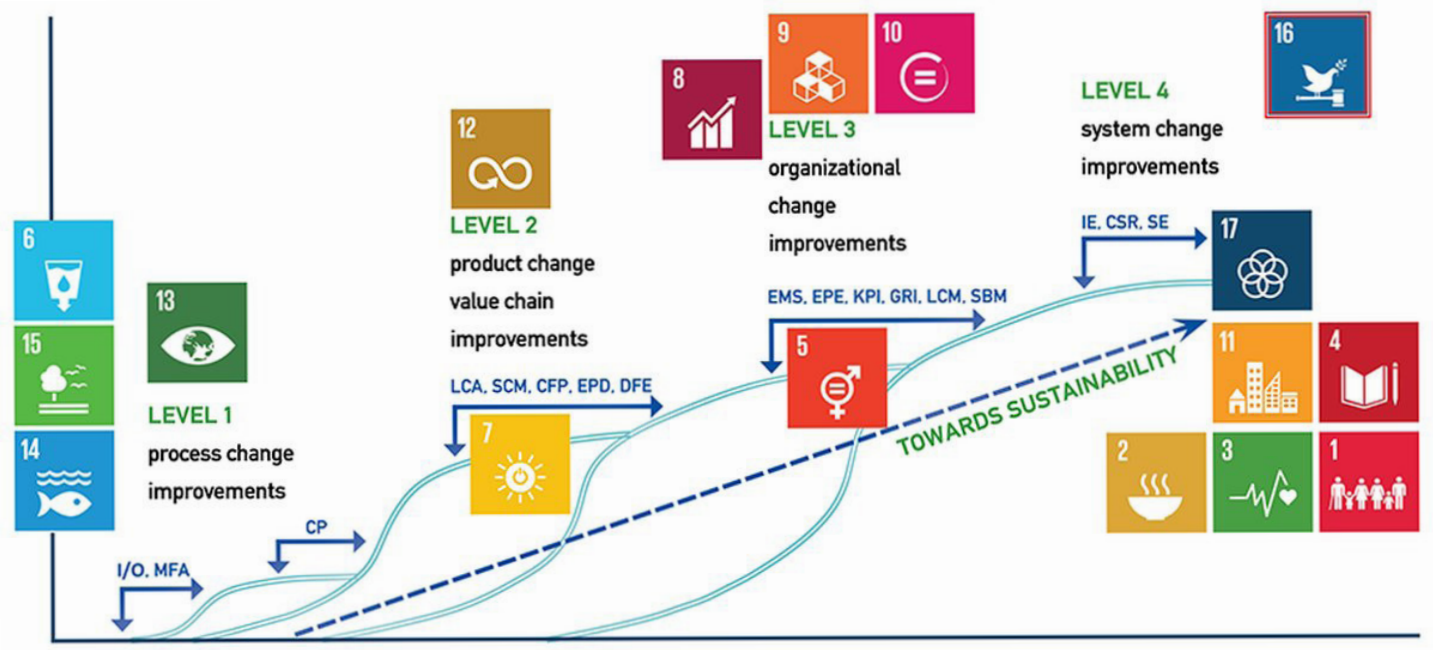


Figure 6: Mapping the SDGs on the CapSEM-model. Source: Fet and Knudson, 2020.

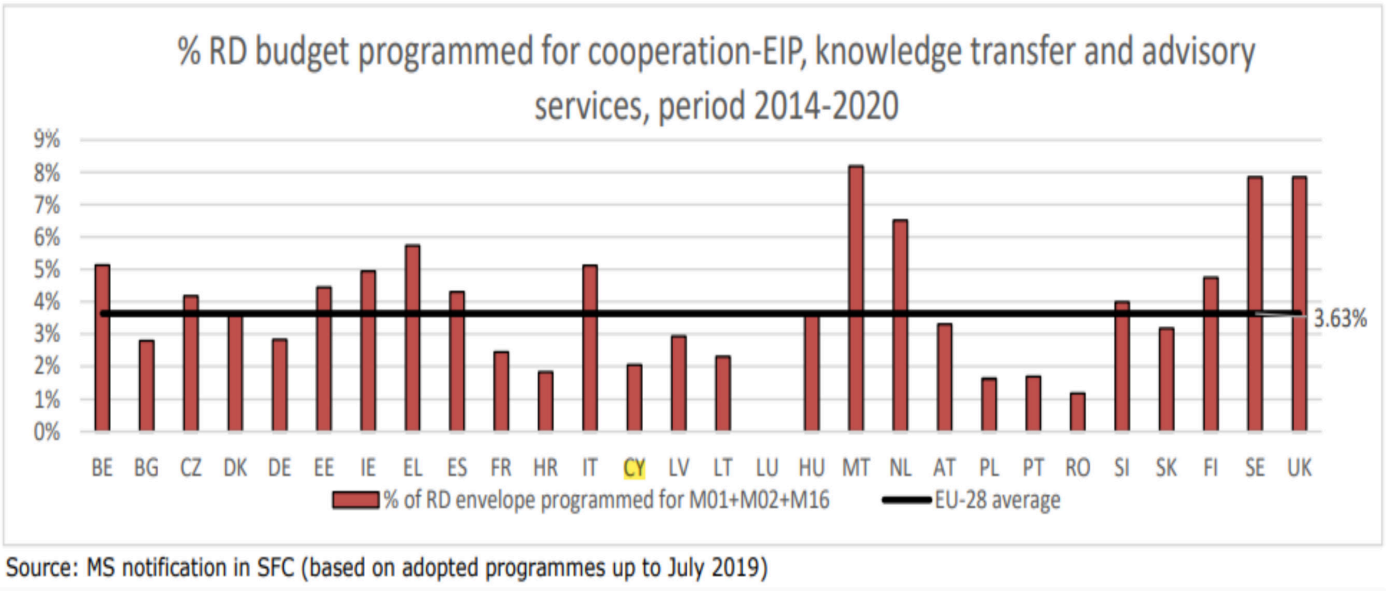


Figure 7: European knowledge transfer and information actions. Source: Newsletter – January 2021, Italian-Cypriot Chamber of Commerce.

Energy

Cyprus is one of the most vulnerable countries in the EU in terms of energy dependency, and security of energy supply. In fact, imported petroleum products currently contribute over 90 % of the island-nation's energy consumption (South EU Summit, 2019). Cyprus is the country with the highest potential for solar energy than any other country in the European Union, but it currently imports most of its energy demand. It currently has a 10% renewable energy share, with a target of 16 % by 2020. But according to the Cyprus Renewable Energy Roadmap, the island could generate around 25-40 % of its needed electricity supply by 2030 via renewable energy sources [38].

Common Agricultural Policy (CAP)

As a full member of the European Union (EU) since 2004, Cyprus will benefit directly from the cap, which provides significant support for farmers and contributions to rural development. The CAP directly supports the small farms in Cyprus (75% of the total number of farms of the island) that need the support of the EU to ensure a high standard of living of those employed. CAP also contributes to the improvement of living conditions in rural areas of our country through rural development measures, and industry reports focusing mainly on the traditional sector of Cyprus agriculture (wine, fruits, vegetables) by market protection measures.

• The provisions under the new CAP require an enhanced Green Architecture and the consideration of Farm to Fork Strategy of the EU.

• In the framework of the Strategic Plan for the new Common Agricultural Policy 40% of total funding will be geared towards climate and environmental goals. Green interventions support for the use of renewable energy, organic farming and the use of pesticides and antibiotics, among other things in the agricultural sector.

• Cyprus will address all 9 specific objectives of CAP including measures for investments to new practices and technology in order to increase productivity, investments for the use of renewable energy in agriculture, investments in reducing emissions from animal husbandry, investments in circular economy.

• Agricultural environmental measures under the second pillar and eco-scheme under the first pillar are presented to significantly reduce the slump in Cyprus in sustainable agriculture (eg, the need for pesticides). Promotion of practices to reduce, increased budget for organic farming, and significantly higher targets for sub-organic land, alternatives to chemical fertilizers, etc.).

• The total budget for the 5-year programme will be more than €450 million and aims to transform the primary sector of Cyprus.

Recovery and Resilience Plan

• Resilient and competitive primary sector reforms:

– Move agricultural practices from the 20th century to the 21st century by investing in a national centre for excellence in Agri-Tech.

– Online, cloud-based platform for improving the trade and information symmetry in the fresh produce upply chain.

– Genetic improvement of sheep and goat population of Cyprus.

• Investments:

– Improve the existing isotope database of local traditional food/drinks in Cyprus by developing a blockchain platform to secure its identity.

– Skill up existing agricultural communities and specialize future workforce through investment in human capital.

• Healthier children:

– Renovating and upgrading the Makarios Children Hospital in response to the need for a comprehensive suite of medical services for children which currently does not exist, including digitalisation of patients' personal dossiers.

[38] Eco-Innovation Observatory Country Profile 2018-2019: Cyprus, Author: Andreas Mitsios (Deloitte Développement Durable)

Cyprus rural context

Relatively old farmers

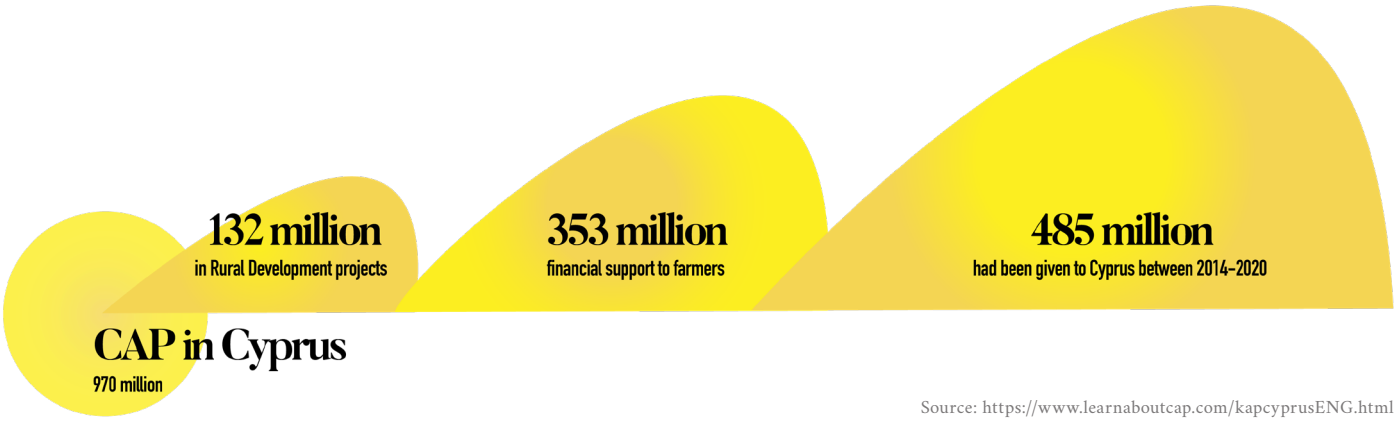
only 1.7 % of farmers are under 35 years old, while 40 % are older than 64 (31.1 % in EU28).

Small farms

89.9 % of holdings are under 5 hectares.

An important contribution to the economy

The primary sector (agriculture, forestry and fishing) accounts for 2.3 % of the country's economy (total GVA) and agriculture for 3.6 % of total employment. This is higher than the European average in economic terms (1.5 % in EU-28) but lower in terms of employment (4.3 % in EU28).



Source: https://www.learnaboutcap.com/kapcyprusENG.html

Internet of Food and Farm 2020 (IoF2020)

Smart farming based on the Internet of Things (IoT) technology, field farmers collect real-time data on irrigation and crop protection processes to increase production, improve product quality, and optimize resources and agricultural processes. Digital Ecosystem Utilization (CYSLOP for short) is a use case for the Internet of Food and Farm 2020 (IoF2020) project aimed at demonstrating IoT solutions on vegetable farms in Cyprus. The selected pilot areas are the Limassol district in the mountainous region where the cultivated crops to be surveyed are aronia, gojiberry and raspberry (4 plots), and the coastal area of Ammocostus where there are 2 plots of outdoor strawberries and cherry tomatoes (hydroponics).

The expected environmental, economic, and social impacts involve efficiency improvement in terms of pesticide and water use reduction between 5% and 10%, respective cost reduction of 10%, reduction of farm visits by 20%, and more than 20 newly deployed IoT devices. Lastly, by incorporating innovative traceability technology, this use case is among the first to integrate information from the entire food value chain (from farm to fork) to a marketplace, offering elaborate value propositions to users [39].

Agro-Tech to Promote Cypriot Specialty Food

The agricultural sector in Cyprus - including forestry and fishing - represents only the 2,3% of the national GDP and it has the potential to grow faster if modernized via suitable investments. In fact, rural development accounted for 25.6% of total agricultural spending in 2020 to modernize the agricultural sector in Cyprus and drive significant growth in GDP[40]. In the immediate future, technology will play a major role in the agricultural sector, guaranteeing a shield from climate change, as well as reducing water-waste, helping a better management of resources, and increasing farm productivity. Total factor productivity (TFP) increased between 2005 and 2016 in Cyprus, thanks to investment in the agricultural sector. As highlighted in Figure 8, capital productivity presents the returns on investments, while productivity reflects the developments in yields and rents.

Appropriate investment in AgroTech through recovery plans not only stimulates growth and productivity in this sector, but also provides a competitive advantage tool for identifying Cyprus' food specialty, recognizing quality and sustainability. It creates an opportunity to identify consumer preferences and priorities from a perspective.

From cloud software to monitor crops and animals, which respectively represents the 39,5% and 60,5% of the share of Cyprus agricultural output (716,9 million Euro)[41], Agro-Tech can enhance the competitiveness of small and medium-sized enterprises, and upgrade their potentiality in the regional, national, and international market. Technology instruments, such as data collectors and data analysis tools, also have the advantage to stress out the strengths and weaknesses of the sector and can be a tool to put in place effective measures to reduce soil erosion, improve air and water quality and reduce pressure on water resources, for instance a pilot study on smart irrigation in Cyprus demonstrated a 22 per cent reduction in total irrigation needs [42]. These benefits associated with traditional and genuine organic products in Cyprus can also have relevant impacts in the fields of wine and gastronomy. Finally, Cyprus develops a technically sound degree in agriculture, strengthens the skills and training needed to meet business needs, and in 2016 the lowest percentage of young farmers in Cyprus manage EU farms. We encourage industry-academia collaboration to counter the total number of people (1.3%) [43].

[39] Chapter 10 Use of IoT technologies for irrigation and plant protection the case for Cypriot fruits and vegetables;
Book: Bio-Economy and Agri-production; Author: Theocharis Moysiadis, George Adamides, Andreas Stylianou, Nikolaos Zotos,Marianthi Giannakopoulou-George Alexiou; Publisher: Elsevier;Date: 2021

[40] European Commission, Eurostat and Directorate General for Agriculture and Rural Development. Updated June 2020.

[42] European Commission, Eurostat and Directorate General for Agriculture and Rural Development. Updated June 2020.

[42] Nikos Kalatzis, Nikolaos Marianos and Fotis Chatzipapadopoulos, IoT and Data Interoperability in Agriculture: A Case Study on the Gaiasense TM Smart Farming Solution, Paper presented at the 2019 Global IoT Summit (GIoTS), 17-21 June 2019.

[43] DG AGRI – EUROSTAT. Zomeni M, Martinou AF, Stavrinides MC, Vogiatzakis IN (2018) High Nature Value farmlands: challenges in identification and interpretation using Cyprus as a case study. Nature Conservation 31: 53–70. https://doi.org/10.3897/ natureconservation.31.28397

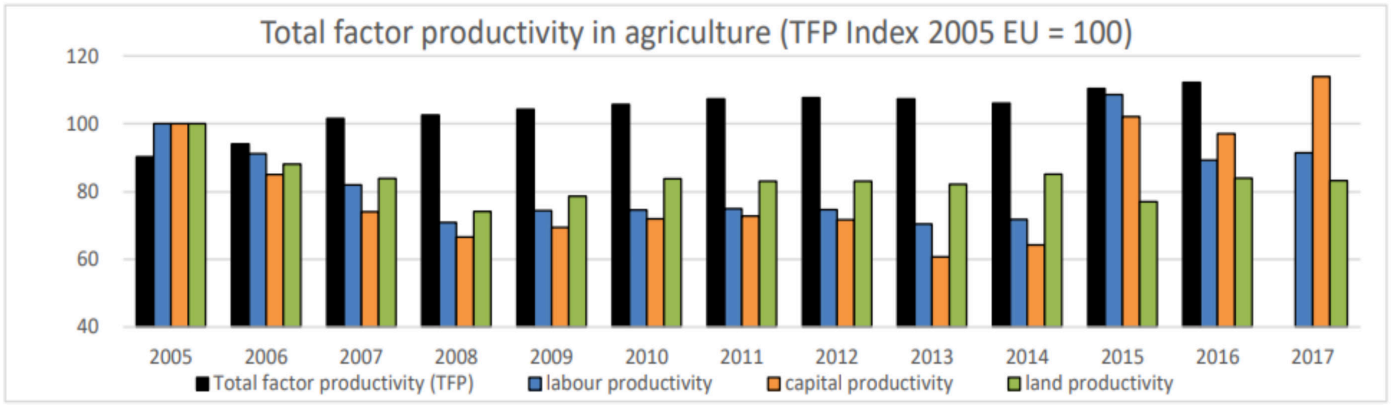


Figure 8: Total factor productivity in agricoltune in Cyprus. Source: Newsletter – January 2021, Italian-Cypriot Chamber of Commerce.

Case study: Data Driven Potato Production, IOF project in Cyprus. Image: iof2020.eu

3.14 Next strategic policies

Funds for the sustainable future of the sector

Promoting resource conservation agriculture and focusing on quality rather than quantity are the most important goals of the new decade. With the help of generous EU funding, the government has invested heavily in the modernization and restructuring of the entire agricultural sector, providing additional support to the sector through various programs and subsidies. As depicted by the concentration of economic growth limited to few sectors, one of the key challenges aimed to be solved by the new growth model is the need to address diversification and productivity. The select reforms and investments in this section aim to contribute to this – through both, "a new strategic positioning of Cyprus' primary and secondary sectors, its traditional sectors driving growth including tourism and ICT, as well as additional new economic sub-sectors to be developed to restructure and rebrand the economy" (www.cyprusprofile.com). Over the last two years, Cyprus has introduced a number of initiatives to support the agricultural sector in areas such as water and waste management, smart farming, environmental protection and new measures to ensure better animal welfare. In addition, the country has a global focus on the protection and promotion of high quality traditional products. This will soon be marked with a new country and official "origin seal" indicating products manufactured by the local agricultural sector using local raw materials.

The next Common Agricultural Policy (CAP) 2023-2027

On June 25, 2021, negotiators from the European Parliament, the Council of the European Union and the European Commission agreed to reform the Common Agricultural Policy (CAP). This preliminary political agreement paves the way. It paves the way for the European Parliament and the Council to formally adopt the required legislation in the fall of 2021. Launched in 2023, the new CAP aims to promote a sustainable and competitive agricultural sector that supports farmers' livelihoods and ensures health and sustainability nutrition for society, and a vibrant rural area. Agriculture and rural areas are at the heart of Europe's green deals, and the new CAP will be an important tool for achieving Farm-to-Fork [44] and biodiversity strategy ambitions. CAP Strategic Plans will put into practice enhanced conditionality, ecoschemes, farm advisory services as well as agrienvironmental and climate measures and investments to address the Green Deal targets, in particular those stemming from the Farm to Fork Strategy and the Biodiversity Strategy for 2030, and to fulfil the climate and environmental specific objectives of the CAP[45].

The Cyprus Recovery and Resilience Plan (RRP) 2021-2026

The "RRP" or the "Plan" reflects the integrated, ambitious and at the same time realistic plan of the Republic of Cyprus, for the effective utilisation of €1,2 bln to be allocated to Cyprus for the period 2021-2026, by the EU Recovery and Resilience Facility (the "RRF"). The strategic objective of the RRP is "to strengthen the economy`s resilience and the country`s potential for economically, socially and environmentally sustainable longterm growth and welfare"[46]. Through the measures of RRP, the aim is to promote Cyprus as:

1. A country with high levels of resilience, productivity and competitiveness through a sustainable model of long-term growth;
2. A country where the education system and workforce development are aligned with the skills needed for the future;
3. A country that is among the pioneers in Green and Digital transition;
4. A country with a resilient health system that follows best practices from top health systems around the world;
5. A welfare state with a strong protection network for those in need of state assistance;
6. A state of law, transparency and accountability, with strong anti-corruption mechanisms.

The strategic objective of the RRP is "to strengthen the economy's resilience and the country's potential for economically, socially and environmentally sustainable long-term growth and welfare".

The RRP has been developed around five policy axes, namely: (1) Public health, civil protection and lessons learned from the pandemic, (2) Accelerated transition to a green economy, (3) Strengthening the resilience and competitiveness of the economy, (4) Towards a digital era and (5) Labour market, social protection, education and

[44] Commission, E. (2020). Farm to Fork Strategy. DG SANTE/Unit 'Food Information and Composition, Food Waste'',' DG SANTE/Unit 'Food Inf. Compos. food waste'',' 23. https://ec.europa.eu/food/sites/food/files/safety/docs/f2f_action-plan_2020_strategy-info_en.pdf

[45] European Commission. (2018). Cap Specific Objectives, brief 4 - Agriculture and Climate Mitigation. Directorate-General for Agriculture and Rural Development, 4, 16.

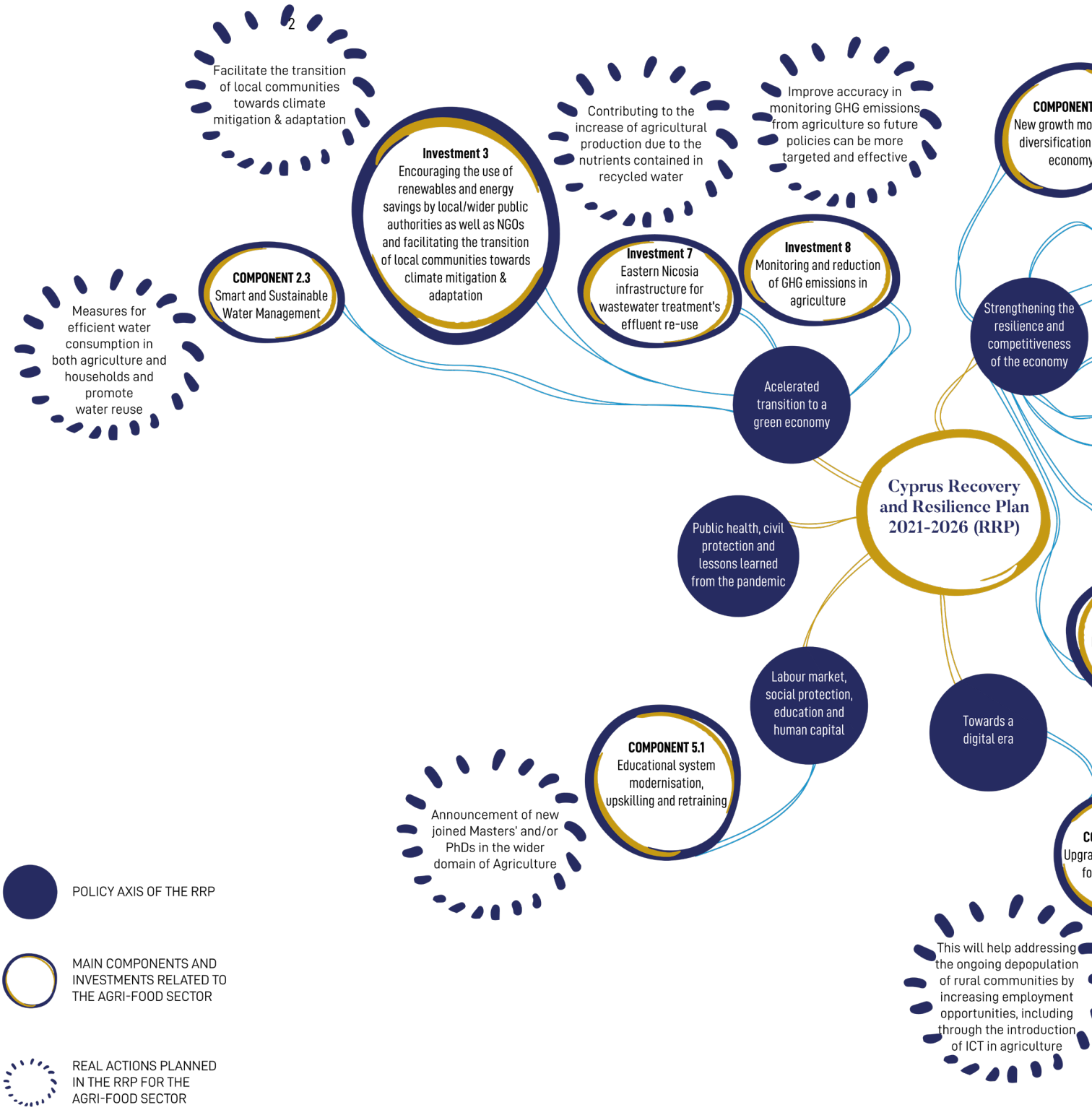
[46] Cyprus Recovery and Resilience Plan 2021-2026, Republic of Cyprus, European Union

CAP Strategic Plans

Taking into account Member States' specific needs, national level CAP strategic plans will combine a wide range of local and EU-level objectives to deliver targeted, tangible results.

How the future CAP will contribute to the EU Green Deal, European Commission. (2020)

3.15 Recovery and Resilience Plan 2021-2026



Main funded projects related to agri-food sector in the Cypriot Recovery and Resilience Plan 2021-2026

The following paragraphs describe in detail the funding contained in the RRP 2021-2026 destined directly and indirectly to the Cypriot agri-food sector, like shown in the scheme above.

POLICY AXIS 1
Resilient and Effective Health System, Enhanced Civil Protection

Policy area/domain: Health.
The strategic goals of the Ministry of Health are related to the implementation of sustainable reforms, within a healthcare system that focuses on prevention, social provision and continuous upgrading of the provided services based on professionalism and respect, equally to all citizens. A key characteristic of the recently implemented National Health System (NHS) is the enhanced access of all citizens to healthcare services. The COVID-19 pandemic demonstrated the need to further improve and modernise the health care system and complete the implementation of the sector reform. In this framework, the Republic of Cyprus has proceeded with the adoption and implementation of a "National Reform Program". This program is of a fiscal nature with the aim of safeguarding the public health system and ensuring financial support for businesses and employees.
This includes measures aimed at strengthening the resilience of the health system and the ability of hospitals to deal with any future health crises and to establish the necessary infrastructure, equipment and procedures. The measures also concern the employment of additional medical, nursing and other support staff but also the application of appropriate human resource management methodologies in public hospitals.
In this first policy axis, no funding is provided for interventions relating to nutrition and, more generally, to the food and agricultural sector.

POLICY AXIS 2
Accelerated transition to a green economy

Policy area/domain: Energy policy
The axis 2 further includes various support schemes aiming to assist households, enterprises, municipalities, communities and the wider public sector and NGOs to implement energy efficiency and renewable energy investments. It includes investments related to the energy upgrade of public buildings and other public infrastructure, including in the water treatment sector. Incentives for the reduction of greenhouse gas emissions in agriculture, industries, businesses and other organisations, are also incorporated in this component, as well as the development of advanced testing procedures in the area of renewable energy and smart grids for promoting high-quality research. In order to address the serious climate challenges, the Government of the Republic of Cyprus is promoting a fiscally neutral green reform, in accordance also to the European Green Deal.
The reform will introduce a carbon tax for fuels used in the sectors of the economy that do not fall under the Greenhouse Gas Emissions Trading Scheme.

COMPONENT 2.3 Smart and Sustainable Water Management
The national objectives in relation to Water Supply and Sewerage Services focus on ensuring adequate and uninterrupted supply of good quality potable water, maximizing the infrastructure for sewerage collection systems, sewage treatment and reuse of treated effluent to be re-used in agriculture; reducing water supply and distribution system water losses, reducing the non-revenue water and groundwater abstraction, improving operational efficiency of the services being provided to the consumers through technological advances and establishing transparency in financial transactions.

Source: Cyprus Recovery and Resilience Plan 2021-2026, Republic of Cyprus, European Union

Investment 3: Encouraging the use of renewables and energy savings by local/wider public authorities as well as NGOs and facilitating the transition of local communities towards climate mitigation & adaptation
- Facilitate the transition of local communities towards climate mitigation & adaptation.
Local authorities are recognised as important partners in the implementation of structural reforms and investments for accelerating the transition to a green economy.
Local rural communities have committed to undertake actions for just, inclusive, decarbonised and climate resilient towns governed by the principles of sustainability.

Investment 7: Eastern Nicosia infrastructure for wastewater treatment's effluent re-use
By extension, the investment will contribute to wider and long-term national objectives such as:
• Contributing to the increase of agricultural production due to the nutrients contained in recycled water;
• Increased economic benefits of farmers (income) due to the possibility of irrigating new high efficiency crops (mainly livestock plants) and contribution to the preservation of traditional agriculture.

Investment 8: Monitoring and reduction of GHG emissions in agriculture
This investment aims to improve accuracy in monitoring GHG emissions from agriculture so that current policies effectiveness can be assessed and mitigated, and future policies can be more targeted and effective.
Europe is facing significant challenges in curbing greenhouse gas (GHGs) emissions and ensure food security in a climate changing environment. Although agriculture is affected by climate change, it is also a driver of climate change itself. The agricultural sector accounts for 10% of the European Union (EU) total GHG emissions in 2019 (EEA 2019).
There is an urgent need to monitor the GHG emissions from agricultural for the following reasons:
1. To provide accurate emission data from the agricultural sector through the National Inventory System of the country
2. To develop and implement policies based on accurate and real data
3. To evaluate the policy measures that are or will be implemented in the Agricultural Sector for the mitigation of GHG
Farmers, food processing industries, farmers' associations, advisory agencies specialised in the agricultural sector, and policy makers in the Department of Agriculture will be provided with policy strategies and tools able to reduce GHG emissions.

POLICY AXIS 3
Strengthening the resilience and competitiveness of the economy

Policy area/domain: New Growth Model and diversification of the economy
While at the time of drafting this Component the European Commission-funded Long-term Economic Strategy (LTES) project is still ongoing and the strategy is not yet fully elaborated, the core of the project has been completed and decisions have been taken in defining the building blocks of the long-term strategy:
1. analysis of the challenges the country is facing and barriers to growth, competitive advantages and strengths to leverage in order to drive growth
2. sectors/sub sectors with high-potential to drive future growth – traditional and new
3. a Vision for Cyprus 2035, strategic objectives, and the determination of Cyprus' optimal new economic growth model
4. key policy areas and reforms needed to unleash the country's growth potential.

Source: Cyprus Recovery and Resilience Plan 2021-2026, Republic of Cyprus, European Union

COMPONENT 3.1 New growth model and diversification of the economy
The new economic growth model for Cyprus as defined in the context of the new LTES aims at sustainable long-term growth, competitiveness and resilience. Reforms and investments in this component target a number of sectors/sub-sectors identified in the LTES as drivers of future growth:
• Primary Sector – developing a competitive agriculture sector primarily through agri- tech and strong collaboration with business, higher-education institutions and research centres to excel
• Secondary Sector – developing a competitive light manufacturing sector that includes production in areas of green-tech, agri-tech, etc.
• Services Sector – placing emphasis on further developing the already growing ICT sector and digital services, the export oriented tertiary education and the expert oriented medical services.
• Sustainable Tourism – developing a strong agritourism and sustainable hospitality infrastructure and attracting health & wellness tourists through a competitive and reputable healthcare system.
• Circular economy – placing emphasis on waste management improvement.

Sub-Component 3.1.1 Resilient and competitive primary sector

Reforms

• *Reform 1*: *Move agricultural practices from the 20th century to the 21st century by investing in a national centre for excellence in agri-tech*
The reform has a strong emphasis on driving the agri-tech agenda and hence a strong digitalisation component, where farmers can access a centralised repository of resources and ultimately technologically-enable their operations for increased yield, productivity, and efficiency.

CHALLENGES
Cyprus is severely affected by climate change, putting at risk both the safety and adequacy of domestically produced food and livestock production. Rising temperatures, declining rainfall and extreme weather events are the main threats facing farming today. In addition, lack of irrigation water and the presence of new enemies and diseases exert destructive pressures on agricultural development, while the intensive cultivation results in the substantial degradation of agricultural land, posing a threat on biodiversity. In general, Cyprus' agriculture sector is characterised by low productivity, increased fragmentation and old farmers' population.
here is also a lack of awareness and knowledge of the benefits of technological solutions, methodological implementations, such as livestock genetic improvement, as well as technical know-how to implement/ take advantage of solutions (including smart agriculture), which will make farms more productive and cost competitive. In addition, agricultural contribution to greenhouse gas emissions must be drastically reduced through the development of innovative practices and an efficient monitoring system. The Agricultural Research Institute (ARI) is the foremost body for the evaluation, consolidation, improvement and maintenance of the genetic base of crop and livestock production in Cyprus. ARI's research programs promote the National Strategy for Smart Specialisation in the field of agriculture and contribute to the reform and strengthening of the competitiveness of the rural economy.

OBJECTIVES
The Reform aims to establish a nationally organised centralised operating model that provides a common mechanism for farmers and the agriculture sector, to access relevant information, services, funding options (grants, private investors, and other sources). This mechanism will afford strategic direction on boosting the competitiveness and viability in the market, while concurrently ensuring the protection of the environment, the adaptation and mitigation of the primary sector in a climate changing setting and the sustainable use of natural resources. During the implementation period, the following will be further achieved: announcement of new joined

Source: Cyprus Recovery and Resilience Plan 2021-2026, Republic of Cyprus, European Union

Masters' and/or PhDs in the wider domain of Agriculture.

• *Reform 2*: *On-line, cloud-based platform for improving the trade and information symmetry in the fresh produce supply chain*

The investment has a strong emphasis on digitalisation and use of technology/emerging technology to make the primary sector more competitive.

CHALLENGES

Cyprus is characterised by long standing drawbacks of the fresh produce supply chain, especially regarding traceability, market price distortions and the information asymmetry which weakens producers' position in the market. Furthermore, the Cypriot fresh produce supply chain experiences long standing unfair trading practices which weaken further the producer's position in the market, widen the gap between producer and consumer prices and create unnecessary transaction costs that are transferred to the producer. The producers are receiving low prices for their production, whereas, market structure and the way prices are announced in a non-transparent way, constitute additional challenges for their viability and sustainability.

The above have therefore a direct impact in the profitability of the producers and becomes a major obstacle towards the generation renewal of the producers.

OBJECTIVES

The project, which will be coordinated by the Agricultural Research Institute, takes a holistic approach in resolving long standing drawbacks of the Cypriot fresh produce supply chain. Information technology seems capable of taking the fresh produce supply chain into a new era. In this context, the project aims to utilise innovative cloud-based information technologies in order to develop an online trading platform that will record fresh produce entering the local market and moving along the supply chain, allowing the following:

- keep records of supplies and sales for growers,
- support the organisational structure of Producer Organisations (POs) in terms of pricing and sales planning,
- enhance online transactions thereby improving the position of micro-farms in the supply chain,
- provide the means for product tracking,
- support the symmetry of information on price changes along the value chain,
- improve information on product supplies on a real time basis thereby optimise the decisions on daily price movements (based on historical demand data),
- provide supply and demand statistics on a real time basis in order to improve production planning.

The project places Producer Organisations (POs) at the core by strengthening their role (and hence the producers' role) in the trading system; an objective extensively highlighted by the Common Agricultural Policy (EU). The phenomenon of Unfair Trading Practices (UTPs) in the agricultural sector brings serious negative consequences for the farmer, such as loss of income, higher production costs than estimated, difficulties in production planning, overproduction of products and waste of food. The phenomenon also limits both the purchasing power and the choices of consumers and concerns all sectors of the economy and affects all households, with social and economic implications.

• *Reform 3*: *Genetic improvement of the Cyprus sheep and goat population*

The reform will boost the economy of the agricultural sector and also promote the efficient use of feed produced on agricultural land by selecting more efficient livestock, with higher productivity per unit of feed consumed. In addition, more sustainable breeding practices will be implemented to support the entire small ruminant farming system. The reform has a strong digitalisation component, data collection and reporting via digital means that would significantly increase the digital skills of the sheep and goat community and related stakeholders. Implementing novel agri and biotechnology methods and know-how through genomic evaluation and selection of sheep and goats will be a breakthrough in transferring innovative research results to industry, with tangible benefits in the years to come.

Source: Cyprus Recovery and Resilience Plan 2021-2026, Republic of Cyprus, European Union

CHALLENGES

The primary sector in Cyprus faces various challenges in the last decades, including the lack of investment in new technologies, methodologies and business models that would render it competitive.

In particular for sheep and goat farming and associated income, the sector lags behind in adopting new processes on farming, in implementing productivity improvement as regards milk production, in order to have adequate income from quality products such as milk, good negotiating power in the milk and halloumi cheese production and value chain, as well as to be resilient in the face of adverse climatic effects, lack of successors, aging workforce etc. Sheep and goat farmers not only need to be directed through a comprehensive transformation of their operation that would benefit their livelihoods, but also remain the key players in providing the halloumi cheese industry with enough milk to produce quality cheese, especially in accordance to the halloumi cheese Protected Designated Origin (PDO) specifications, and to cover the growing export demand for this product.

Lack of adequate training and guidance, inadequate record keeping on farms, little, if any, coordination and cooperation among sheep and goat farmers, and lack of accurate data to make informed decisions regarding selecting the genetically superior animals for breeding to achieve increased productivity, are all challenges that will be addressed with the proposed reform.

OBJECTIVES

In line with existing national strategies for the support of the sheep and goat sector, the national plan for the genetic improvement of the Cyprus sheep and goat populations, the Cyprus Smart Specialisation Strategy, and the nationally funded research project AGRICYGEN, this reform aims to employ cutting edge genomic technologies in Cyprus' sheep and goat production, crop production and ecological enhancement of Cyprus' soils.

The objective of this Reform 3 is to enhance the productivity and sustainability of the primary production sector through the promotion of agrotechnology, advanced reproduction and genomic improvement of sheep and goats to optimise the production of dairy products. It consists of specific measures to implement the latest technological, methodological and digitisation advancements in small ruminant production, with respect to animal genetic improvement, in order to expedite and increase the accuracy of productivity upgrade per animal and for the whole farm. Relevant synergies and avoidance of duplication will also be pursued between this reform and other related measures through the Cyprus Common Agricultural Policy (CAP) plan for the next period (2021-2027). Complementarity with the CAP strategic plan is envisioned, since the CAP strategic plan will encompass measures directed to trigger farmer investment to improved farm facilities, new equipment and for promoting activities to enhance animal welfare. However, the proposed measure differs significantly from the CAP strategic planning.

Investments

• *Investment 1*: *Construction of a collaborative marine aquaculture infrastructure (port and land facilities) in Pentakomo coastal area*

The investment will promote efficient use of natural resources and reduction of greenhouse emissions by developing sustainable marine offshore aquaculture and improving its environmental performance. Sustainable aquaculture development will contribute in achieving the United Nations Sustainable Development Goals (SDGs).

CHALLENGES

Aquaculture is an integral part of Cyprus's national fisheries sector and is an important activity of the wider productive primary sector. Aquaculture represents over 80% both in terms of volume and value of the total annual national fisheries production. Cyprus is among the top 5 EU countries as regards to aquaculture contribution in the national production of fisheries products. Marine aquaculture represents more than 99% of the total national aquaculture production and its produce is the 3rd most important export product in terms of value from the agricultural primary production sector. The sector has been growing at 5 – 6 % during the last fifteen years.

Source: Cyprus Recovery and Resilience Plan 2021-2026, Republic of Cyprus, European Union

Seven out of the nine licensed marine offshore aquaculture units present in Cyprus are located and currently operating in the wider area of Vasilikos - Moni.

OBJECTIVES

This investment aims to cover the gap of not having sufficient, proper, and functional port and land infrastructure for covering the daily needs of this activity. The construction of a collaborative infrastructure (port and land facilities) that will specifically be designed for aquaculture activity, will cover existing as well as future needs of more than 70% of the marine aquaculture units operating in Cyprus.

• *Investment 2*: *Enhancing the existing isotopic databases of Cypriot local traditional food/drinks, by developing a Block Chain platform, to ensure their identity*

The Investment has a strong emphasis on protecting local and traditional products thereby making the market more competitive, with a strong digitalisation element.

CHALLENGES

Authenticity and safety are key issues for the protection of traditional food products. To this end, EU and the Member States have developed quality branding schemes and specific regulation, providing assurance to consumers and other stakeholders about the authenticity and quality of traditional and local foods (such as wine and alcoholic beverages)which is of prime importance in adding value to the European Agri-food economy. The concept of authenticity can be broken down into two main components: the composition and the origin of food. To qualify as authentic, a food must meet the requirements of legislation on the label and description of any geographical origin, raw materials and production processes. The competent control bodies need to develop therefore, sophisticated methods of certifying authenticity, which require the use of advanced technology.

OBJECTIVES

By creating a network of participants from the Ministries (Health, Agriculture, Natural Resources and Environment and Finance) and the competent authorities, producers, industry, academia and research institutions, technology providers, consumers and the Cypriot community in general, the project aims to strengthen the ability to ensure quality and safety in food supply. In the future, the resulting isotopic database will be linked to other European ones coordinated by the Joined Research Centre of EU.

In addition, using the blockchain technology, different stakeholders from the food supply chain will be able to upload their data, with easy-to-use user interfaces for both producers and consumers, as well as the competent control bodies. Blockchain technology uses cryptography to add a layer of security to the data stored on the network. The decentralisation feature, on top of cryptography makes blockchain provide better security than other systems. In this way the system is easily accessible for all stakeholders, it is reliable and unbiased due to high security of data. Regarding the authenticity certification, it will be centralised and will be provided by the State General Laboratory.

• *Investment 3*: *Upskill the existing farming community and professionalise future labour force by investing in human capital.*

The investment has a strong emphasis on driving upskilling in the farming community through close coordination with the universities/academia and R&I communities. The investment has a strong emphasis on designing and implementing tailored degrees, placements, and coordination between local universities/academia with the ultimate objective of increasing fit-for-future employment opportunities in the primary sector.

CHALLENGES

The majority of farmer managers in Cyprus have practical experience in the farming sector, 72% based on FSS 2016 data (Cyprus Analytical Factsheet https://ec.europa.eu/info/sites/default/files/food-farming- fisheries/by_country/documents/analytical_factsheet_cy.pdf). A small proportion of farm managers have full agricultural

Source: Cyprus Recovery and Resilience Plan 2021-2026, Republic of Cyprus, European Union

training, around 1%. Cyprus in comparison with EU average ranks significantly lower.
Knowledge and innovation can play a key role in helping farmers and rural communities meet current and future challenges. Although there is already agricultural research providing new knowledge, it tends to remain fragmented and poorly applied in practice. Further, insufficient or very slow uptake of new knowledge and innovative solutions in agriculture, hinders the smooth transition to a more sustainable agriculture, as well as the competitiveness and sustainable development of the agricultural sector.

OBJECTIVES
Developing a competitive primary sector is at the core of a resilient economy and at the core of the new economic growth model. Increasing the level of human capital in the agricultural sector in Cyprus would mean that the sector would become more professional. Practically, this would translate to more efficient use of limited resources through investing in newer technologies which would result in a more competitive agricultural sector and would also mean that the sector's export potential would become more plausible. The operation of a well-structured Agricultural Knowledge and Innovation System (AKIS) (implemented under the Common Agricultural Policy) with clear objectives and roles on the part of the actors involved is crucial for achieving a time-solid and efficient system for the transfer of knowledge and innovation that will bridge the gap between practical application on the one hand and knowledge, science, experience and research on the other. The investment aims to complement the AKIS and enhance its results, through capacity building and knowledge transfer. In addition to the strengthening of AKIS, there is a need to strengthen the current educational programme provided by the Department of Agriculture so that it improves current areas taught, such as Integrated Pest Management (IPM), hydroponic environments, management and financial literacy, use of less hazardous pesticides and animal and public health, with other novel and new areas in the sector such as smart irrigation systems, precision farming, robotisation, etc.

Sub-Component 3.1.2 Innovative and competitive secondary sector
The objective of the component is to reduce dependence on limited and vulnerable sectors of economic activity and enhance self-sufficiency in critical sectors, as well as to increase the resilience, competitiveness and contribution of the secondary sector to sustainable growth. The impact of the component is expected to be positive in all areas such as growth potential, the digital transition and mitigation of the economic and social impact of the crisis. In relatively small economies such as Cyprus's the capacity to enhance exports plays a strategic role in fostering the diversification of the country's economic base and improving growth on a sustainable basis.

Investments

• *Investment 5*: *Creation of a National Commercial Identity and promotion of the traditional product "halloumi"*
CHALLENGES

The severe effects of the recent COVID -19 crisis, especially in the tourism sector, have manifested once more the unsustainable nature of the growth model that Cyprus has been following for decades now. In addition, the high concentration in a very limited number of sectors, makes the economy highly vulnerable to external crises.
In this context, and in the context of the strategy for reinforcing the secondary sector the MECI is trying to establish a brand name for the Cypriot products in order to promote exports abroad.

OBJECTIVES
A study (including consultation) on the creation of a National Commercial Identity "Made in Cyprus" (branding) focusing on the quality and structural characteristics of Cypriot products and services combined with elements

Source: Cyprus Recovery and Resilience Plan 2021-2026, Republic of Cyprus, European Union

of the tradition and history of the island. The creation of a National Commercial Identity will aim at building and managing a good reputation for Cypriot products and services, highlighting their distinctive characteristics. It can facilitate penetration into foreign markets as often the successful transfer of this image is just as important as the quality of exported goods and services. The creation of a new "Branding" should be accompanied by supportive actions such as the creation of networking and promotion tools for Cypriot products and services and the new commercial "image" that will be created. A study from a consultancy firm for implementing a strategy for halloumi cheese in order to increase its distinctiveness as an authentic Cyprus product and designing a promotional and awareness campaign. Halloumi is the most important agricultural product exported from Cyprus and its reputation is extensive globally. The Republic of Cyprus, via its various institutions and governmental bodies, owns the trademark Halloumi in many countries all over the world, including the European Union.

• *Investment 6*: *Scheme for modernisation and digitalisation of enterprises engaged in manufacturing and trading of agricultural products*

CHALLENGES
Limited ability of SMEs engaged in the agricultural sector to digitalise, low awareness of the available digital solutions and their potential benefits and inadequate technical capabilities to implement digitalisation solutions create barriers to digitalisation of smaller, family-owned SMEs engaged in the traditional – agricultural sector. Owners and managers often do not know how and where to apply digital solutions to business processes and employees often need technical know-how to integrate such digital solutions.

OBJECTIVES
The goal of the component is to mitigate the impact of the crisis and strengthen the resilience of the agricultural sector, promote diversification of the economic activity and accelerate economic growth.

Sub-component 3.1.3 Sustainable, high value-added tourism sector
Rural areas in the European Union are currently undergoing significant economic and social changes.
There is an increasing awareness of the need to accelerate improvements in rural areas through diversification of their economic base, which seems to be the only answer to socioeconomic survival of these communities. This can be achieved through the creation of synergies between tourism and related sectors such as agriculture, manufacturing and culture. Diversification of the tourism product by developing special tourism products such as Slow/Rural tourism and attracting specific markets segments such as health tourism, have the potential to encourage entrepreneurship, generate local employment and stimulate external investment into the communities, also contributing to territorial cohesion. Sub-component 3.1.3, aims at enhancing the sustainability and value added of the tourism sector and includes investments linked to the implementation of a new tourism strategy for sustainable development, greening of tourism and development of the tourism sector in the mountains, remote and inland areas. In line with the National Tourism Strategy of Cyprus, it aspires to minimise the environmental impact of tourist development while giving incentives for the introduction and promotion of new forms of tourism (e.g. nature tourism, agrotourism, slow tourism and culinary tourism), building on the Cypriot tradition.

Investments

• *Investment 8*: *Enhancing the added value of the tourism sector with emphasis on the countryside, mountainous and remote areas*
- Renovation of traditional restaurants or businesses selling traditional products, subject to their inclusion in the Label "Taste of Cyprus". The Scheme runs complimentarily with the LEADER Programme; whereas LEADER

Source: Cyprus Recovery and Resilience Plan 2021-2026, Republic of Cyprus, European Union

encourages the creation of new agrotourism establishments, DMT will support existing ones upgrade their services. LEADER is also implemented through Local Action Groups (LAGs) which do not cover the totality of the countryside, mountainous and remote areas. The Deputy Ministry of Tourism and Department of Agriculture have set an interministerial Working Group to coordinate and ensure there are no overlaps between the Schemes.

CHALLENGES
Despite the potential of Cyprus's traditional cuisine and products, there is an absence of distinct character in restaurants offering traditional dishes and small businesses selling traditional products. Gastronomic tourism has thus emerged as a significant component of consumers' lived experiences, regardless of country of origin, shaping decision-making processes, dining choices, and even holiday destinations as a whole. Gastronomic tourism is increasingly integrated into local systems (links to agricultural and manufacturing sectors), sustainability and regional development.

OBJECTIVES
This investment aims to provide support to SMEs, mostly food establishments, and more specifically taverns, but also micro, small and medium enterprises selling traditional products, in order to promote the upgrade of Cypriot hospitality and enhance the development of Cypriot gastronomy. Inclusion of these businesses under the Quality Label "Taste of Cyprus" rewards the compliance of enterprises to specific and commonly accepted quality criteria, but also pushes SMEs to use local suppliers and raw materials produced in the local community. Indeed, "Taste of Cyprus" was created through another co-financed project, which aimed at diversifying the tourism product by promoting gastronomic tourism.

• *Investment 10*: *Enrichment of the tourism product in rural, mountainous and remote area.*
- Revival of countryside, mountainous and remote areas through the creation of authentic experiences to enrich the tourism product and visual / aesthetic upgrade of infrastructures that have tourist aspects.
- Thematic Route Aphrodite – Inia.

CHALLENGES
The DMT is implementing the creation of a large "Authentic Experience Route" of 300 kilometres, which will pass through the most important mountain, rural and remote parts of the country. This route will be promoted as the "Signature Brand Experience" of the country, since it will include points of interest, villages, traditional food, authentic experiences, agrotourism, traditional hospitality, etc.

OBJECTIVES
These would boost the local economy and simultaneously provide activities to visitors, such as workshops, live demonstrations, traditional souvenirs, etc. This would enhance the diversification of the tourism sector, employment creation (as primary or secondary source of income), reduce out-migration and stimulate re-population, more balanced spread of tourists on the island, new markets.

• *Investment 13*: *Establishment of the Orounda Livestock Waste and Animal-By-Product (ABP) Management Facilities*
Livestock waste management in Cyprus is particularly important to achieve a close-loop operation, minimise externalities and recover nutrients for soil improvement and reduce environmental impact. . Especially since the number of piggeries, poultry and other livestock farms in operation is on the rise in Cyprus and intensive livestock farming has greatly evolved over the years, thus, extracting more natural resources and simultaneously producing more waste. Although many advances have been made over the years in Cyprus to effectively manage such waste with the operation of livestock waste treatment plants, nevertheless, the area under consideration for

Source: Cyprus Recovery and Resilience Plan 2021-2026, Republic of Cyprus, European Union

this proposal, the Orounda Complex area, still faces intense problems with waste management, due to the high numbers and density of the livestock farms, the insufficient existing treatment in open lagoons and the limited land availability for discharging treated effluent. The Orounda Complex consists currently of at least 8 local communities, with approximately 50 livestock farms (40% piggeries, 35% sheep and goat farms, 15% poultry farms and 10% cattle farms), and faces several challenges related to the mismanagement of livestock waste. Odours and emissions pose a constant nuisance to the neighbouring local communities, raising significant social and environmental concerns. Simultaneously, the area was designated as nitrate vulnerable zone. Apart from incineration, there exist other processes for managing the ABPs, more environmentally friendly, that could yield into biological mass, which in turn can be further treated for producing biogas for energy, thus contributing in this way to the sustainable development and the increase of use of renewable energy sources. The purpose of the investment is to develop regional Livestock Waste Management Facilities to serve the farms of the wider Orounda Complex area, which will provide an integrated solution for the effective management of the organic waste produced mainly from piggeries, poultry, sheep, goat and cattle farms. In combination, the investment will serve for utilising ABPs to gain energy through biogas production, after being processed with pressure sterilisation in a nearby unit. The facilities will serve several purposes via different processes / components:
1. The valorisation of piggery, poultry and cattle farm manure, and fallen stock from farms, or other material confiscate or possess the Veterinary Services of Cyprus, for energy production through the process of anaerobic digestion.
2. The aerobic treatment of the anaerobic process liquid to produce water for irrigation.
3. Co-composting of sheep and goat manure with agricultural pruning and park and garden waste to produce high-quality compost.
4. Co-composting of anaerobic digestate and aerobic sludge with agricultural pruning and park and garden waste to produce of organic soil conditioner.

CHALLENGES
Most livestock wastewater is currently directed to 120 open lagoons that might lead to leaks and spills.
The lagoons are uncovered and often operate under anaerobic conditions, thus, generating significant odours that are a nuisance to more than 7000 residences of the neighbouring communities. The low organic matter content (>1%) of the soil in Cyprus would benefit by the production and application of higher value compost.
The Government has already recognised the significance of this practice and has allocated funds through the new Common Agricultural Policy (CAP) 2021- 2027 Strategic Plan in the form of subsidies to farmers for compost application. Unlike other RES (PV, Wind energy), electricity production through the valorisation of the livestock waste is not affected by environmental climate conditions and can operate on a 24-hour basis.
National Soil resilience plan: green organic waste and livestock organic waste, should be co-composted with agricultural pruning to produce organic soil amendment for application in agricultural land. The proposed project will reduce methane and N2O emissions by treating livestock waste through anaerobic digestion and produce energy with the produced biogas.

OBJECTIVES
- Livestock liquid waste and ABP biomass are transformed into biogas and then energy, covering the energy demand of local farms and communities. Heat recovered from the energy production process will be utilised to cover the thermal energy demand of the system.
- Treated effluent shall be used for irrigation purposes of local arable land and the production of animal feed to cover the needs of the local livestock.
- Livestock solid waste is processed into compost
The project will make use of three well-established technologies, aiming to utilise all waste streams from livestock farming on a fully and quantitatively Circular way:

Source: Cyprus Recovery and Resilience Plan 2021-2026, Republic of Cyprus, European Union

1. Anaerobic digesters with pasteurisation and pressure sterilisation.
2. Aerobic and other treatment of the liquid resulting from the anaerobic digestion.
3. Co-composting of the digestant and agricultural pruning and park and green waste to produce organic soil amendment and compost.

More specifically, the objectives of the investment are as follows:

1. Treat the big quantities of livestock waste produced in the area and other ABPs, as well as the treatment of agricultural pruning and other organic waste of the area
2. Produce electricity from biogas
3. Produce compost and improve agricultural land
4. Combat desertification at the local level
5. Reduce odour annoyance of local communities to less than 10% of the duration of the day, which is the EU recommended threshold
6. Reduce GHG emissions
7. Produce water for irrigation and minimise water abstraction

The facility will be established in proximity from the 8 communities (max 2.5 km from each community) and the waste will be transferred by pipeline from the large pig farms and the slaughterhouse waste. Whereas waste from smaller facilities will be transferred to the facility via trucks and tankers. The wastewater treatment plant will produce water that will be supplied to farmers for irrigation. The water will be supplied for free to the local water grid, this eliminates the need to purchase extra services regarding its handling. The negatively impacted 8 communities of the Orounda complex that will directly benefit from the new facilities.

POLICY AXIS 4
Towards a digital era

Policy area/domain: Upgrade infrastructure for connectivity

The current situation in Cyprus demonstrates low fibre deployment for very high capacity networks (mainly in urban areas and almost non-existing in rural), while deployment of 5G has only started in 2021.

It is obvious that a digital divide persists in Cyprus, even though some progress has been made the past few years. Cyprus lags behind in ultrafast broadband coverage, fast broadband uptake and ultrafast broadband uptake, and the broadband price index. While fixed broadband coverage is among the factors boosting Cyprus' ability to benefit from the digital economy, the main challenge remains to encourage take-up of ultrafast broadband. Take-up is influenced by factors such as high pricing, lack of compelling content with many e-government projects still under implementation, low digital literacy with only 50% of citizens having basic digital skills and low ultrafast broadband coverage. High broadband pricing is considerably affected by the lack of competitiveness and infrastructure monopoly in suburban and rural areas, where alternative operators hesitate to invest because of the low population density in these areas. The country's geographical location also affects prices, since international connectivity provided by submarine cables is expensive and constitutes a considerable cost component for Telecom providers. E-government, e-health and e-education services are less developed than in other EU countries, and thus, provide lower incentives to citizens for ultrafast broadband use.

Regarding digital literacy, Cyprus lacks behind since almost a sixth of Cypriots have never used the Internet, and half lack basic digital skills.Despite growing demand in the labour market, the supply of ICT specialists is still below the EU average. Slow internet connection speeds are a key barrier to industrial digital adoption, particularly amongst SMEs. That means more people could move to suburban or rural areas, reducing pressure on transport networks and urban housing.

Source: Cyprus Recovery and Resilience Plan 2021-2026, Republic of Cyprus, European Union

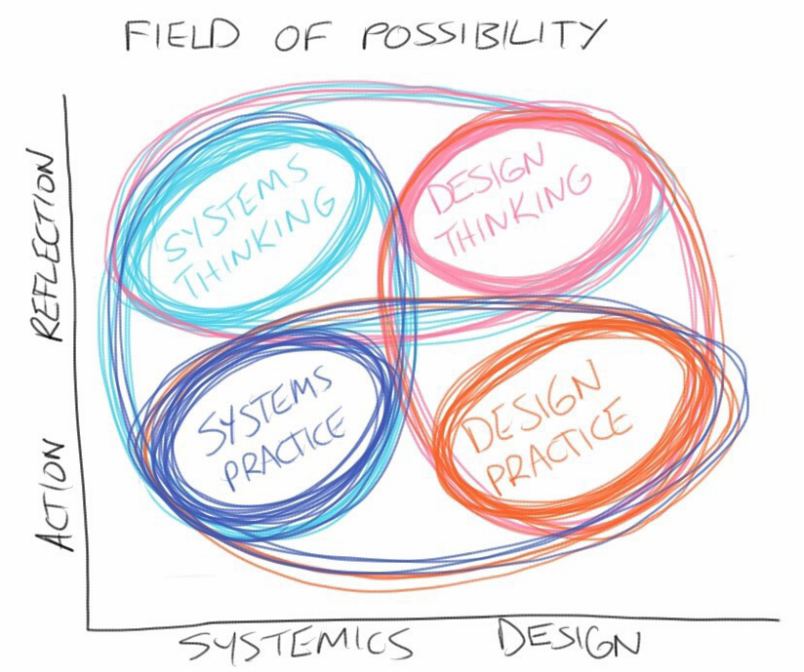
COMPONENT 4.1 Upgrade infrastructure for connectivity
This will help addressing the ongoing depopulation of rural communities by increasing employment opportunities, including through the introduction of ICT in agriculture, and by ensuring better access to key services such as health care. In less densely populated or inaccessible areas (such as forests or mountains) very high capacity networks based on wireless solutions such as 5G are also expected to help develop new local business models (like rural tourism or smart agriculture), thereby contributing to the green transition of local economies through inter alia streamlined consumer-supply chains.

POLICY AXIS 5
Labour market, social protection, education and human capital

Policy area/domain: Education
The objective of the reforms and investments proposed is to enhance the quality and effectiveness of education at all levels, in order to help all students to acquire the right skills and competences for today's and tomorrow's society and economy. Leveraging digital technologies and optimising our nation's innovation capacity is vital to supporting a recovery that leads to greener, more inclusive, sustainable economies, and stronger, more resilient societies. Cyprus lags behind in digital performance and maturity – including in rankings on digital skills - in relation to other EU member states.

COMPONENT 5.1 Educational system modernisation, upskilling and retraining
The implementation of this Reform will allow the upgrading of the role of Cyprus's Agricultural Research Institute as the country's centre of excellence in agriculture, animal husbandry and environment protection. To contribute further to strengthening the country's primary production sector and the protection of the environment, it is of crucial importance for ARI's role to be enhanced through a strong collaboration with the Public Universities, announcing a new joined Masters' and/or PhDs in the wider domain of Agriculture. An enhanced and strong collaboration between ARI and Higher Education ensures that "new generations" of students will build on the success of interdisciplinary research areas. Moreover, such collaboration would increase funding opportunities, foster further international research collaborations, promote the development of high added-value products for the agricultural sector and facilitate the establishment of innovative agri-tech spinoff companies, as well as start-ups. In addition, this will ensure maximised economic and societal returns from the national resources allocated to research, higher agricultural education and the primary sector.

Source: Cyprus Recovery and Resilience Plan 2021-2026, Republic of Cyprus, European Union


FIELD OF POSSIBILITY
REFLECTION
ACTION
SYSTEMS THINKING
DESIGN THINKING
SYSTEMS PRACTICE
DESIGN PRACTICE
SYSTEMICS
DESIGN

Analysing the complexity

Cyprus agriculture is experiencing a return to a **more efficient and value-added industry** with the help of innovations and investments in renewable energy and smart technology. Cyprus's small size makes it impossible to compete with low-cost, mass-produced countries, but **the country excel in quality, organic farming, organic production and superfoods.** Decades of success with the famous **Cyprus potatoes** are a good example of what can be achieved by combining strong marketing campaigns in key markets with high quality products. Younger educated people are now entering what is seen as a cutting-edge sector and farmers have enjoyed **greater water security** in recent years **thanks to the latest desalination and recycling technology.** Another interesting initiative is the **recent legislation allowing for trade of industrial hemp**. Apart from the benefits it brings to patients (top priority), it will boost the island's economic development and attract large amounts of foreign investment throughout the production chain. On the other hand, **interesting opportunities come from Posidonia Oceanica , an endemic Mediterranean seagrass,** covered beneathneath the EU laws. It shelters and nourishes a wealthy biodiversity, at the same time as presenting a extensive variety of marine and coastal ecosystem services.

4.1 Paradigm shift

Systemic Design is an approach to design process. It models production and energy systems after nature's principles, **to reach zero emissions** in air, water and soil, since natural systems are efficient par excellence.

Systemic Design main goal is to promote a paradigm shift, providing a new way to act:
- it manages the output and input;
- it activates new relationship between subject;
- it creates awareness in the community;
- it generates a new economic, productive, social, ethical system.

Systemic Design Pillars
1. Output > Input: outputs (waste) of a system become inputs (resources) for another.
2. Relations: relationships create the same open system.
3. Autopoiesis: autopoietic systems are supported and reproduced autonomously by coevolving together.
4. The context in which it operates is fundamental and priority over the outside. Act locally man at the center.
5. The man related to his environmental, social, cultural and ethical context is the center of the project.

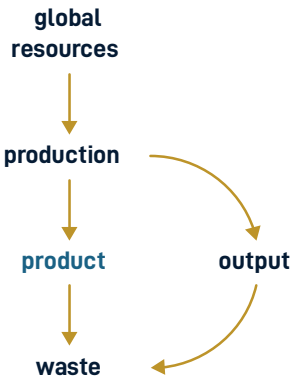
Linear model

Product = Quantity

Economic value

Strong competition

Low interest in waste

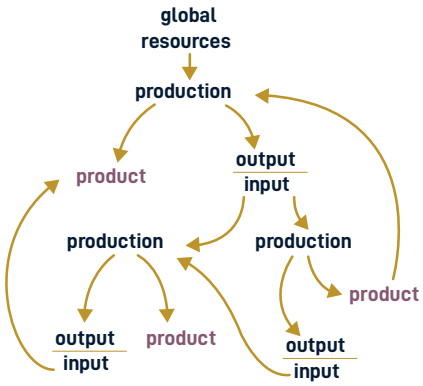


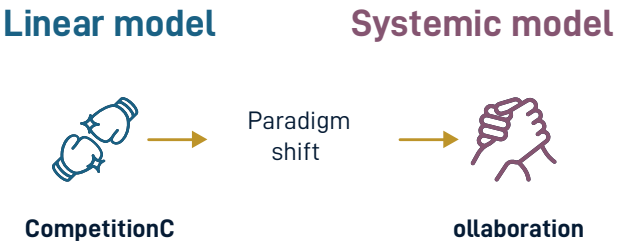
Systemic model

Balanced engagement of all actors

Networks of local relationships

Waste turns into a resource





Methodology

1. Holistic Diagnosis of the territory
An in-depth analysis of the territorial context at different levels of study to better understand the current scenario. Holistic diagnostics is defined as the mapping of the current state of a system's components and their interrelationships and relationships in the context, product, process or service that utilizes a variety of research tools at different levels to provide an overview. This tool aims to facilitate a horizontal dialogue between all parties involved, whether experts in various fields or citizens.
Steps: Assess, Research, Collect, Visualize, Interpret.

2. Holistic Diagnosis of the topic
Analysis of the current production processes of a specific supply-chain and the flow of energy and matter.
Steps: Assess, Research, Collect, Visualize, Interpret.

3. Identification of the challenges
Identify issues in the current production process and its flow. Analysis of various issues affecting the current system in terms of both challenges of the territory and the sector analyzed. Identification of ystem problems should be reconfirmed through desk and field investigations. The first is based on reviewing the literature in official databases for the purpose of addressing a specific problem, and the second is based on interviews with relevant participants and stakeholders in the area and company (all levels from CEO to employees).

4. Identification of the opportunities
Investigation of new opportunities to improve the current scenario and its significance. Challenges turn into new opportunities for the whole system. In this phase, as in the previous phase, desk and field surveys are used. Also consider the various best practices already applied in other contexts.

5. Systemic project
Development of new systems models based on relationships between processes and actors that optimize energy and material flows and value waste as a resource. Develop new circular manufacturing systems and identify positive impacts inside and outside the company. Analysis of the problems and opportunities allowed us to identify many solutions that fit the company and its domains. The system project phase is to define a multi-criteria analysis and then implement it in the system to select the best opportunity for the scenario.
The new system model will be compared to the previous linear model to determine its evolution from various perspectives. Development of new systems models based on relationships between processes and actors that optimize energy and material flows and value waste as a resource. Choice of possibilities. It is necessary to select the various possibilities identified for each task. In fact, not all possibilities can be optimally adapted to the application context and characteristics. A multi-criteria analysis tailored to your situation and project will help you achieve this goal and choose the most appropriate one. When defining these criteria, the five principles of system design and insights gained from holistic diagnosis should be considered. You can now implement the selected features in your system. Redefined flows, processes, and functions allow defining new relationships, actors, and boundaries of a system.

6. Study of the outcomes
Identification and study of new results generated by new system models. Analysis of regional outcomes and impacts on businesses at economic, environmental and social dimensions. Moving from a linear model to a systems model has far-reaching implications for the overall scenario, affecting both the company and the context. Further analysis from a holistic and broader perspective is needed to better understand them.
The study of the Outcomes implies the correlation of the data obtained from the Holistic Diagnosis with the new elements introduced in the Systemic Project. The objective is the definition of a series of realistic assumptions and quantitative/qualitative forecasts of the outcomes generated by the shift to a systemic model in a certain territory, performed on several categories and on different possible scales and timeframes.

4.2 S.W.O.T. analysis

SWOT analysis is a technique developed at Stanford in the 1970s and is often used in strategic planning. SWOT stands for Strengths, Weaknesses, Opportunities and Threats and is a structured planning method that evaluates these four elements of an organization, project, or business venture. SWOT Analysis is a framework used to evaluate competitiveness and develop a strategic plan, it evaluates internal and external factors and their current and future potential. The tool is intended to facilitate a realistic, fact-based and data-driven view of the strengths and weaknesses of an organization, initiative or industry. SWOT analysis is a simple yet powerful system. The idea is to leverage strengths, remediate weaknesses, minimize threats, and maximize opportunities.

Strengths
Strengths describe what sets an organization apart from its competitors: strong brands, loyal customer bases, strong balance sheets, and unique skills. For example, hedge funds may develop monopoly trading strategies that outperform the market. Then he must use these results to determine how to attract new investors.

Weaknesses
Weaknesses prevent an organization from operating at an optimal level. Areas that companies need to improve to remain competitive are weak brands, above-average turnover, high levels of debt, inadequate supply chains, or lack of capital.

Opportunities
Opportunities represent favorable external factors that can give an organization a competitive advantage. For example, when a country cuts tariffs, automakers can export their cars to new markets, increasing sales and market share.

Threats
A threat represents an element that can harm an organization. For example, drought is a threat to wheat companies because it can destroy or reduce yields. Other common threats include rising material costs, increased competition, and labor shortages. etc.

Inside
What is happening within the company serves as a great source of information about the strengths and weaknesses of WOT analysis. Examples of internal factors include financial and human resources, tangible and intangible (branded) assets, and operational efficiencies.

Outside
What happens outside the company is just as important to a company's success as internal factors. External influences, such as monetary policy, market changes and access to suppliers, are categories that can list opportunities and disadvantages.

HELPFUL (to achieve the goal)

HARMFUL (to achieve the goal)

INTERNAL ORIGIN (attributes of the Agri-food sector)

EXTTERNAL ORIGIN (attributes of the environment)

Strengths

1. **Sheep, goats, pigs, poultry** and livestock products account for about one-third of the island's total agricultural production
2. **Waste treatment in olive oil production**
3. **Compost** produced from **recycled plants** (such as lawn, garden clippings, tree leaves, vine leaves, etc.)
4. **Biological waste treatmen**t (that turns biodegradable waste into either high-quality compost or Solid Recovered Fuel)
5. Advanced glasshouse for producing exotic flowers; organic and **energy efficient production of wine and olive oil**
6. The **CAP** directly supports the small farms in Cyprus (**75% of the total number of farms** of the island)
7. Announcement of new joined **Masters' and/or PhDs in the wider domain of Agriculture**
8. **Halloumi** is the most important agricultural product exported from Cyprus and its reputation is extensive globally
9. In 2016 the government passed the 'Production and Trade of Industrial Hemp Law 2016' - which allows for the **licensed production and export of Industrial Cannabis**
10. The **development of the aquaculture sector** is favorable in Cyprus, thanks to: the good environmental and climatic conditions, availability of adequate sea areas at a reasonable distance from the coastline, the existence of appropriate infrastructure, skilled human resources and access to research facilities
11. **8 food and wine Cyprus products registered in the EU**
12. **Four different wine regions** have been designated as producing their own unique product **with controlled appellations of origin**
13. **Cyprus wines territory** is one of the few places left in the world that is **free from phylloxera**, the pest dreaded by winemakers worldwide

Weaknesses

1. **Landholdings** are generally small, highly fragmented, and dispersed under traditional laws of inheritance
2. The **fishing industry** is small, indeed most fish is imported
3. Cyprus' has the **lowest share of young farmers** in the total number of farm managers in the EU in 2016 (1.3%)
4. **Low contribution of the agricultural sector in the GDP**: agriculture, forestry and fishing accounts only the 2% in the GDP
5. In Cyprus the **total number of farms** declined between 2005 and 2016 as well as the agricultural area and the number of livestock whom increased the units **livestock density**
6. The operation of SMSs is characterized by the **luck of cooperation with other enterprises as well as research centers**. There is a missing link between research and the introduction of innovations at operational level
7. The agri-food **trade balance** in Cyprus is **negative**
8. Cyprus has the most **sales of veterinary antibiotics** in the entire European Union
9. Drawbacks of the **fresh produce supply chain**, especially regarding traceability
10. **Market price distortion**s and information asymmetry
11. Long standing **unfair trading practices**
12. Lack of adequate training and guidance, inadequate record keeping on farms, **lack of accurate data** to make informed decisions in the agri-food sector
13. Orounda Complex area, faces **intense problems with Animal-By-Product (ABP) waste management**, due to high numbers and density of the livestock farms, the insufficient existing treatment in open lagoons and the limited land availability for discharging treated effluent

Opportunities

1. **Tourism** accounts for over 20% of GDP directly and indirectly; 340/365 sunny days, 24°C average temperature
2. First per capita among EU members competing for **funds from Europe**'s largest research and innovation programme, Horizon 2020
3. Ideal weather conditions, strategic location and favourable tax regime allow Cyprus to retain its long-standing position as a **premier ranking international financial centre**
4. Cyprus is ne of the world's major **producers of solar energy**
5. Relatively high **R&D expenditure** to promote sustainable agricultural production
6. Use of **non-conventional water resources**, such as desalination units and water reuse
7. **Anaerobic digestion** for the treatment of animal waste
8. The **Common Agricultural Policy (CAP) 2023-2027** aims to foster a sustainable and competitive agricultural sector
9. Cyprus will receive fundings to accomplish the **EU Green Deal** targets, **Farm to Fork Strategy** and the **Biodiversity Strategy** by 2030
10. The **Cyprus Recovery and Resilience Plan (RRP) 2021-2026** set down a realistic plan for the effective utilisation of 1,2 bln euros
11. **Smart agriculture** and **Internet of Food (IoF)** technologies will make farms more productive and cost competitive

Threats

1. **Energy dependency** on imported sources: high cost of electricity and high dependency on fossil fuels for energy with the biggest share within the EU
2. Relatively **high unemployment rate** after the economic crisis: 9.1% is the forecast for 2021
3. **High public debt**: 108.1% forecast for 2022
4. **Systematic corruption**
5. **Cyprus imports all the petroleum needed** to power vehicles as well as to generate electricity
6. The island is **one of the most water-scarce countries in the world** with a semi-arid climate and limited natural water resources
7. Cyprus produces almost twice as much **greenhouse gas emissions** as the European average
8. **Waste management**: the country is the third largest generator of municipal waste in the EU and majority of the country's waste (approx. 80%) are landfilled
9. Unsustainable levels of **groundwater abstraction**, and not substantial infrastructure investments in dams, seawater desalination and wastewater reuse to maintain water security
10. **Dependence on limited** and vulnerable **sectors of economic activity**
11. Cyprus lags behind in **ultrafast broadband coverage**, fast broadband uptake and ultrafast broadband uptake, and the broadband price index
12. Most of the existing **buildings** have a **low energy efficiency** rating with no energy-saving measures
13. High dependency on private vehicles and high levels of aging vehicles, there is a **lack of sustainable mobility** and alternative environment friendly fuel infrastructure
14. Over 10% of Cypriots have never used the internet, and one in two **lack basic digital skills**
15. Higher **skills mismatch** in the areas of which require high levels of technical competency

SWOT Analysis related to the cypriot Agri-food sector.

4.3 T.O.W.S. strategies

TOWS Analysis is a variant of the classic business tool, SWOT Analysis created by Heinz Weihrich.
TOWS analysis first correlates internal and external factors to help organizations determine the appropriate strategic options to pursue. By combining the opportunities and threats of the external environment with the strengths and weaknesses of the internal organization, four main strategies can be proposed. It helps organizations know how to seize opportunities, mitigate threats, overcome weaknesses and capitalize on strengths.

Four TOWS strategies:

1. Strengths/Opportunities (SO)

For each opportunity, consider all the strengths listed in the SWOT analysis one by one to determine how each internal strength will help you capitalize on each external opportunity.

2. Strength/Threats (ST)

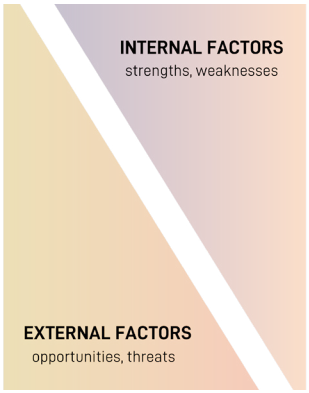
Consider all strengths one by one listed in the SWOT Analysis with each threat to determine how each internal strength can help you avoid every external threat.

3. Weaknesses/Opportunities (WO)

Consider all weaknesses one by one listed in the SWOT Analysis with each opportunity to determine how each internal weakness can be eliminated by using each external opportunity.

4. Weaknesses/Threats (WT)

Consider all weaknesses one by one listed in the SWOT Analysis .



Strengths

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S-O strategy

1. Creation of a **National Commercial Identity and promotion of** the traditional product **"halloumi"**
2. Enhancing the added value of the tourism sector including small and medium enterprises under the **Quality Label "Taste of Cyprus"** to rewards the compliance to specific and commonly accepted quality criteria
3. Thematic Route **Aphrodite – Inia "Authentic Experience Route"** of 300 kilometres, this route will be promoted as the "Signature Brand Experience" of the country
4. Construction of a **collaborative marine aquaculture infrastructure** (port and land facilities) in **Pentakomo** coastal area
5. The **strat-up of the cannabis industry** bring a new 'cash-crop' to Cyprus agriculture creating new jobs across the entire supply chain
6. Enhancing the productivity and sustainability of the primary production sector through the promotion of **agrotechnology**
7. Advanced reproduction and **genomic improvement of sheep and goats** to optimise the production of dairy products
8. Introduction of **ICT and wireless solutions in rural areas** to help develop new local business models (like rural tourism or smart agriculture)

W-O strategy

1. Development of the **Orounda regional Livestock Waste and Animal-By-Product (ABP) Management Facilities**
2. Cloud-based information technologies in order to develop an **online trading platform** that will record fresh produce entering the local market and moving along the supply chain
3. **Revitalising traditional minor crop**, such us the **indigenous carob genetic resources** and developing **food, beverages and medicinal products of high added value** (prickly pears, pomegranates, carobs, aloe vera)
4. **Industrial Cannabis can provide concrete solutions for ensuring nutritious food; environmentally friendly non-food products; clean air and soils**

S-T strategy

1. Greater water security thanks to the development of the **latest desalination and recycling technologies**
2. Cyprus cannot compete with countries that produce huge volumes at low cost, but the country can shine in **organic farming, bioproduction and superfoods**
3. Ensuring adequate and uninterrupted supply of good quality potable water, maximizing the infrastructure for sewerage collection systems, sewage treatment and **reuse of treated effluent to be re-used in agriculture**

W-T strategy

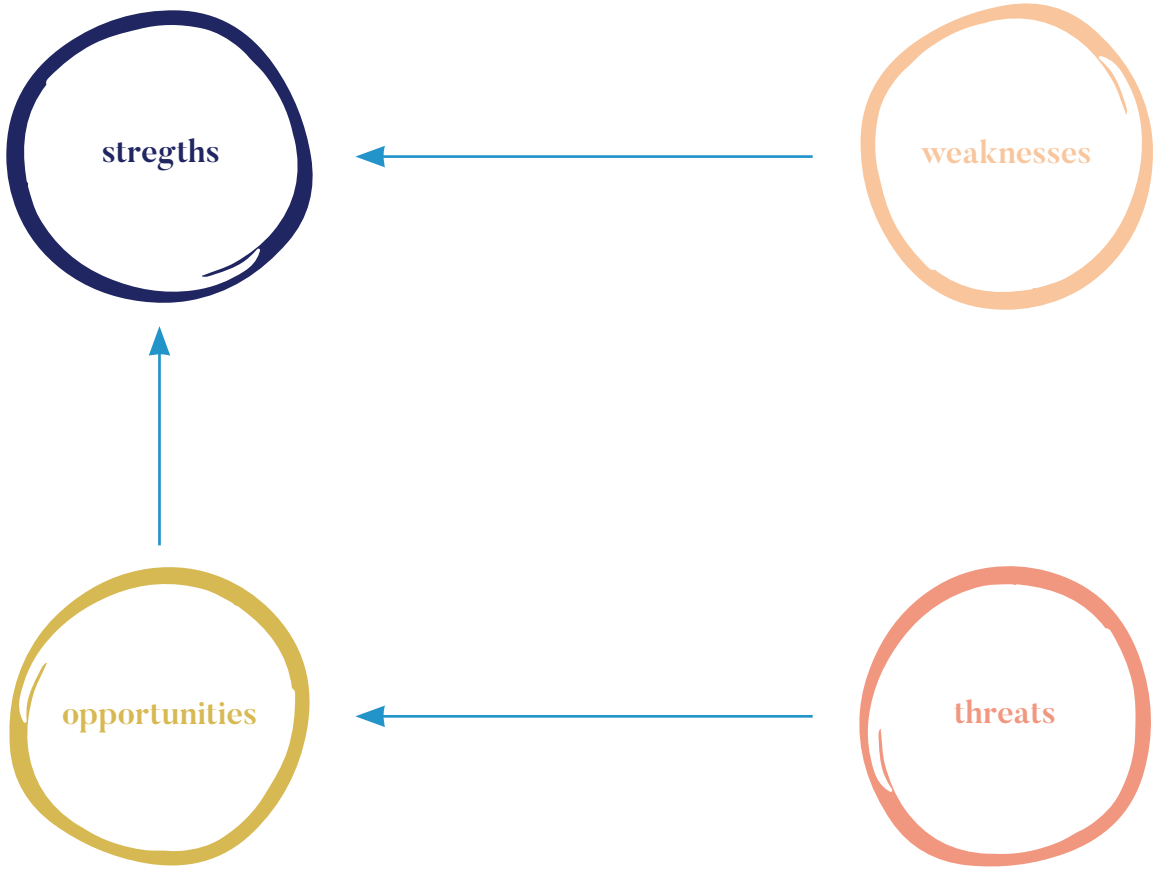
1. Cyprus can achieve **commercial success in niche markets** such as wine industry, so a winning action is **revitalising viticulture** to bring back traditional local varieties of grapes
2. **Increasing the biodiversity in agricultural ecosystems** by **looking at traditional species no longer grown in Cyprus** like corn, barley, ancient wheat, chickpeas and cowpeas
3. Announcement of new joined **Masters' and/or PhDs in the wider domain of Agriculture**
4. Repatriating manufacturing processes, (textiles in particular) and fostering innovative value chains (construction materials, food production, cannabinoids extraction) the **Industrial Cannabis sector could deliver long term sustainable growth and create highly skilled jobs** across the EU rural economies

4.4 Project matrix

Following the SWOT analysis, all aspects of the Cyprus agri-food sector emerged as strengths, weaknesses, opportunities and threats. These factors internal to the system (strengths, weaknesses) are compared with factors external to the sector (opportunities, threats) and therefore properties of the Cypriot context.

This procedure is called TOWS analysis and serves to outline the strategic actions to be implemented to intervene in the scenario in question. Thanks to the scientific analysis conducted so far, in addition to the holistic diagnosis of the territory and the study of the legislative directions that the Republic of Cyprus will undertake on the subject, it has been possible to define a project matrix, in which the main challenges for the sustainability of the agri-food sector, and consequently of the island, have been cataloged according to the ecosystem services to which they respond. For each challenge, one or more intervention proposals emerged.

The main idea, upstream of these intervention strategies, is to be able to transform the weaknesses of the Cypriot agri-food system into strengths, while the threats external to the agri-food supply chain into project opportunities so that they can be implemented becoming internal strengths of the system.



	Natural ecosystem indicator	Category	Challenge	Strategy proposal	Description
Supporting	soil formation	W - O	The **soil can be contaminated by** both the **use of fertilizers in open field cultivation to feed animals and the use of livestock manure**, resulting in nutrient overload (NO3) on the aquifers and accumulation of metals in the soil from animal manure (Cu and Zn). Moreover Cyprus soil has a really low organic matter content (>1%).	Green organic waste and livestock organic waste, should be co-composted with agricultural pruning to **produce organic soil amendment** for application in agricultural land. The **Orounda Livestock Waste and Animal-By-Product (ABP) Management Facilities** will reduce methane and N2O emissions by treating livestock waste through anaerobic digestion and produce energy with the produced biogas.	- **Co-composting of sheep and goat manure with agricultural pruning** and park and garden waste to produce **high-quality compost.** - **Co-composting of anaerobic digestate and aerobic sludge** with agricultural pruning and park and garden waste to produce of **organic soil conditioner.**
	nutrient cycling	S - O	**Cyprus ranks last among EU countries in the indicators measuring nitrogen and phosphorus in agricultural land**, causing surface and groundwater pollution. The island also has the **most sales of veterinary antibiotics and pesticides in the entire European Union**.	**Industrial Cannabis** can play a crucial role in a new greener and more sustainable society by providing concrete solutions for ensuring nutritious food; environmentally friendly non-food products; clean air and soils.	- Used as a catch crop, **hemp improves the yields of subsequent crops and restores soil health**: thanks to its root system it has the ability to **remove heavy metals from soils**. - Hemp needs fewer inputs than most other fibre crops: **water, pesticides and herbicides are used in low doses**. Manure and other natural fertilisers represent 50% of the total fertilisers use. Organic is on the rise.
Regulating	water purification & wastre treatment	S - T	The island is **one of the most water-scarce countries in the world** with a semi-arid climate and limited natural water resources. Livestock waste management in Cyprus is particularly important to achieve a close-loop operation, minimise externalities and recover nutrients for soil improvement, reduce pressure on water resources and minimize environmental impact.	The **wastewater treatment plant** will produce water that will be supplied to farmers for irrigation from **Orounda Livestock Waste and Animal-By-Product (ABP) Management Facilities.**	- **Treated effluent** resulting from the anaerobic digestion shall be **used for irrigation purposes** of local arable land **and the production of animal feed** to cover the needs of the local livestock. - **The water will be supplied for free to the local water grid**, this eliminates the need to purchase extra services regarding its handling.
	air quality regulation	W - O	Cyprus produces almost **twice as much greenhouse gas emissions as the European average**, so improvements can be done also in **livestock and agriculture sector**, since **are the main contributors for NH3 emissions. Most livestock wastewater is currently directed to open lagoons** that often operate under anaerobic conditions, thus, **generating odours and emissions** pose a **constant nuisance to the neighbouring local communities**, raising significant social and environmental concerns.	**Licensed production of Industrial Cannabis** can absorb high CO2 levels reducing green gas emission. The promotion of the anaerobic digestion of the manure in the farms like **Orounda Livestock Waste and Animal-By-Product (ABP) Management Facilities** will contribute to reduce the ammonia emissions and not only.	**- Hemp is an impressive carbon sink**: while the plant fixes CO2 in the soil, thanks to its deep root system, its derived biomaterials further increase the overall capture balance of the crop. **One hectare of hemp can capture up to 13.4 tons of CO2,** making it as efficient as one hectare of tropical forest. - **Anaerobic digesters** with pasteurisation and pressure sterilisation.
	water regulation	S - T	Cyprus supplements its low natural water supply with **desalinated seawater** to meet drinking water needs. This is an **energy-intensive process**, costly and polluting, relying on fossil fuels and **contributing to greenhouse gas emissions**. Both the **agriculture and tourism sectors consume large volumes of water** (64% and 5% respectively) and there is room for efficiency improvements. **Unsustainable levels of groundwater abstraction**, and substantial infrastructure investments in dams, seawater desalination and wastewater reuse to maintain water security.	Promotion of **non-conventional water resources**, such as desalination units, **potable water reuse** (process of using treated wastewater for drinking water) and water reuse for domestic and irrigation uses. Increase the efficiency of water use in agriculture by applying **intelligent systems for recording and managing irrigation systems.**	- Utilize recycled water in agriculture by constructing a **clay tank for the storage of excess recycled water from the sewage treatment plant in Anthoupolis** and the establishment of a **primary and secondary distribution network**. - The implementation of IoT and IoF technologies (**smart irrigation systems, precision farming**) will reduct water use of 5% - 10% in agriculture. - Encourage **organic farming** and the **cultivation of valuable products** such as prickly pears, pomegranates, carob trees, cannabis, aloe vera and others that grow well in the dry climate of the island.
Provisioning	food	S - O	The agricultural sector in Cyprus, including forestry and fishing, represents only the 2,3% of the national GDP. **The agri-food trade balance in Cyprus is negative**; cereals and oilcakes are the main products imported by Cyprus from non-EU countries, while main imports from EU member states are beverages (spirits, liqueur, water and soft drinks). The fishing industry is small and most fish is imported.	The **development of the aquaculture sector** is favorable in Cyprus and it could lead to a greater fish independence. Cyprus can achieve commercial success in niche markets by the systematic **cultivation of long-overlooked fruit and vegetables.**	- Construction of a **collaborative marine aquaculture infrastructure** (port and land facilities) **in Pentakomo coastal area**. - Creation of a **National Commercial Identity and promotion of** the traditional product **"halloumi"**. - **Genetic improvement of the Cyprus sheep and goat population**. - **Improve the indigenous carob genetic resources** and developing food, beverages and medicinal products of high added value. - Increase the biodiversity in agricultural ecosystems by **looking at traditional species no longer grown in Cyprus** (corn, barley, ancient wheat, chickpeas and cowpeas, local varieties of grapes). - **Enhancing** the existing isotopic databases of Cypriot **local traditional food/drinks, by developing** a **Block Chain platform**, to ensure their identity.
Cultural	recreation & eco-tourism	S - T	Cyprus's **travel and tourism sector accounts for over 20% of GDP** directly and indirectly and is currently reliant on **"sun and sea" international visitors**, resulting in **overcrowding during peak periods** and in **underuse of tourism infrastructure in off-peak periods**. **Overexploitation of attractions and oversaturation of tourist areas** and peaks of demand for water and energy, combined with Cyprus' poor water and waste management and reliance on fossil fuels are **reducing the sustainability of the tourism sector**. The **lack of diversification** in this sector could expose the country to a **demand shock** due to economic, social and political developments.	Developing a strong sustainable tourism (**agro-tourism**) and creation of **networking and promotion tools for Cypriot products and services. Four different wine regions** have been designated as producing their own unique product **with controlled appellations of origin,** while **8 food and wine Cyprus products registered in the EU.**	- **Thematic Route Aphrodite – Inia "Authentic Experience Route"** of 300 km, this route will be promoted as the "Signature Brand Experience" of the country. - Enhancing the added value of the tourism sector including small and medium enterprises under the **Quality Label "Taste of Cyprus"** to rewards the compliance to specific and commonly accepted quality criteria.

Project matrix for the agri-food sector in Cyprus; the main challenges of the system are faced implementing new proposals.

4.5 Relevant opportunities

Fostering the biodiversity heritage

Innovation has helped revive traditional small-scale crops or crops abandoned by the advent of high-intensity agricultural systems. For example, the University of Cyprus (UCY), the Agricultural Research Institute (ARI) and the Central Research Institute of Chemistry are currently jointly screening local carob genetic resources and developing high value-added foods, beverages and pharmaceuticals. The carob tree, once nicknamed "black gold" but gradually abandoned over several decades, is making a comeback. The UCY project planted 6,000 carob trees in November 2017, and 34,000 more on land leased by the forestry department in Orites, Paphos, to create the island's largest organic carob farm. ARI, which works with numerous international organizations and has five pilot stations in Cyprus, is also conducting research on how Cyprus can increase crop biodiversity while improving yield, quality, sustainability and taste. The goal is to increase the biodiversity of agricultural ecosystems by considering traditional species that are no longer growing in Cyprus as these older species (genotypes). It has the right properties to diversify crops and improve the quality of products available to consumers. Scientists in this European research project are testing experimental breeding techniques to identify plants that have adapted to the scorching Cyprus heat and water scarcity. "More than 20 varieties are grown in the experimental field, spread over approximately 11 hectares, including corn, barley, stale wheat, chickpeas and eastern beans" (http://www.cyprusprofile.com). The most promising candidates will be naturally crossed to produce drought-tolerant varieties. The project's goal is to help local farmers expand their products into potential new markets, and the researchers predict that by 2023 the new crop may become a European market reality[47].

Cannabis Opportunities

The many tax planning opportunities and other benefits of doing business and living in Cyprus are well documented. The country's impressive achievements in attracting highly qualified professionals, foreign investors and businesses are commendable and clear. Best of all, ideal weather conditions, strategic location and favorable tax regime allow Cyprus to maintain its long-standing position as a first-class international financial center. Of course, without careful advance planning and planning, in 2016 the government passed the "Industrial Hemp Production and Trade Act 2016", which allowed the licensed production and export of industrial cannabis[48]. Under the European Green Deal, industrial cannabis could play an important role in a new, greener and more sustainable society by providing concrete solutions to deliver nutritious food, environmentally friendly non-food products, clean air and soil. By repatriating production processes (especially textiles) and developing innovative value chains (building materials, food production, cannabinoid mining), the industrial cannabis sector will create long-term sustainable growth and create highly skilled jobs in the EU rural economy. In short, combining locally sourced raw materials with global know-how[49].

Hemp pickers in Akaki harvesting the crop, Cyprus. Image: Cyprus-mail.com

Carob tree in Orites, Paphos. Image: Cyprus-mail.com

Carob pods, seeds and chips are called 'The black gold'. Image: Bible Belt Balabusta

Developing Aquaculture

Cyprus has a long tradition and history of fishing despite its limited contribution to GDP. Nevertheless, aquaculture is an important activity, accounting for about 80% of all fishery production and value. The aquaculture sector includes 9 marine and 7 inland farms, 3 hatcheries, 1 shrimp hatchery and 2 other inland ornamental farms located in the mountainous Troodos region. Offshore cage aquaculture (aquaculture) accounts for approximately 90% of total sales, and strong growth in this sector is expected to attract additional investment through active marketing at home and abroad. The main commercially aquacultured marine species are sea bream and European sea bass, accounting for approximately 70% and 30% of total production respectively. About 65% of the country's total marine life production is exported to markets in Europe, the Middle East and the United States, with the remainder consumed domestically. The main factors favorable to the development of the aquaculture sector are the favorable environmental and climatic conditions of Cyprus, "the availability of suitable marine areas at reasonable distances from the coastline, adequate infrastructure, access to qualified personnel and research facilities" (http://www.cyprusprofile.com). In Cyprus the financing of the European Maritime and Fisheries Fund (EMFF) is primarily aimed at ensuring the competitiveness and environmental sustainability of the aquaculture sector through the development of joint support facilities and infrastructure, investments to improve the efficiency of aquaculture facilities, promotion of aquaculture products to new markets and development of offshore spaces. According to the EMFF, aquaculture activity in Cyprus will triple by 2023, contributing to food security, environmental protection and employment.

Revitalising Viticulture

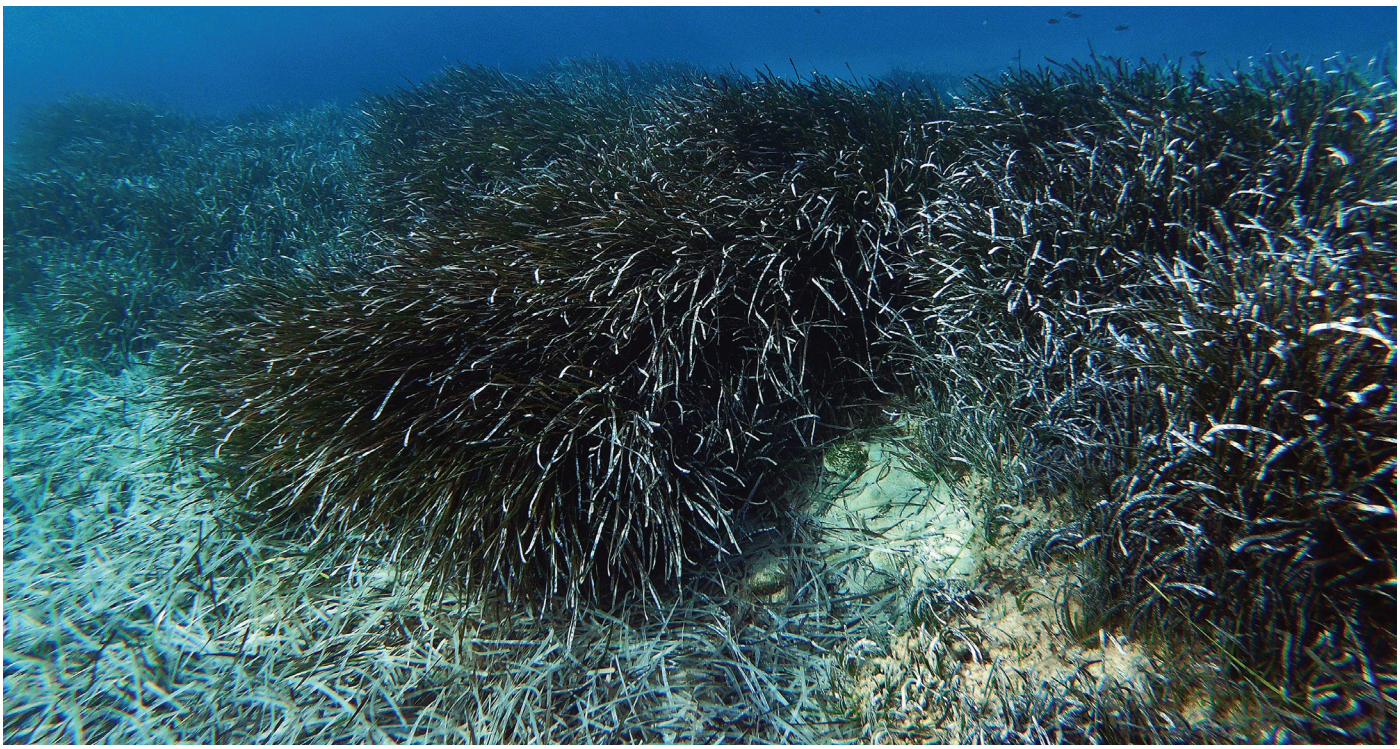
In the 1980s, the country launched a campaign to phase out local grapes in favor of foreign varieties like Chardonnay, Sauvignon, Merlot, Grenache and Syrah, believing they would be more exportable. Fortunately, the trend reversed after Cyprus joined the EU in 2004 and the Union focused on highlighting local products from its member states. A program was adopted to save native varieties that have been cultivated for centuries and are threatened with extinction. Efforts to save the legacy of Cypriot viticulture have been enormous. Success, and with the country now producing interesting vintages, the reputation of Cypriot wine and this new territory is rapidly growing around the world. Four different wine regions have been identified to produce their own unique Denomination of Origin product. Different proportions of native Cypriot red grape varieties such as Maratheftiko, Ofthalmo or Mavro or the white Xynisteri grape are blended with smaller amounts of specific foreign varieties such as Cabernet Sauvignon, Cabernet Franc, Syrah or Merlot. The unique landraces and local character of Cypriot wines reflect the country's terroir, which is also one of the few places in the world free of phylloxera, the plague feared by winemakers around the world.

Posidonia Oceanica seagrass

Posidonia Oceanica is a seagrass native to the Mediterranean, protected by European Union law, that protects and nurtures the rich biodiversity serving diverse marine and coastal ecosystem services. Posidonia Banquettes are often perceived as a nuisance, but they are actually key to the health and resilience of coastal ecosystems. Posidonia sheds its leaves on a regular basis throughout the year, mainly in the fall and winter. Leaves and plants removed during this natural stripping are carried ashore by the action of waves and high water levels associated with storm surges and strong terrestrial winds. As a result, large amounts of Posidonia kelp (leaves and rhizomes) can deposit on beaches and rocky shores. It is estimated that up to 7,000 tonnes of seaweed deposits can be present on some Mediterranean beaches in winter (eg Spain, Italy, this work)[50]. Accumulation of such seagrass deposits on the beach is a major problem for the majority of local Cypriot governments. Banks and scattered Posidonia are commonly removed in many places as part of beach cleaning activities and are often removed for aesthetic reasons (odor, appearance, reduced beach usage, etc.) and landfilled. Removal of Posidonia seagrass poses many challenges to communities and other stakeholders, but it also entails significant economic costs and ecosystem impacts.

[48] EIHA. (2020). The Hemp Manifesto. Cnbc, April. (http://www.cnbc.com/id/30685661/)
[49] CYPRUS CANNABIS ASSOCIATION (CYCA) (https://www.cy-ca.org/cyprus-cannabis-association-cyca/)
[50] Fund, R. D. (n.d.). Governance and beach-dune Posidonia management of systems.

Local vineyard in Cyprus. Image: www.lofficiel.cy



Posidonia Oceanica seagrass. Image: www.posbemed.interreg-med.eu

Goat dairy industry

The sheep and goat enterprise are a precious cattle market in Cyprus. It contributed approximately 20% to the entire value of animal manufacturing in 2018, with normal area manufacturing valued at 77 million € (yearly evaluation of the sheep and goat area, 2018). Specific traits in the sheep and goat market set the level for some of demanding situations that want to be addressed for the system to end up sustainable and to have top potentialities for the future (Papachristoforou, Markou, 2016). First, the wide variety of farms is declining, and the farmer populace is ageing. Additionally, the variable climatic conditions (specially the common droughts located) cause uncertainty in roughage manufacturing and withinside the availability of herbal vegetation. Global traits and excessive costs of animal feed also are a main trouble for the sheep and goat area. One positive trait of sheep and goat farming is that it in large part remains a family business, with little or no employed labour. In addition, this industry is tightly related with traditional and local products along with the Halloumi cheese, recognised with a Protected Designated Origin (PDO), other cheeses and yogurts. These products are part of a strong culture that, both locally and internationally, has been the motor of the sector due to the great demand for halloumi cheese in more than 40 countries abroad at a time when the economic factors are unfavorable to sheep and goat farmers. Sheep and goat milk corresponds to 22% of general milk manufacturing in Cyprus and to approximately 8% of the entire market of animal manufacturing in the island. Only 20% of milk produced is processed on farm, whilst the remainder is sold to dairies and used for manufacturing of the traditional Halloumi cheese and different cheeses (Anari, a kind of whey cheese, Kefalotiri for yogurt)[51].

Industrial symbiosis for valorising food waste

Waste = food

Both literally and figuratively. Food waste is not an absolute concept: food can be reused. Also waste could and should be used as feedstock for industrial production loops.

Principles of circular economy: what about waste?

• Design out waste

In principal, waste does not exist when product designed to fit within a cycle of remarketing, remanufacture, disassembly or repurposing. Example: non-toxic biological materials composted or anaerobically digested, polymers/alloys/other man-made materials recovered or upgraded.

• Cradle to Cradle® design concept: a "biomimetic" concept where the product is designed with its full "life circle" in mind-mainly two feedback loops are defined.

1) Biological cycle where materials are returned to the biosphere in the form of compost or other nutrients, from which new materials can be created.

2) Technical cycle where materials that are not used up during use in the product can be reprocessed to allow them to be used in a new product.

Manufacture of fermented whey-based products enriched with banana flour

The synergistic use of mixed Hallumi cheese whey and Ugandan banana residues as fermentation media toward the development of novel foods in a biorefinery approach to asses the contribution of green banana flour to the physicochemical characteristics of the fermented whey-based yogurt-like products during refrigerated storage.

• Contribute to diversification of cheese and banana industries by creating more market opportunities that will boost the local and global economies.

• Compared to different regions, whey from Cypriot dairies gives excessive lactose content material and consequently super capacity for product-pushed biorefining.

• Moreover, banana flavour is one of the maximum favored flavours in dairy merchandise[52].

[51] Hadjipavlou, G., Tzouramani, I., & Ligda, C. (2021). Impact of Diverse Technical and Economic Factors on Sustainable Farmer Market Choices: The Case of Cyprus Sheep and Goat Milk Channel Choice. Journal of Innovation Economics & Management, n°34(1), 57. https://doi.org/10.3917/jie.034.0057

[52] Sofia Lalou, Adamantini Paraskevopoulou, F. M. (n.d.). Sustainable utilization of orange peels through the production of bioflavour.

[53] Michalis Koutinas, Food Waste Valorisation for the Production of Added-Value Commodities: Focus on Citrus Peel Waste as a Feedstock for Sustainable Biorefineries

Valuable food waste streams in Cyprus

Citrus Peel Biorefinery

Citrus, with potatoes, is the principal export crops of the island and about 60% of all farms in Cyprus produce olives, citrus fruits or has permanent crops combined.

Latest avaliable data for citrus waste in Cyprus depict the situation in 2010 as follow[53]:

• 15,000 tons solid waste

• 25,000 tons liquid waste

Biorefinery technology allows to gain important sub-products from lemon and orange peels, such as:

- Essential oils (food flavorings)
- Pectin (multiple food applications)
- Cellulose & hemicellulose (various applications)
- Succinic acid & ethanol

Biogas production from dairy sector and hemp hurds

Whey serum blended with pork mannure as a renewable raw material for biogas production.

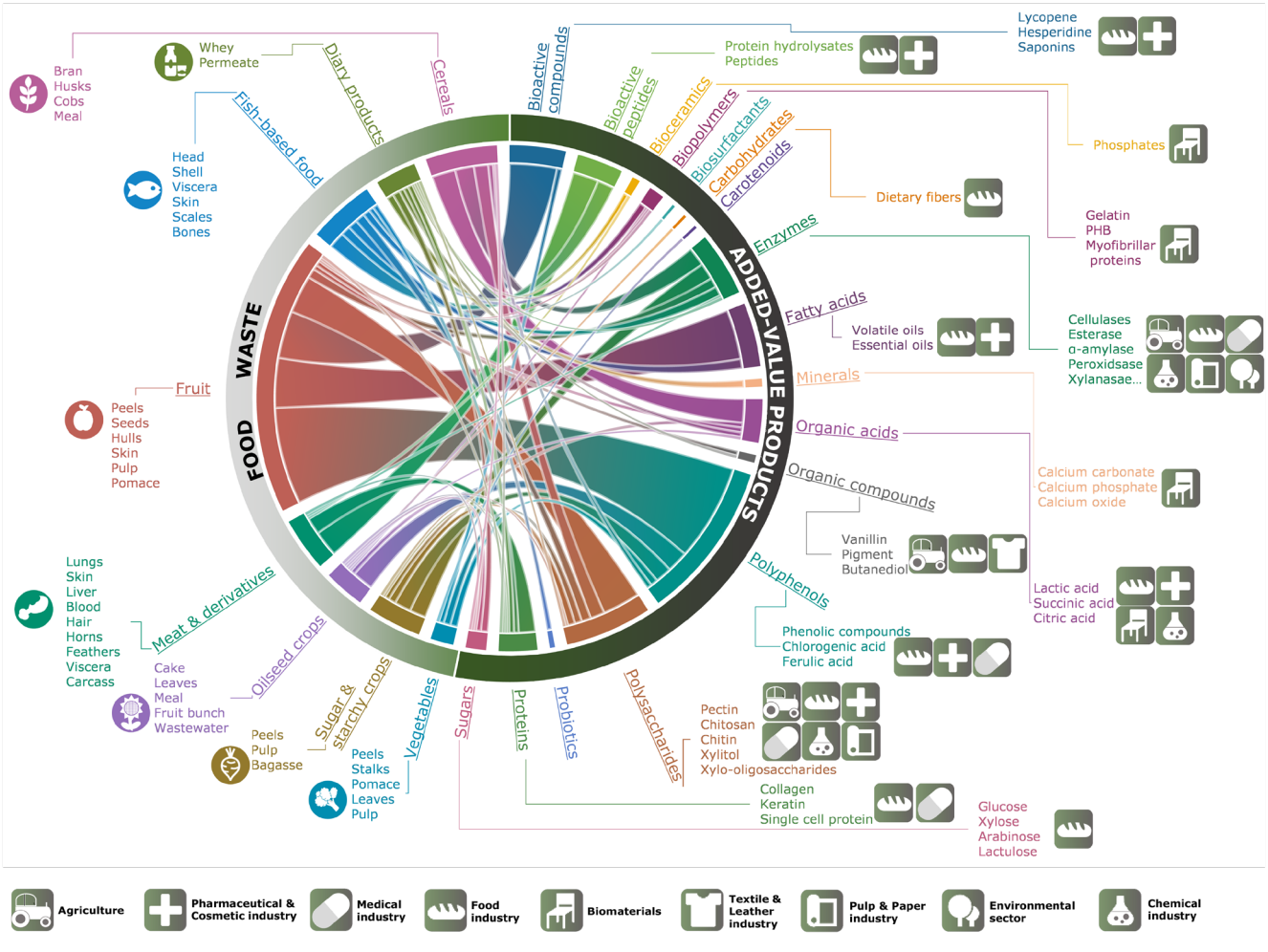
Whey serum storage in silos

- Monthly 750,000m^3 as waste – costing €2,500
- Currently used for biogas and animal feed production

Animal feed from cheese whey

• Whey blended with pig feed

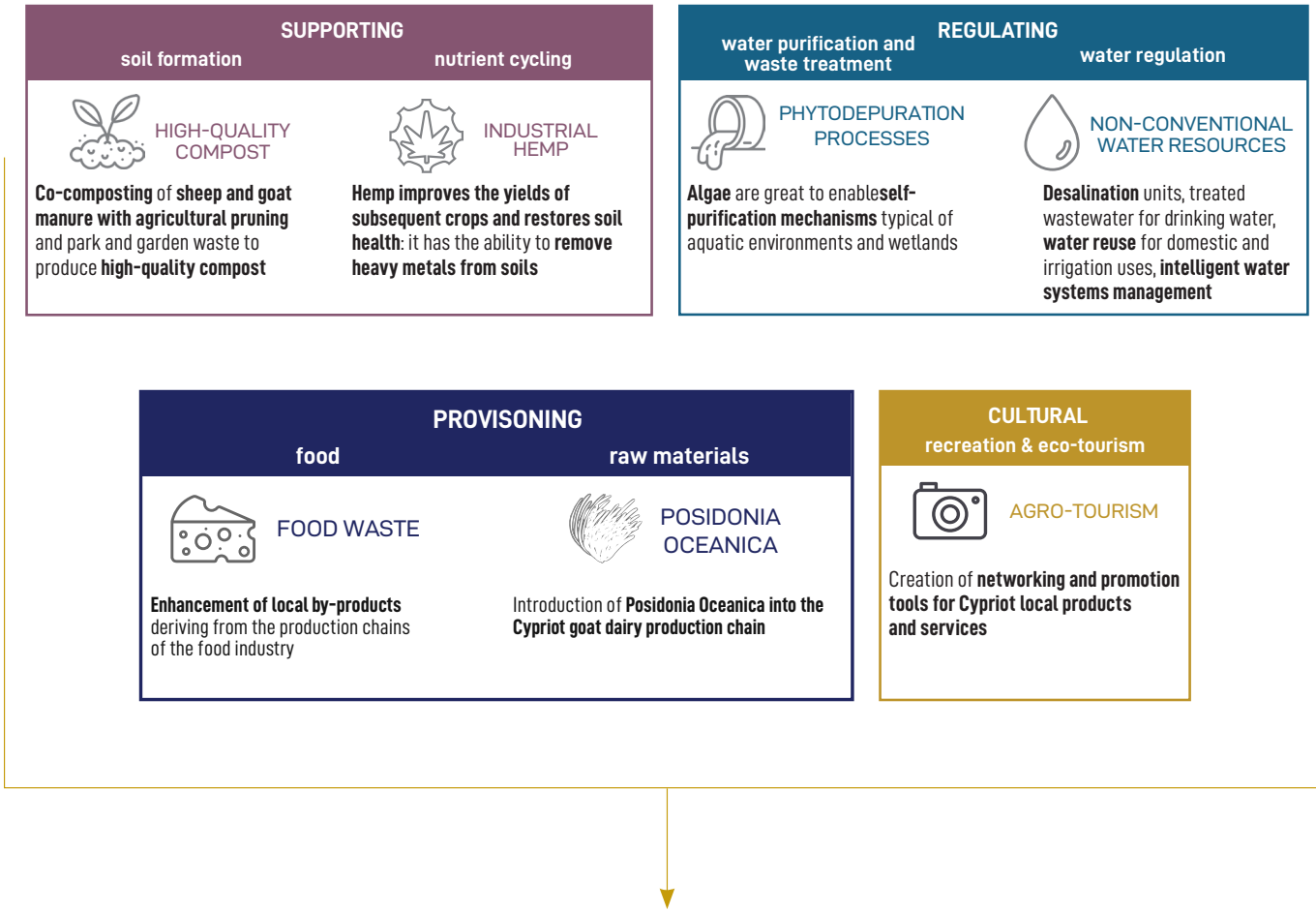
• Pig feed softens in texture



Potential pathways to valorise food waste into added-value bio-based products and the sector of application. The thickness of the connecting lines represents the number of different pathways tested, as documented in the scientific literature. Source: European Commission's Knowledge Centre for Bioeconomy, https://ec.europa.eu/knowledge4policy/bioeconomy

4.6 Valuable outcomes

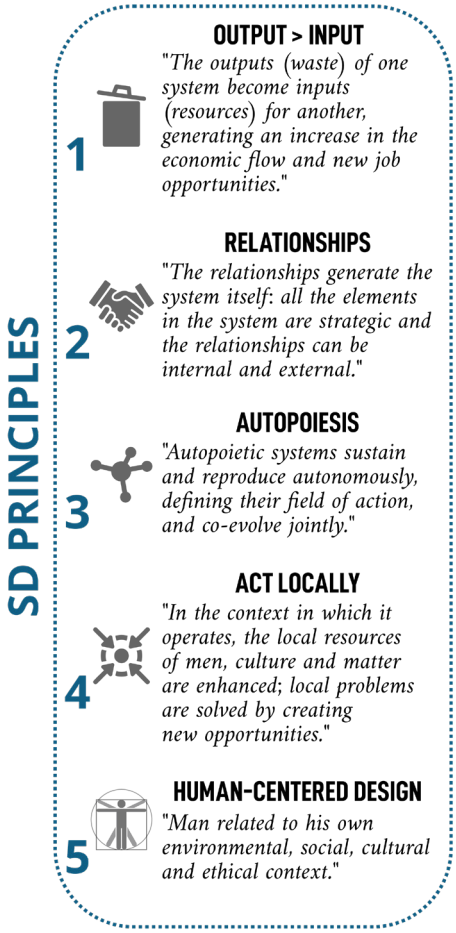
The Cypriotagri-food opportunities are emerged crosscutting the territorial information for the sector with the main funded policies the Cypriot agri-food sector will receive in the next years.
All the chances arised are classified according to the natural ecosystem service they belong to.

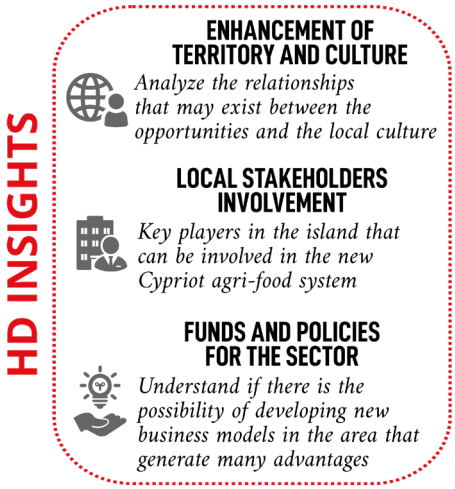


Cypriot agri-food opportunities emerged by natural ecosystem service

Multicriteria analysis

The multicriteria analysis gave the tools to evaluate the opportunities even in relation with the five systemic design principles and the Holistic Diagnosis points of views.





Multicriteria analysis

	CYPRIOT AGRI-FOOD OPPORTUNITIES EMERGED BY NATURAL ECOSYSTEM SERVICE	SUPPORTING		REGULATING
		soil formation	nutrient cycling	water purification and waste treatment
SD PRINCIPLES		HIGH-QUALITY COMPOST	INDUSTRIAL HEMP	PHYTODEPURATION PROCESSES
		Co-composting of **sheep and goat manure with agricultural pruning** and park and garden waste to produce **high-quality compost**	**Hemp improves the yields of subsequent crops and restores soil health**: it has the ability to **remove heavy metals from soils**	**Algae** are great to enable **self-purification mechanisms** typical of aquatic environments and wetlands
1 OUTPUT > INPUT		- Livestock liquid waste and ABP biomass are transformed into biogas and energy - Heat recovering to cover the thermal energy demand of the system - Treated effluent used for irrigation and animal needs - Livestock solid waste is processed into compost	The real added value of hemp is the **possibility to use the whole plant**. Talks, roots, leaves, flowers and seeds can be transformed and used in: textile, paper, ropes, insultation material, fibre boards, bioplastics, compost, animal bedding, fuel, paint, feed, food, cosmetics, medicinal preparations.	**Waste water treatment from livestocks, agriculture activities and manufacture of food** is necessary to achieve a close-loop operation in the agri-food sector. The wastewater after being properly purified can be used for different purposes except drinking.
2 RELATIONSHIPS		- Farms - Agri-food companies - Fruit growing - Horticulture gardens - Renewable energies - Stores	Hemp can provide a concrete solution for ensuring nutritious food, environmentally friendly non-food products, clean air and soils. Consequently, the **whole economy of rural areas could be positively impacted**.	The collected, treated and recycled **water can be supplied for free to the local water grid**, this eliminates the need to purchase extra services regarding its handling.
3 AUTOPOIESIS		- Produce compost and improve agricultural land - Combat desertification at the local level - Reduce odour annoyance of local communities - Reduce GHG emissions - Produce water for irrigation and minimise water abstraction	Hemp needs fewer inputs than most other fibre crops: **water, pesticides and herbicides are used in low doses**. Manure and other natural fertilisers represent 50% of the total fertilisers use.	Spirulina and Chlorella Algae are great supplements of chlorophyll and vitamins. **Spirulina** grows thanks to Co_2 and heat, while **Chlorella Vulgaris** grows in saline wastewater coming from demineralisation of **cheese whey**.
4 ACT LOCALLY		**8 local communities** of the Orounda complex will directly benefit from the new facilities, moreover it will serves **50 livestock farms** (40% piggeries, 35% sheep and goat farms, 15% poultry farms and 10% cattle farms).	By **repatriating manufacturing processes** (textiles in particular) and **fostering innovative value chains** (construction materials, food production, cannabinoids extraction), the sector could deliver **long-term sustainable growth** and **create highly skilled jobs across** the EU **rural economies**.	**3 municipalities** will directly benefit of irrigation water for new high efficiency crops (mainly livestock plants) and traditional agriculture thanks to the Eastern Nicosia infrastructure for wastewater treatment's effluent re-use.
5 HUMAN-CENTERED DESIGN		From the farmers point of view there would be a huge **economy and energy savings.** The waste treatment system of the island could have numerous benefits from this change of paradigm.	In a mature hemp value chain, with adapted varieties and the **possibility to harvest the whole plant** (flowers/seeds, leaves and stalks), the economic benefits for farmers and the environment would be undeniable.	From the farmers point of view there would be a huge **economy and energy savings.** The waste treatment system of the island could have numerous benefits from this change of paradigm.
HD INSIGHTS ENHANCEMENT OF TERRITORY AND CULTURE		In addition to the Orunda complex, high-quality compost can be produced by countless players in the Cypriot agricultural sector.	Possibility to **gain green energy** from renewable sources such as the anaerobic digestion and **co-digestion of of cheese whey (Halloumi) and hemp hurds** (cannabis manufacture).	New business where the **algae are cultivated with the CO_2 produced by food manufacture** processes while **cleaning the waste water** and then used **to produce flour or bio-oil**.
LOCAL STAKEHOLDERS INVOLVEMENT		**- Orounda Livestock Waste and Animal-By-Product (ABP) Management Facilities** **- Riverland Bio Farm, Kampia** **- Integrated waste management plant, Koshi**	The future rise of hemp cultivation in Cyprus and the largely available volumes of cheese whey, like Halloumi one, could unlock unprecedented **renewable biomethane potentials**.	**- Orounda Livestock Waste and Animal-By-Product (ABP) Management Facilities** **- Eastern Nicosia infrastructure for wastewater treatment's effluent re-use** **- Integrated waste management plant in Koshi** **- Sewage treatment plant in Anthoupolis**
FUNDS AND POLICIES FOR THE SECTOR		Cyprus recovery and resilience Plan (RRP) 2021-2026; Policy axis 3; Investment 13.	Cyprus agreement on production and trade of Industrial Hemp Law, 2016.	- Cyprus RRP 2021-2026 -Common Agricultural Policy (CAP) 2023-2027
TOTAL SCORE		26/40	27/40	29/40

water regulation

NON-CONVENTIONAL WATER RESOURCES

Desalination units, treated wastewater for drinking water, **water reuse** for domestic and irrigation uses, **intelligent water systems**

- Treated wastewater for drinking water.
- Saline water purified for drinking water.
- Purified wastewater for aquaculture to raise fishes.
- Collected water from the Air Conditioning and the dehumidifier is filtered and returned into the system.

These alternative methods of water supply involve different actors of the territory such as **agricultural realities**, food production **companies**, **aquaculture plants**, **waste treatment facilities** and **urban buildings**.

The implementation of **IoT and IoF technologies** will reduct water use of 5% - 10% in agriculture. **Precision farming** can lead to a reduction of up to 22% on total irrigation needs

All the unconventional water supply methods indicated so far can be **implemented on the island**, without resorting to foreign facilities.

Farmers, ranchers, production facilities, tourism sector and citizens can benefit from the implementation of these alternative water supply methods.

Storage of excess recycled water from the sewage treatment plant and the establishment of a **primary and secondary distribution network**. **Smart irrigation systems and precision farming.**

- **Polycarpos Vlachos camp site** in Troodos National Forest Park
- **HerbanLeaf Farms Ltd**. in Parekklisia
- **Collaborative marine aquaculture infrastructure** in Pentakomo coastal area

- Cyprus recovery and resilience Plan (RRP) 2021-2026
- Common Agricultural Policy (CAP) 2023-2027

25/40

PROVISONING

food

FOOD WASTE

Enhancement of local by-products deriving from the production chains of the food industry

- **Manufacture of fermented whey-based products** enriched with local fruit waste flour (yogurts).
- **Citrus peel waste biorefinery** to produce essential oils, multiple food applications, cellulose, succinic acid & ethanol.
- **Clean energy from biowastes.**

Construction of a **collaborative marine aquaculture infrastructure, increase the diversification** of the agricultural sector, **genetic improvements** on cattle local population.

Increase the biodiversity in agricultural ecosystems by **looking at traditional species no longer grown in Cyprus** (corn, barley, ancient wheat, chickpeas and cowpeas, local varieties of grapes).

Genetic improvement of the Cyprus sheep and goat population. Improve the indigenous carob genetic resources and developing food, beverages and medicinal products of high added value.

Cyprus can achieve commercial success in niche markets by the systematic **cultivation of long-overlooked fruit and vegetables.**

4 different wine regions have been designated **with controlled appellations of origin,** while **8 food and wine Cyprus products registered in the EU.**

- **Zacharias Symeou sheep farm** in Aradippou
- **Andreou & Kosti Farm** in Tersefanou
- **Pentakomo Collaborative aquaculture plants**
- **Planty hydroponic facilities**, Psematismenos
- **Dodoni Agricultural Dairy Industry in Ypsonas**

- Cyprus RRP 2021-2026; policy axis 3; component 3.1; Reforms 1 , 3; investments 1, 3.
- Common Agricultural Policy (CAP) 2023-2027.

34/40

raw materials

POSIDONIA OCEANICA

Introduction of **Posidonia Oceanica into the Cypriot goat dairy production chain**

- P. Oceanica can **replace straw in animal feeding.**
- **Dead leaves used like shock-absorbing material.**
- **Maintainance** of the moisture level of **fresh fish.**
- Conversion into **cellulose, medicine, cosmetics or for wood composites manufacture.**
- **Methane production.**

Creation of a new industrial ecosystem consisting in a **smart and synergetic use of seagrass and Halloumi cheese whey** to generate new local market values.

- Healthy **water quality indicator.**
- Maintenance of marine ecosystems.
- It **grows spontaneously** in the Mediterranean.
- Posidonia **captures large quantities of CO_2** from the atmosphere.

40% of the beaches in Cyprus experiences seagrass banquettes removal with heavy machinery (88% of the cases). In 53% of the beaches removal occurs once a year but in the 40% of the cases it happens 3 or more times a year.

Given the efforts made to remove dead leaves from the beaches a **design of a new entrepreneurial ecosystem capable of diversifying the local economy** is desirable.

Replacing straw with Posidonia is particularly successful for **goat nutrition,** allowing intervention in the **goat dairy sector** and specifically in the **production of Halloumi**.

- **Zacharias Symeou sheep farm**
- **Riverland Bio Farm**
- **Dodoni Agricultural Dairy Industry**
- **Chersonissos Akama**
- **Larnaca bay**

- Interreg PosBeMeD project.
- Natura 2000 network.

31/40

CULTURAL

recreation & eco-tourism

AGRO-TOURISM

Creation of **networking and promotion tools for Cypriot local products and services**

The shift towards agrotourism, slow tourism and rural tourism constitutes a step towards a more sustainable use of resources, taking the weight off the over-exploited coastal areas and **promoting the unknown mountainous and remote and rural areas of the island**.

Thematic Route Aphrodite – Inia **"Authentic Experience Route"** of 300 km, this route will be promoted as the "**Signature Brand Experience**" of the country.

Cyprus' **travel and tourism sector accounts for over 20% of GDP** directly and indirectly.There is a great opportunity to expand the tourism sector with the **Cypriot food and wine offer**.

Enhancing the existing **isotopic databases of Cypriot local traditional food/drinks**, by developing a **Block Chain platform, to ensure their identity**.

Enhancing the added value of the tourism sector including small and medium enterprises under the **Quality Label "Taste of Cyprus"** to rewards the compliance to specific and commonly accepted quality criteria.

Creation of a **National Commercial Identity and promotion of** the traditional product **Halloumi cheese.**

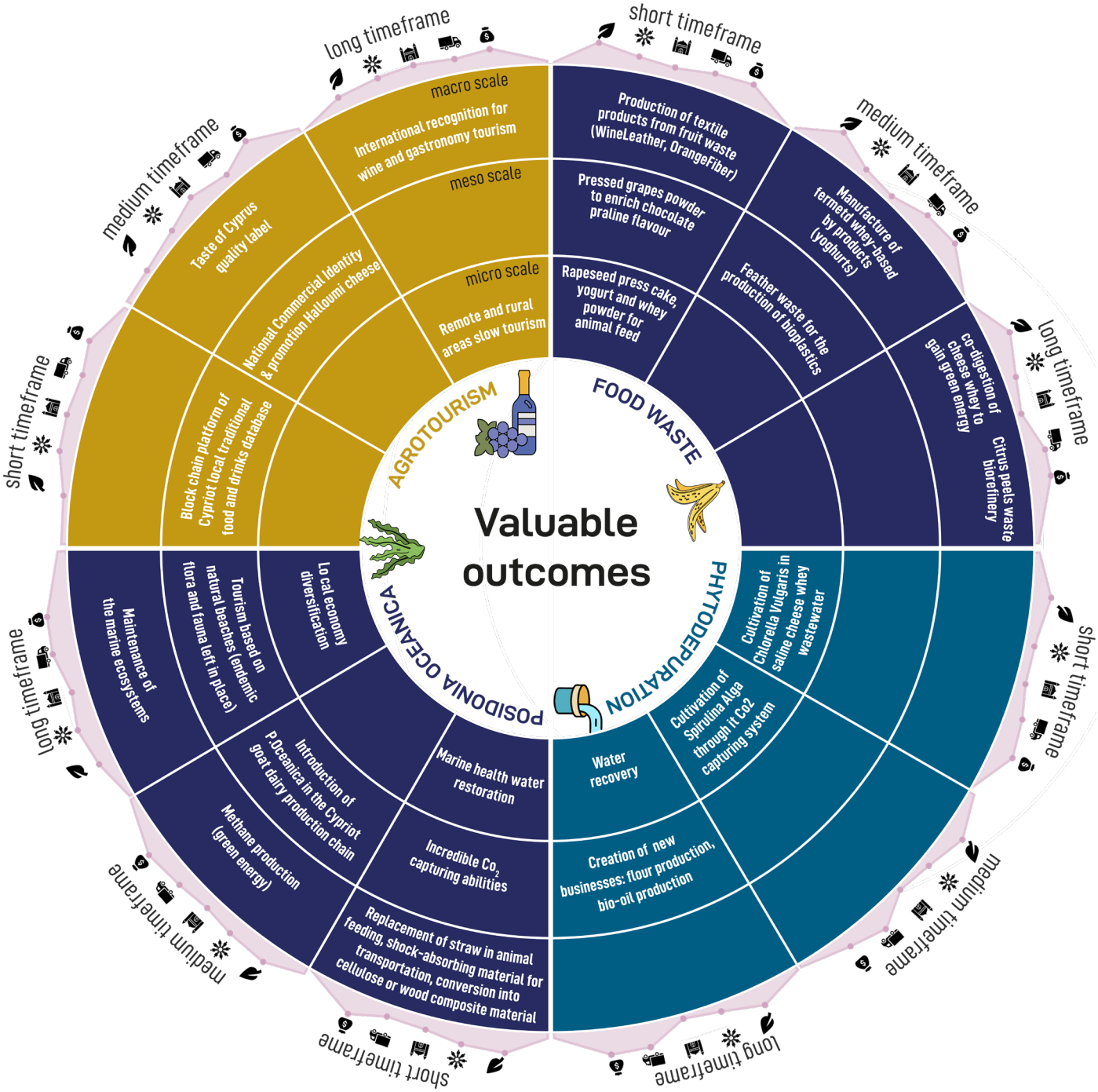
- **Riverland Bio Farm** in Kampia
- **Polycarpos Vlachos camp site**
- **Dymatou Estate** in Dimes
- **Kato Mylos nature trail excursion area**
- **Aphrodite Thematic Route**

Cyprus recovery and resilience Plan (RRP) 2021-2026; Policy axis 3; Sub-component 3.1.3; Investments 2, 8, 10

28/40

Valuable outcomes

The proposals scored in the multicriteria analysis have been deeper explored following three assets: point of views (environmental, social, cultural, logistical and economic), spatial scales (local, regional or national and international) and timeframes for implementation (short, medium, long). The valuable outcomes are showed repropousing the natural ecosystem services scheme.



Relevant systemic outcomes for the Cypriot agri-food sector emerged by natural ecosystem services

Relevant value chains to work with

Concluding the analysis and the evaluation of the intervention opportunities in the Cypriot agri-food sector alowed to point out three value chains of relevant interest for a systemic project to design a more sustainable and resilient agri-food sector. Crosscutting desk research and scientific literature concerning Halloumi cheese and Posidonia Oceanica supply chains emerged that both can be the protagonists of a new circular model.

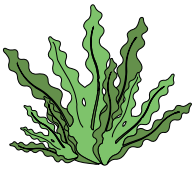
Halloumi Cheese is a major export product for Cyprus and the most internationally renowned food products of the island. Halloumi cheese consumption in Cyprus accounts for 6.4 kg per person per year, leading to big amounts of whey waste production and waste. This one can be used to produce fermented whey-based by-products like yogurts (widely consumed in Cyprus) and bio-methane through co-digestion with hemp hurds.

Dairy industry

Goat products

In the culinary culture of the island, goat dairy products are widely consumed, in fact halloumi cheese as well as being the most consumed cheese is also the most exported Cypriot PDO product.
Halloumi Cheese is the most internationally renowned food product of the island, thus leading to big amounts of wasted whey production.
The serum can be used to produce fermented whey-based by-products like yogurts (widely consumed in Cyprus), cosmetics and bio-methane.

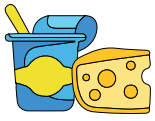
Seagrass



Posidonia Oceanica beach banquettes

Using Posidonia Oceanica as a substitute for straw in animal feed for dairy goats could promote a sustainable livestock system helping to reduce the over-exploitation of peat lands and decrease the amount of waste destined for incineration, thus reducing its environmental impact, while helping reduce production costs, optimize production costs and contributing to the maintenance of meadows.

Novel foods for human consumption



Functional edible products derived from Halloumi whey

The synergistic use of mixed Halloumi cheese waste serum and local fruits residues as fermentation media toward the development of novel foods in a biorefinery approach. Whey cheese presents a high content of amino acids in chains that prevents protein degradation muscles and encourages the synthesis of these. Therefore Whey Protein Concentrates (WPC) are ideal for the production of fermented whey-based food by-products such as desserts, yogurts and beverages.

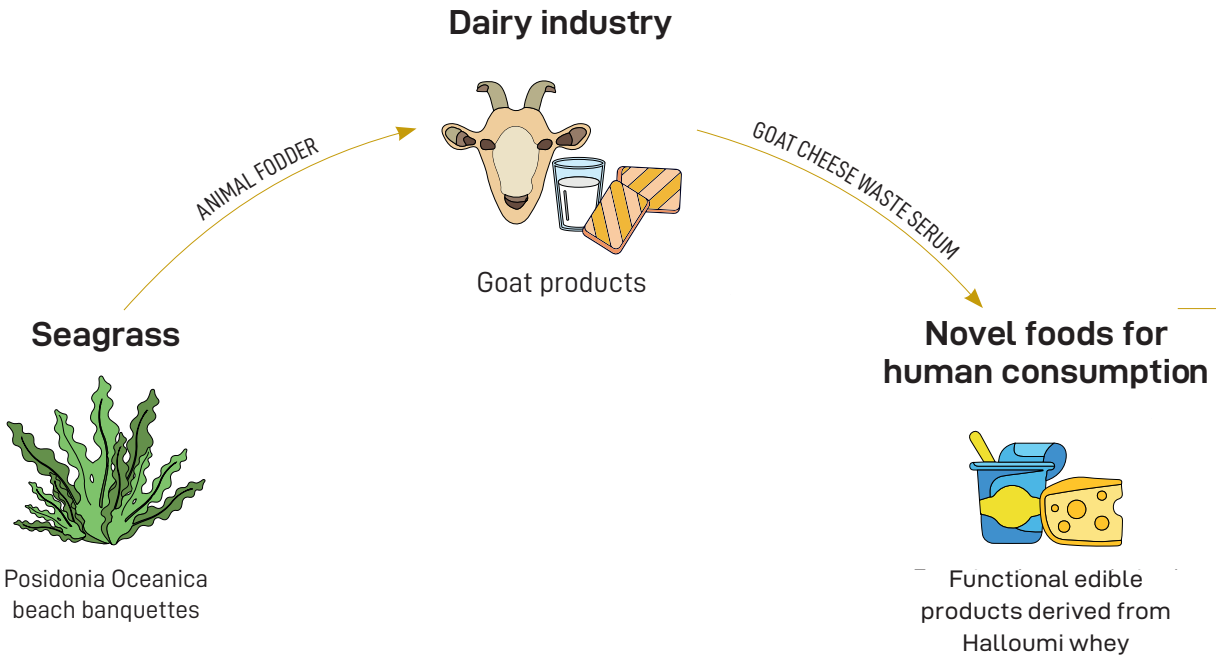
Systemic project proposal

Diversification is Key

Cyprus has decided to become cleaner and greener by adopting sustainable development principles, and the growing **contribution of scientists and researchers is diversifying agriculture** into small-scale wineries, aquaculture and farmers of nutritious medicinal plants. Agricultural technologies and **smart agriculture** are on the rise, and startups and research centers are working more closely with farmers to find fresh ideas that will transform **agricultural enterprises**. "Through a successful mix of resilient and resource-rich farmers, increased government support and cutting-edge research, Cyprus agriculture is transforming to respond to the rapidly changing trends in the European market and ultimately become a more resilient sector in the future" (http://www.cyprusprofile.com). With a **focus on today's health food trends,** Cyprus has seized the opportunity to achieve **commercial success in its niche by systematically growing long-forgotten fruits and vegetables** and reclaiming traditional local grape varieties to expand its **booming wine industry**. Long known for its citrus fruits, potatoes and olives, Cyprus is also associated with **prickly pears, pomegranates, carobs, aloe vera** and other valuable products that thrive in the island's arid climate.

5.1 Circular system dynamics

To define the project topic I have focused my attention on the goat dairy industry, since innovative value chains can be implemented for a new circular model in the cypriot agri-food sector, like Posidonia Oceanica seagrass and novel foods production. The replacement of straw by P. Oceanica provides milk and cheese with very similar characteristics to those obtained from animals fed with straw.
Moreover the milk from animals fed with algae shows greater technological suitability and functional goats' milk yogurt is the ideal vehicle to deliver bioactive nutrients.



Source: Anne van Eldik, María Isabel Hortelano, Daniel Álvarez, Juan Sotillo, Cándido Gutiérrez, Víctor Garcia, Margherita Bacchiocchi, and María Belén López, "Influence of feeding Murciano-Granadina Goats with Posidonia oceanica Banquettes on the Resulting Milk and Cheese." Journal of Food and Nutrition Research, vol. 5, no. 1 (2017): 54-62. doi: 10.12691/jfnr-5-1-9.

Source: SYBAWHEY, Industrial symbiosis for valorising whey and banana wastes and by–products for the production of novel foods [H2020–MSCA–RISE–2015]

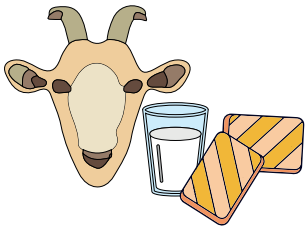
whey-based beer 

whey-based cheese 

whey-based yoghurt 

- Sustainable livestock system promotion
- Reduction of the over-exploitation of peat lands
- Contribution to the maintenance of meadows
- Synergistic use of waste and by-products

Dairy industry



Goat products

Dairy sector

246.373 (€000's)
Registered sailings in 2015 for operation of dairies and cheese making in Cyprus

136.999 (€000's)
Total domestic exports of idustrial Cypriot dairy products in 2016

25.435 (€000's)
Registered 2015 yoghurt sailings in Cyprus

Halloumi cheese

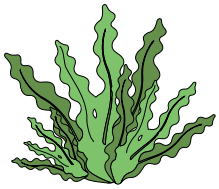
127.579 (€000's)
Registered sailings in 2015 for the Cypriot Halloumi cheese

33,437 tonnes
Export of Halloumi cheese in 2019 (equevalent of 222.6 million of euro); increase of 117% from 2015

6,4 Kg/person
Cypriot cunsumption of Halloumi cheese in 2015

11.230 tonnes
Production of cheese whey waste from the Cypriot Halloumi cheese industry in 2010

Seagrass



Posidonia Oceanica beach banquettes

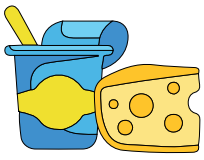
Main numbers

125 Kg/year
Production of dry seagrass material per 1 Km wide belt of seagrass meadow

80%
Of European coastal municipalities remove the seaweed deposits before the summer season

45%
Of local authorities and tourist operators negatively consider the presence of banquettes

93 kg/m3
Average of sediment retainment while removing a banquette



Functional edible products derived from Halloumi whey

Dairy whey-based product

Butter
From sweet whey cream

Ricotta (Italy)
Registered sailings in 2015 for operation of dairies and cheese making in Cyprus

Gjetost (Scandinavia)
Classic whey cheese made from goats milk

Yoghurt
Fermented whey-based product enriched with local fruit wastes flour

Mysost (Scandinavia)
Classic whey cheese made from cows milk

Myzithra (Greece)
From cheese whey made of sheep milk or a mixture of sheep and goat milk

Anthotyros (Greece)
From cheese whey made of sheep milk or a mixture of sheep and goat milk

Manouri (Greece)
From cheese whey made of sheep milk or a mixture of sheep and goat milk

Goal

Adopting new processes on farming for sheep and goat livestocks. Finding new value chains for cheese whey and serum would help the sustainability of the Cypriot Halloumi cheese industry, since the production of *high amount of cheese whey makes wastewater treatment expensive*, particularly in the case of small cheese plants.

Features

Whey cheese can be used as animal fodder rich in nutritious components

High-quality compost: co-composting of sheep and goat manure with agricultural pruning and park and garden waste

Product-driven biorefining: whey-based yoghurt, cheese and beer

Biogas and bioethanol production from whey serum blended with pork mannure

Source: Industrial Statistics Report, 2016; Republic of Cyprus.

Goal

Changing the perception of the banquette from waste matter to a good water quality indicator and strong sign of Mediterranean identity. Need to invest in how to utilise this plant like a material input for several supply chains.

Features

Shock-absorbing material for fragile transportation

Maintainance of the moisture level of fresh fish

Conversion into cellulose, animal fodder, medicine, cosmetics or for wood composites manufacture

Methane production

Source: Anne van Eldik, María Isabel Hortelano, Daniel Álvarez, Juan Sotillo, Cándido Gutiérrez, Víctor Garcia, Margherita Bacchiocchi, and María Belén López, "Influence of feeding Murciano-Granadina Goats with Posidonia oceanica Banquettes on the Resulting Milk and Cheese." Journal of Food and Nutrition Research, vol. 5, no. 1 (2017): 54-62. doi: 10.12691/jfnr-5-1-9.
Source: Rotini, A., Chiesa, S., Manfra, L., Borrello, P., Piermarini, R., Silvestri, C., Cappucci, S., Parlagreco, L., Devoti, S., Pisapia, M., Creo, C., Mezzetti, T., Scarpato, A., & Migliore, L. (2020). Effectiveness of the "ecological beach" model: Beneficial management of posidonia beach casts and banquette. Water (Switzerland), 12(11), 1–16. https://doi.org/10.3390/w12113238

Goal

Shifting to a functional bioeconomy exploitating by-products and wastes of an industry as the base material for another. Specifically, developing innovative and sustainable processes to convert and combine by-products and waste streams from the Cypriot Halloumi cheese dairy industry.
The market research proved *consumers willingness to pay and consume novel foods derived from agri-food by-products and wastes*.

New markets

Pulverization of Whey Protein Concentrates (WPC)

Beer fermentation

Beauty, pharmaceuticals and cosmetic application

Biogas production

Source: SYBAWHEY, Industrial symbiosis for valorising whey and banana wastes and by–products for the production of novel foods [H2020–MSCA–RISE–2015]
Source: Soft-ripened and fresh cheeses: Feta, Quark, Halloumi and related varieties, E. Litopoulou-Tzanetaki, in Improving the Flavour of Cheese, 2007.
Source: Brown Whey Cheese, Siv Skeie, Roger K. Abrahamsen, in Cheese (Fourth Edition), 2017.

5.2 PDO Halloumi cheese value chain

Halloumi cheese, explained
Halloumi cheese is a chief export product for Cyprus. Exports have risen dramatically over the last few years as call for for the cheese is continuously growing. Currently there are over 19,000 lots of cheese exported and is possibly the maximum the world over famend meals merchandise of the island`s exports. Distributed to upmarket grocery store chains worldwide, it has unsurprisingly emerge as a runaway achievement and these days have become the second one biggest export for Cyprus. The name `halloumi` is now registered withinside the European Union as a Community Collective Trade Mark, which means that no different product may be advertised inside EU borders beneathneath this name. It is likewise registered as a Certification Trade Mark withinside the UK, US and Jordan, and could quickly be registered in different Middle Eastern nations too. The famend cheese can also be registered as an EU Protected Designation of Origin (PDO), which is about to reinforce the product and its logo appeal, in addition to boom dairy production.

Fresh Halloumi
Fresh Halloumi is crafted from curds produced via way of means of curdling milk with rennet. It is cooked and shaped into its function form. It is semi-tough and elastic, folded (right into a square or semi-round form), white to light-yellowish in colour, has a near texture and is without difficulty sliced, with a function scent and flavor. t smells strongly of milk/whey and has an aroma and flavor of mint, a barnyard scent and a pungent, salty flavor. The most moisture content material is 46%, the minimal fats content material is 43% (in dry weight) and the most salt content material is 3%.

Mature Halloumi
Mature Halloumi is crafted from curds produced via way of means of curdling milk with rennet. It is cooked and shaped into its function form and left to mature in salted whey for at the least forty days. It is semi-tough to tough, much less elastic, folded (right into a square or semi-round form), white to yellowish in colour, has a near texture and is without difficulty sliced, with a function scent and flavor. It smells strongly of milk/whey and has an aroma and flavor of mint, a barnyard scent and a pungent, salty flavor; it's miles barely sour and really salty. The most moisture content material is 37 %, the minimal fats content material is forty % (in dry weight), the most salt content material is 6 % and the acidity is 1,2 % (expressed as lactic acid in dry weight).
Halloumi cheeses weigh from one hundred fifty to 350 grams[54].

Whey
The final liquid obtained after milk has been curdled and strained. It is a byproduct of the manufacture of cheese and has several commercial uses worldwide. Traditionally in Cyprus it was fed to pigs but the increase in production over the past years results to excess whey which is diverted through anaerobic processing with other animal-origin waste for the production of biogas. Halloumi cheese industry in 2010 in Cyprus produced up to 11.230tn of cheese whey.

[54] Verheugen, G. (2005). Publication of an application pursuant to Article 50(2)(a) of Regulation (EU) No 1151/2012 of the European Parliament and of the Council on quality schemes for agricultural products and foodstuffs. Pharmaceuticals Policy and Law, 6, 1–2. https://doi.org/10.4324/9781849776110-28

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[56] Grba S, Stehlik-Tomas V, Stanzer D, Vahèiæ N, Škrlin A. Selection of yeast strain Kluyveromyces marxianus for alcohol and biomass production on whey. Chem. Biochem. Eng. Q. 2002; 16 (1): 13–16.

[57] Beausejour D, Leduy A, Ramalho RS. Batch cultivation of Kluyveromyces fragilis in cheese whey. Can. J. Chem. Engng. 1981; 59: 522–526.

[58] Belem MAF, Gibbs BF, Lee BH. Enzymatic production of ribonucleotides from autolysates of Kluyveromyces marxianus grown on whey. J. Food Sci. 1997; 62: 851– 857.

Valorization of cheese whey

Generally, as mentioned previously, whey is a by-product of the dairy industry. For many years, cheese whey has been used as animal feed or disposed of as waste. It may be difficult to remove whey for 2 major reasons.
Firstly, its BOD5 is high, at around 35.000 – 55.000mg O2/litre. Biological oxygen demand (BOD5) indicates the amount of oxygen which bacteria and other micro organisms consume in a water sample during the period of 5 days at a temperature of 20 °C to degrade the water contents aerobically.
This makes waste water purification expensive, in particular withinside the case of small cheese plants.
The 2nd factor is associated with the amount of whey produced annually: over 160.000.000 lots worldwide.
Given the logistical, financial and environmental costs, it's miles surely top-rated to locate approaches of making use of whey[55].

Production of bioethanol from whey

One of the solutions that has been proposed is to produce ethanol on whey containing a small percentage of lactose. However, this process demands a large amount of energy, resulting in high costs, because of the low ethanol yield[56]. The cultivation of microorganisms on cheese whey has been offered as an alternative[57, 59], since this can reduce its BOD by 90–95%[61], resulting in high added-value bio-ingredients for the food industry[58].
In addition to the basic sugars lactose and galactose, whey also contains vitamins and minerals that improve the bioactivity of cultured cells. The yield of lactose to biomass can reach 50–57% [63], and can be optimized by supplementing the culture media with 0.1–5% yeast extract[60, 62].

Production of energy/compost from whey

Whey cheese valorization with the production of renewable energy and composting/fertilizers is important. For instance, after mixing it with other bioproducts, it can produce electricity, steam and heat from biogas enabling reducing at the same time the emissions of greenhouse gas (GHG).

Production of functional food from whey

Cheese whey was formerly used primarily as a source of energy and protein in pig breeding and fattening.
In pig farming, piglets and calves require high-value of protein sources. The cheese whey used as such in feeding pigs could be processed also for human consumption. Indeed, their high content of amino acids in chains prevents protein degradation muscles and encourages the synthesis of these[64]. That is why they are appreciated by sports enthusiasts. In addition, the biological value of the whey protein is 15% to that of the egg.
Thus, whey protein concentrates (WPC), which is a protein-enriched concentrate and poor in lactose and carbohydrates, are increasingly used. This concentrate, which can be in dry/dehydrated form, is composed of 35%, 70% or even up to 80% of proteins. The WPC concentrated protein whey can be used nowadays in various food products such as desserts, yoghurts and beverages. WPC is produced by removing a certain percentage of non-protein constituents from pasteurized whey derived from cheese processing techniques. WPC is processed by physical separation techniques corresponding to precipitation, filtration or chemical analysis techniques[65].
WPC in dried form improves texture, enhances flavor and color, emulsifies and stabilizes dry mixes, extends shelf-life, and improves the quality of processed dairy and meats products, bakery products, snack foods, beverages, cereal products and is used in special sports and nutritional products.

[59] Ben-Hassan RM, Ghaly AE. Continuous propagation of Kluyveromyces fragilis in cheese whey for pollution potential reduction. Applied Biochemistry and Biotechnology. 1994; 47: 89–105.

[60] El-Hawary FI, Mehanna AS. Production of single cell protein from yeast grown in whey. Acta Alimentaria. 1991; 20: 205–213.

[61] Grubb CF, Mawson AJ. Effects of elevated solute concentrations on the fermentation of lactos

[62] Kallel-Mhiri H, Valance C, Engasser JM, Miclo A. Yeast continuous mixed cultures on whey permeate and hydrolised starch. Process. Biochem. 1994; 29: 381– 386.

[63] Moresi M, Colicchio A, Sansovini F. Optimization of whey fermentation in a jar fermenter. Eur. J. Appl. Microbiol. Biotechnol. 1980; 9: 173–183.

[64] Bawa S., 2007. Functional properties of whey and its components as ergogenic aids in sports. AgroFOOD 18 (2), 55-59.

[65] AMS, USDA. (2015). Whey Protein Concentrate (WPC) Handling. USDA, AMS, Agricultural Analytics Division for the USDA National Organic Program, 1–18.

5.3 Posidonia Oceanica in Cyprus

Posidonia Banquettes

Drifting vegetation in Posidonia is a common feature of many Mediterranean beaches, and the continuous deposition and removal of seaweed by the action of waves means that embankments are always dynamically formed (Mateo). et al. 2003). Therefore, the shoulders are permanent (top of the beach) or temporary (on the beach drift line) and can be returned offshore within days or weeks. Seagrass deposits can also be buried under the sand on some beaches. This is because the exchange of substances in Posidonia Oceanica at the beach drift line causes shoulders and balming / destruction. When shoulders accumulate on the beach, they undergo a process of bacterial decomposition and remineralization. Bacterial degradation of seagrass beds leads to the release of various gas by-products. Decomposition of accumulated seagrass under low oxygen conditions, especially large accumulations with fresh sediments, can result in sustained release of malodorous gases, depending on the exact chemical conditions (sulfur). From the contained compounds, Mateo et al., 2003). Posidonia Banquettes are often perceived as a nuisance, but they are actually key to the health and resilience of coastal ecosystems:

1. Prevent beach erosion since they soften and protect the coast, especially the sandy beaches and dunes.
2. Beaches and dunes formation and stabilization, they contribute to the formation of sand dunes and beaches, stabilizing the coastal system.
3. Beach nourishment, they are an important source of nutrients and natural fertilizers for beach and dune vegetation.
4.Biodiversity, they provide unique habitats for abundant, often rare, and endemic animals.

Pressures on the Posidonia littoral zone

The coastal zone of Posidonia faces various pressures and threats from coastal population growth and tourism, eutrophication, coastal and marine pollution, landfill and other coastal activities. The range of Posidonia oceanica meadows has decreased significantly, with an estimated loss of approximately 34%, equivalent to a decrease of 368,837 ha over the last 50 years (Telesca et al., 2015). However, not only are there concerns about this habitat loss, but there are also concerns about local and subregional declines in habitat quality (Pergent-Martini et al., 2016). According to available information, at least 29% of Mediterranean beach habitat has been lost in European countries over the last 50 years (Otero, 2016). The loss of coastal dunes throughout the Mediterranean is also important, accounting for almost 80% of the area lost in some Mediterranean countries in the last century (EEA, 2008). In addition, the Mediterranean coastal region is also one of the most popular tourist destinations in the world (Eurostat Regional Yearbook 2017), and tourism is usually centered around sandy beaches, by so-called "3S tourism": sea, sand, sun. Therefore, population growth and tourism growth are putting great pressure on coastal resources and driving coastal policies in many regions and regions[66].

Legal framework for the management of posidonia littoral zone

For EU countries the main regional directives and laws that regulate the activities of the Posidonia coastal zone are: Marine Strategy Framework Directive (MSFD), Habitat Directive, Marine Spatial Planning Directive (MSP), and Mediterranean Fisheries Regulations (Board Regulation ECNo. 1967/2006). Another important legal document that has significant influence on beach management is the Integrated Coastal Zone Management (ICZM) protocol of the Barcelona Convention, which is the main legal framework for protecting the Mediterranean environment. Collectively, these Mediterranean policies, including the EU Directives (MSFD and MSP), form an umbrella for national policy development of coastal and maritime management at a national level.

[66] Fund, R. D. (n.d.). Governance and beach-dune Posidonia management of systems.

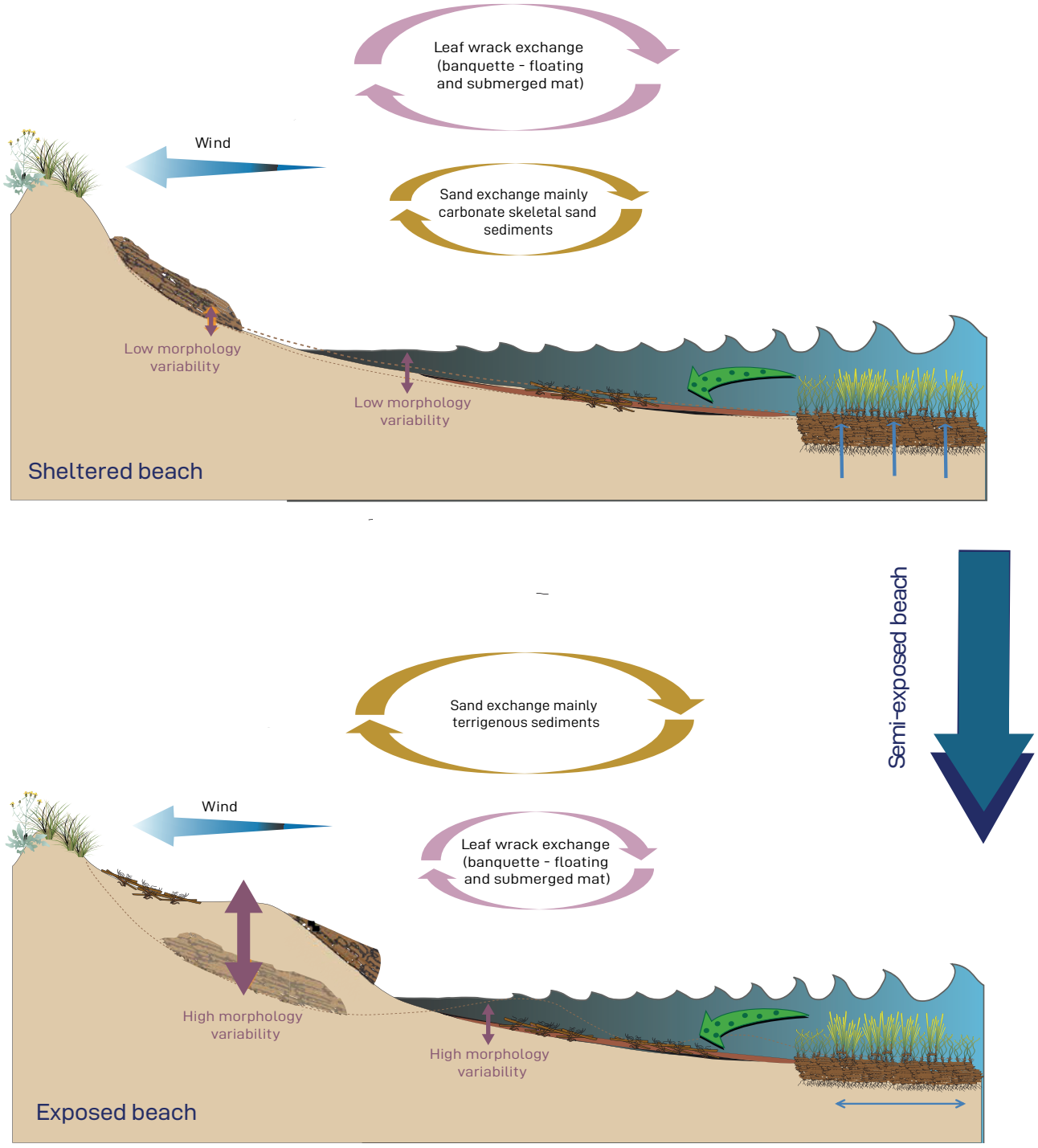


Diagram /profile illustration Posidonia beach-dune system with banquettes in sheltered, semi exposed and exposed beaches. (a) Sheltered environments (b) Fully exposed environments. Matte develops mainly vertically in sheltered environments and laterally in wave-exposed areas.
Source: Fund, R. D. (n.d.). Governance and beach-dune Posidonia management of systems.

Municipal role in beach management

Local councils and municipalities play a central role in coastal governance, since they set specific regulations on the use of coastal areas (including beaches), zoning of activities (such as mooring near the coast), and maintenance of access and services to beach visitors. In some local governments, when beach seagrass deposits are lifted from the beach (even when reprocessed into products or materials for recycling), they are considered organic waste and disposed of according to national and regional transportation procedures. There is lack of clarity regarding storage, cleaning, drying and disposal of Posidonia dead leaves in fact seagrass and algae deposits on the coast are often considered waste. This perception is amplified when Posidonia's debris is scattered on the beach with artificial debris and brought in by the wind and tide. Unless determined by national guidelines, Posidonia chaise lounges are not considered waste or man-made waste under the regulations and guidelines of these regions and must be treated differently. They need to be separated from the waste so that only the parts of the waste are treated.

POSBEMED

POSBMEDis a modular Interreg MED project that focuses on the sustainable management of the Mediterranean coasts, and specifically on the conflicts and opportunities in coastal areas where interdependence between seagrass meadows, dunes and beaches occurs. A socioeconomic evaluation study was performed with a view to examining beach users' and managers perceptions and expectations. Existing management practices on Posidonia oceanica banquettes were also surveyed. The study was conducted in five Mediterranean countries, namely Spain, France, Italy, Greece & Cyprus.

Present management of posidonia banquettes

In the course of this project, up to 83% of the municipalities surveyed removes seagrass deposits from the beach each year. According to the results, banquettes are removed as needed and can reach over 7,000 tons per year by some authorities in Spain, Cyprus and France. In general, no accurate information about this has been collected and these information are missing or inaccessible in many areas. It has been found that removal of seaweed from the shoulders and Posidonia is a common method in more than half of the sites and is performed more than three times a year. Most local governments carried out these tasks during the summer months from late April to September (83%), of which 17% had their beaches removed and cleaned in the fall and winter[67].

Considerable economic cost. City costs for cleaning beaches vary widely by location and country and are estimated to average € 15,000 to € 130,000 per year (Giunta Fornasin et al., 2018). Seagrass removal involves removing a lot of sand from the beach, resulting in additional costs for some communities to fill the beach sand. During the summer season, beaches are mechanically scraped and groomed to remove most of the human-made debris and organic matter, including algae buildup. Posedonia banquettes are manually deleted only in exceptional cases. As for the tools to use, heavy equipment such as backhoes is selected first with a probability of about 44%, and similar ratios (40%) can be seen with light machines such as beach cleaning screens (40%). On average, 26% of municipalities dump in landfills, and at about 20% of sites, materials are reused or disposed of near the beach and returned to their original site at the end of the tourist season. Some coastal areas produce compost from Posidonia and use this substrate as a cheap fertilizer or soil conditioner for agriculture. Shipwrecks are high in salt and sand and may require additional requirements and operating procedures before use (Milano et al., 2018). Other reuses of sediment include building insulation, soundproof panel composite reinforcements, packaging, mattresses and other recycling processes may be taken into consideration.

[67] Fund, R. D. (n.d.). Governance and beach-dune Posidonia management of systems.

Beach management practices by local authorities in 5 EU mediterranean countries

Summary results of 144 surveys conducted by the Interreg Med POSBEMED project.

Presence of banquettes as a negative factor in the beach choice by local residents and tourist visitors per country (ES-Spain, It- Italy, FR-France, GR-Greece, CY-Cyprus). Source: Fund, R. D. (n.d.). Governance and beach-dune Posidonia management of systems.

Country	Private company	Public technical Service
Greece	69%	31%
Italy	68%	32%
France	55%	45%
Spain	75%	25%
Cyprus	55%	45%

Entity in charge of beach cleaning and banquette removal operations (2017). Source: Fund, R. D. (n.d.). Governance and beach-dune Posidonia management of systems.

	On every beach	On some beaches	On none of them
Greece	38	43	19
Italy	14	56	30
France	49	46	5
Spain	32	58	10
Cyprus	40	35	25

Percentage of seagrass banquettes removed by the local authorities in different countries (%). Source: Fund, R. D. (n.d.). Governance and beach-dune Posidonia management of systems.

	Once a year	Twicea year	3 or more times a year
Greece	38	8	54
Italy	32	27	41
France	3	57	40
Spain	11	4	85
Cyprus	53	7	40

Percentage of frequency of Posidonia banquette removal by the local authorities in different countries (%). Source: Fund, R. D. (n.d.). Governance and beach-dune Posidonia management of systems.

In general, for a significant portion of tourists, the presence of banquets on the beach has been shown to be a negative factor in their choice. This is especially true in areas where marketing is based on providing tropical style white beaches (intensive/urban beaches). In reality, beach management is still primarily concerned with meeting user expectations, but the acceptance of beach benches among tourists is greater than both tour operators and authorities expect. Beach fans' knowledge and awareness of the role played by banquets varies between 39% and 66% from country to country and is increased by education level and available information.
The direct costs caused by the presence of a banquet can be determined as a result of multiplying the tourist losses already identified in the survey by the tourist's average daily spending. The calculated value is 2.98 euros per square meter of beach. Conditional assessments show that the potential demand to keep the beach in its natural state without removing the bench is represented by the willingness to pay up to € 8,031,496.59. This is 2.08 euros per square meter of beach[68]. Overall, management's decision to keep the beach in its natural state has a negative economic impact on the tourism industry. This is about 1 euro per square meter. Overall, it was shown that 2/3 of the potential economic loss of the tourism sector, due to the presence of Posidonia on the beach, are offset by the preferences of other tourists for a beach in a natural state.

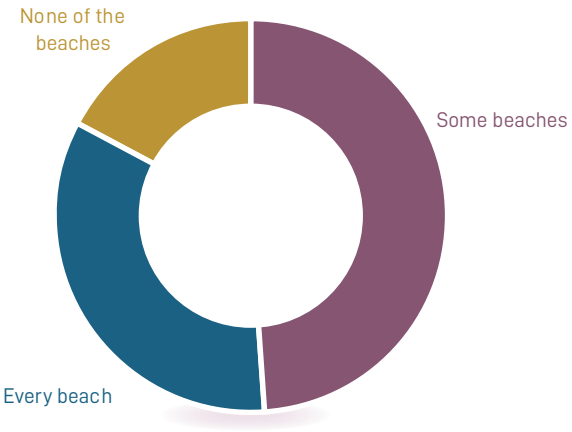
Green label for natural beaches
Although the public largely expressed negative perception and low awareness of their ecological importance, the strong majority agreed that proper information and motivation (i.e. through Agree the establishment of a green label for natural beaches) could help increase their willingness to accept banquettes on the beach. When asked to comment on how important a green label designation would be in influencing their future beach selections, 74% of beach goers said they favoured the use of specific green labels for information and promotion, which would be assigned to the beaches in a natural state, e.g. with a possible presence of banquettes. This indicates that the use of beach certifications like the Blue Flag beach designation, if correctly followed, could contribute to beachgoers' decisions with regards to the permanence of the banquettes on beaches in the future.

Recommendations for beach managers
- Posidonia banquettes ought to stay intact, mainly in herbal seashores and dunes of excessive conservation value.
- Awareness increases acceptance: inform neighborhood seashore site visitors at the ecological that means and significance of banquettes.
- Avoid heavy equipment or any equipment that scrapes, gouges or scours the seashore.
- Man-made muddle need to be eliminated from banquettes manually or with the aid of using using hand tools.
- For extraordinarily frequented non-eroding seashores, bear in mind clearing handiest small sections of banquettes to permit less complicated get entry to for summertime activities.
- For minor accumulations, bear in mind burying banquettes beneathneath the sand, or returning them to the ocean beneathneath beneficial wind or tide conditions.
- If needed, handiest use motors with rubber tires; no operations <5m seaward of dunes; save you destruction or alteration of seashore biota and profile.
- When banquette elimination is deemed necessary, bear in mind the usage of the aid to reconstruct eroded dunes, or sell for different re-use purposes.

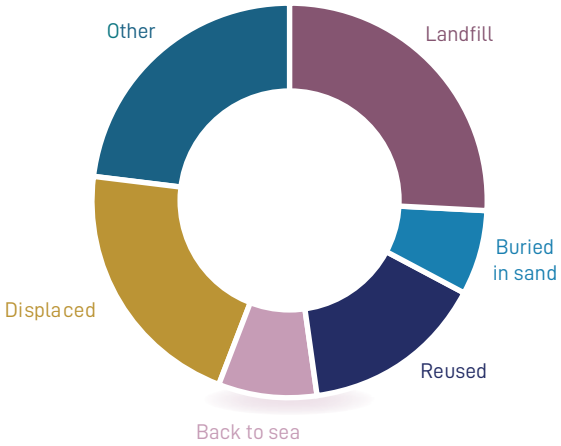
[68] Fund, R. D. (n.d.). Governance and beach-dune Posidonia management of systems.

	Heavy machinery	Light machinery	Manually
Greece	18	29	53
Italy	31	46	23
France	50	39	11
Spain	35	52	13
Cyprus	88	6	6

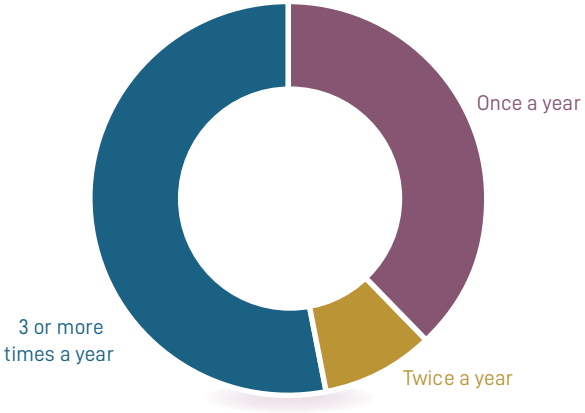
Percentage of type of method and machinery used in banquette removal operations by local Authorities in 5 EU Mediterranean countries. Source: Fund, R. D. (n.d.). Governance and beach-dune Posidonia management of systems.



Results on banquettes removal by local authorities in 5 EU Mediterranean countries. Source: Fund, R. D. (n.d.). Governance and beach-dune Posidonia management of systems.



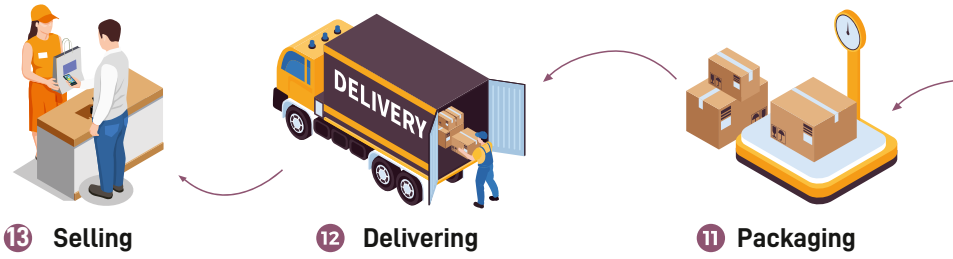
Reuse, recovery and disposal of banquettes after removal operations by local Authorities in 5 EU Mediterranean countries. Source: Fund, R. D. (n.d.). Governance and beach-dune Posidonia management of systems.

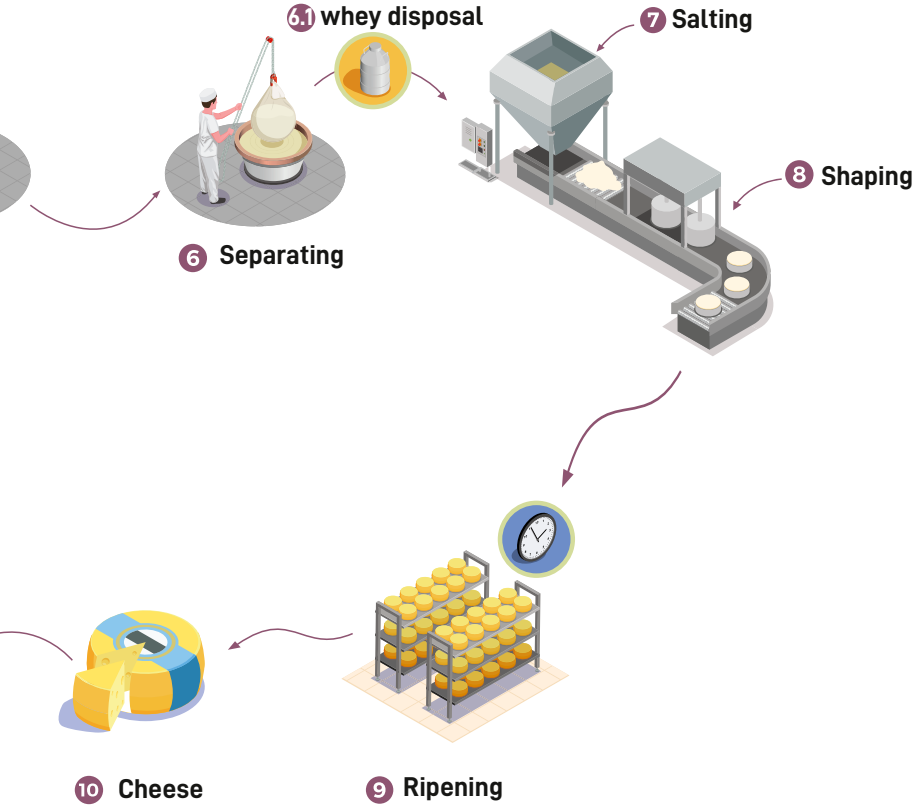


Results on frequency of banquette removal operations by Local Authorities in 5 EU Mediterranean countries. Source: Fund, R. D. (n.d.). Governance and beach-dune Posidonia management of systems.

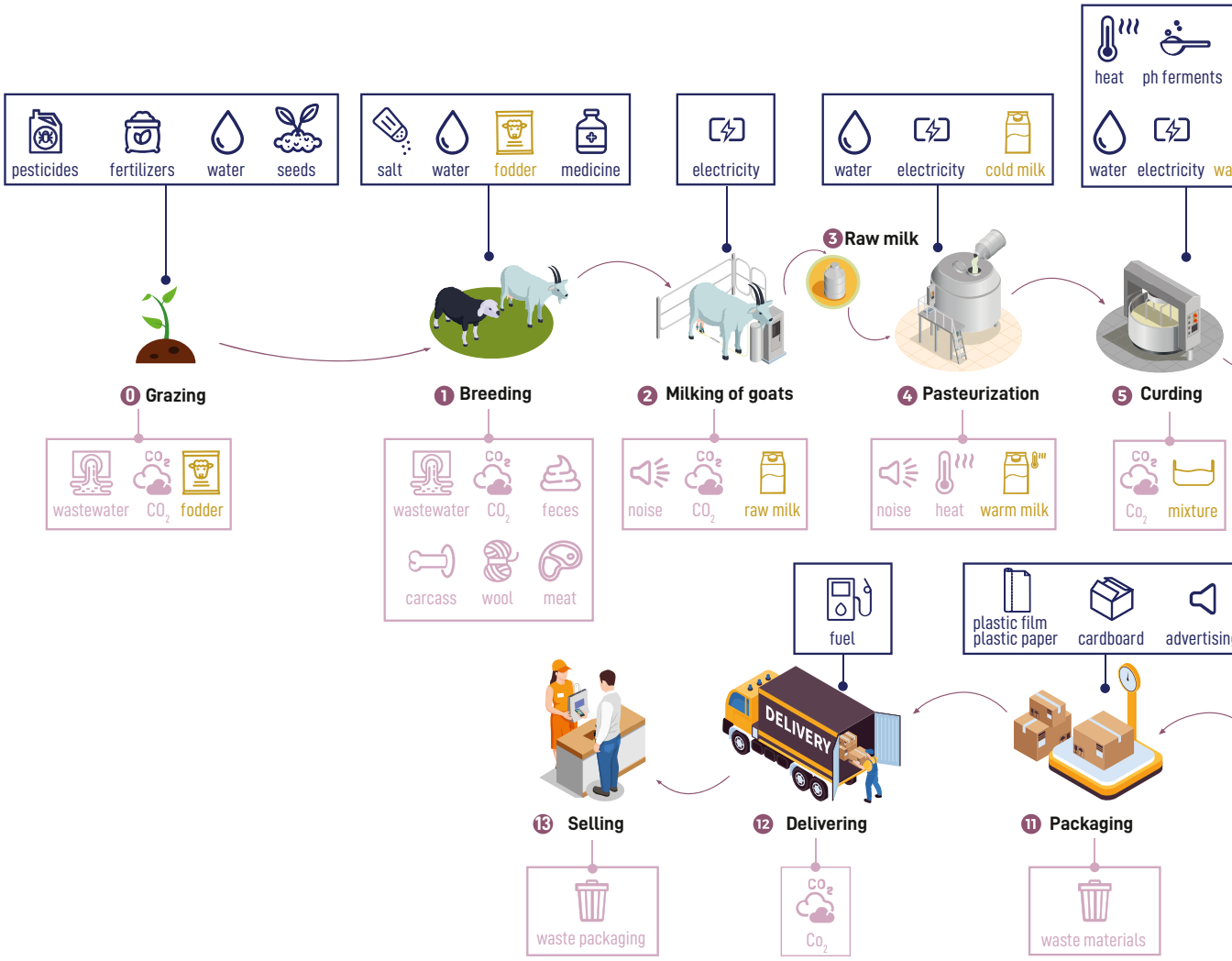
5. Cypriot goat dairy system sector

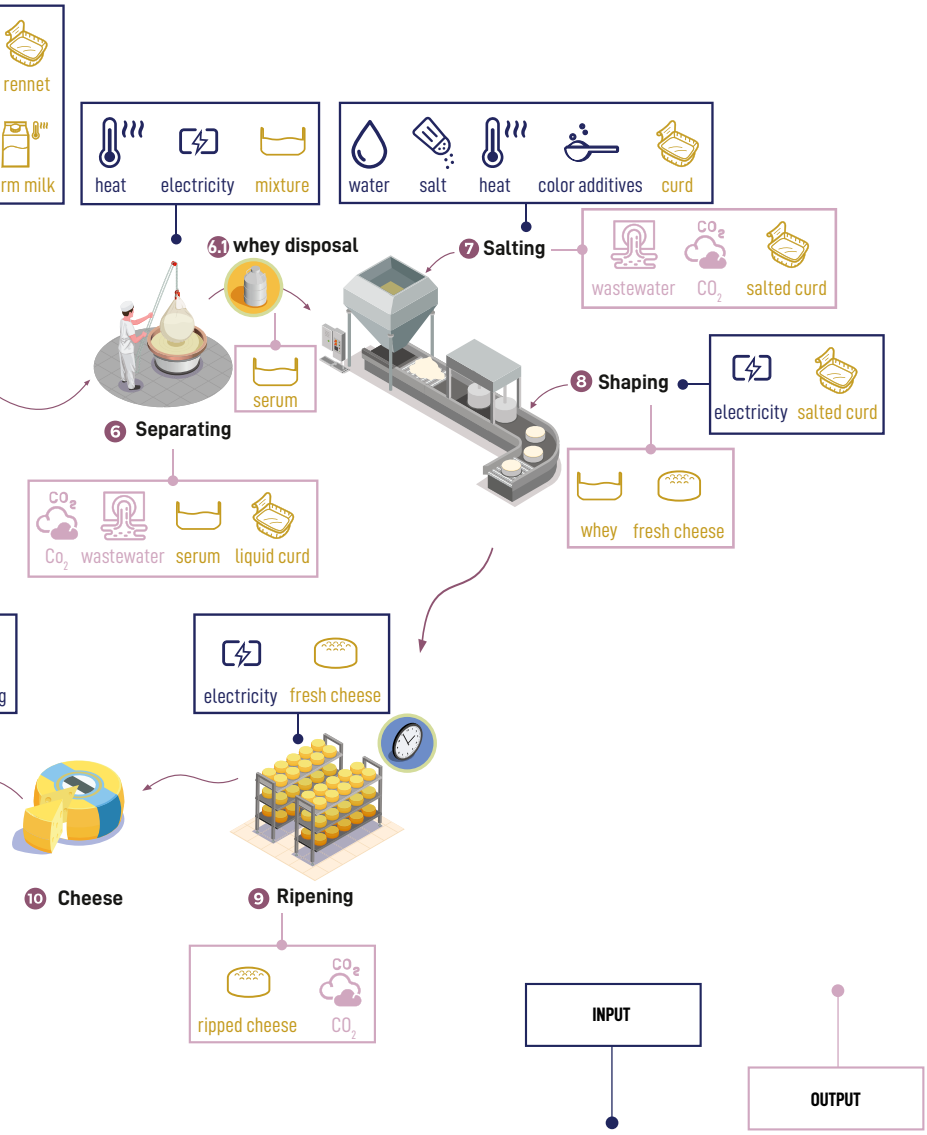
Goat cheese industry chain



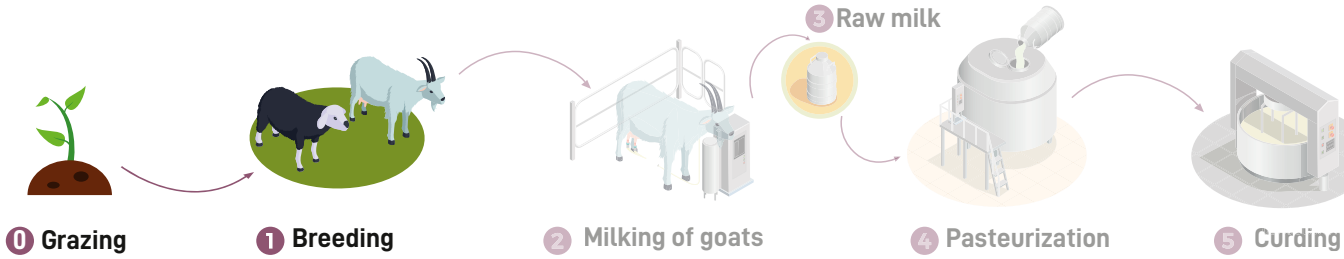

6.1 whey disposal
7 Salting
8 Shaping
6 Separating
10 Cheese
9 Ripening

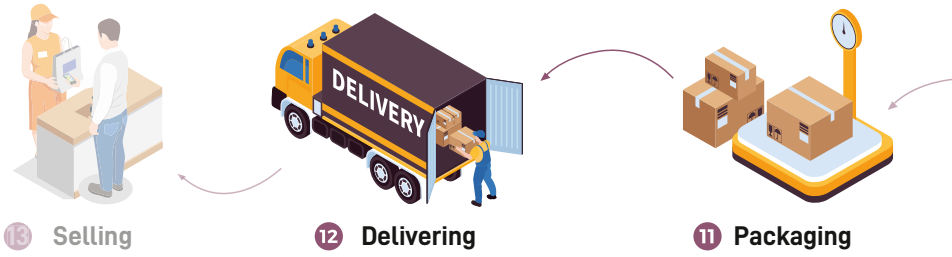
Input - output of Cypriot goat cheese industry

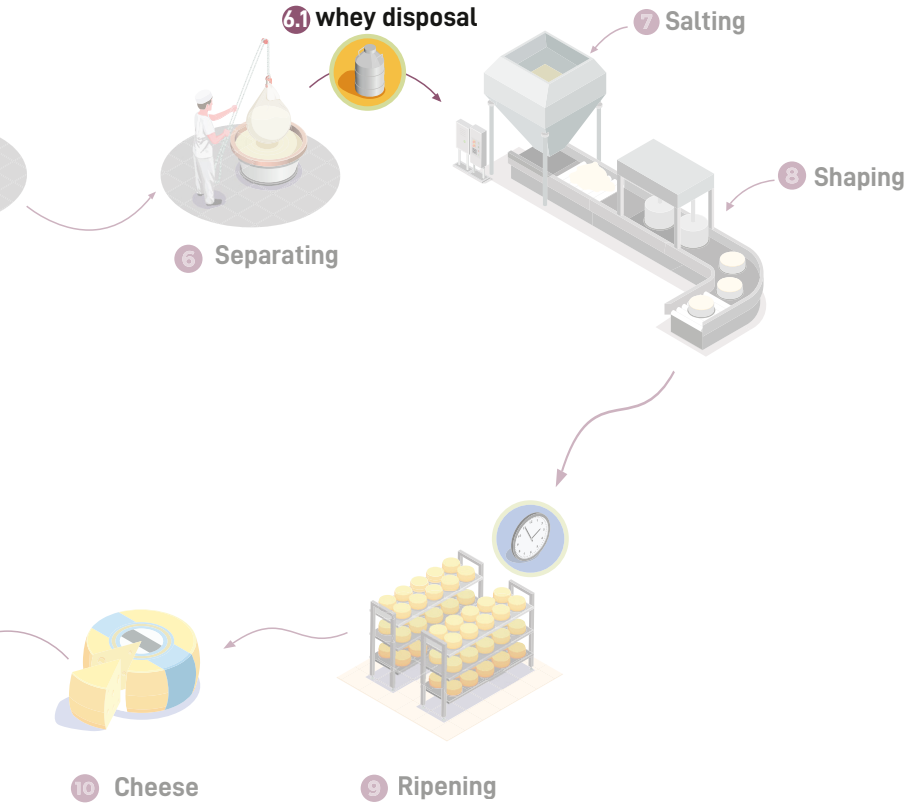



rennet
rm milk
heat
electricity
mixture
water
salt
heat
color additives
curd
6.1 whey disposal
7 Salting
wastewater
CO_2
salted curd
serum
8 Shaping
electricity
salted curd
6 Separating
Co_2
wastewater
serum
liquid curd
whey
fresh cheese
electricity
fresh cheese
10 Cheese
9 Ripening
ripped cheese
CO_2
INPUT
OUTPUT

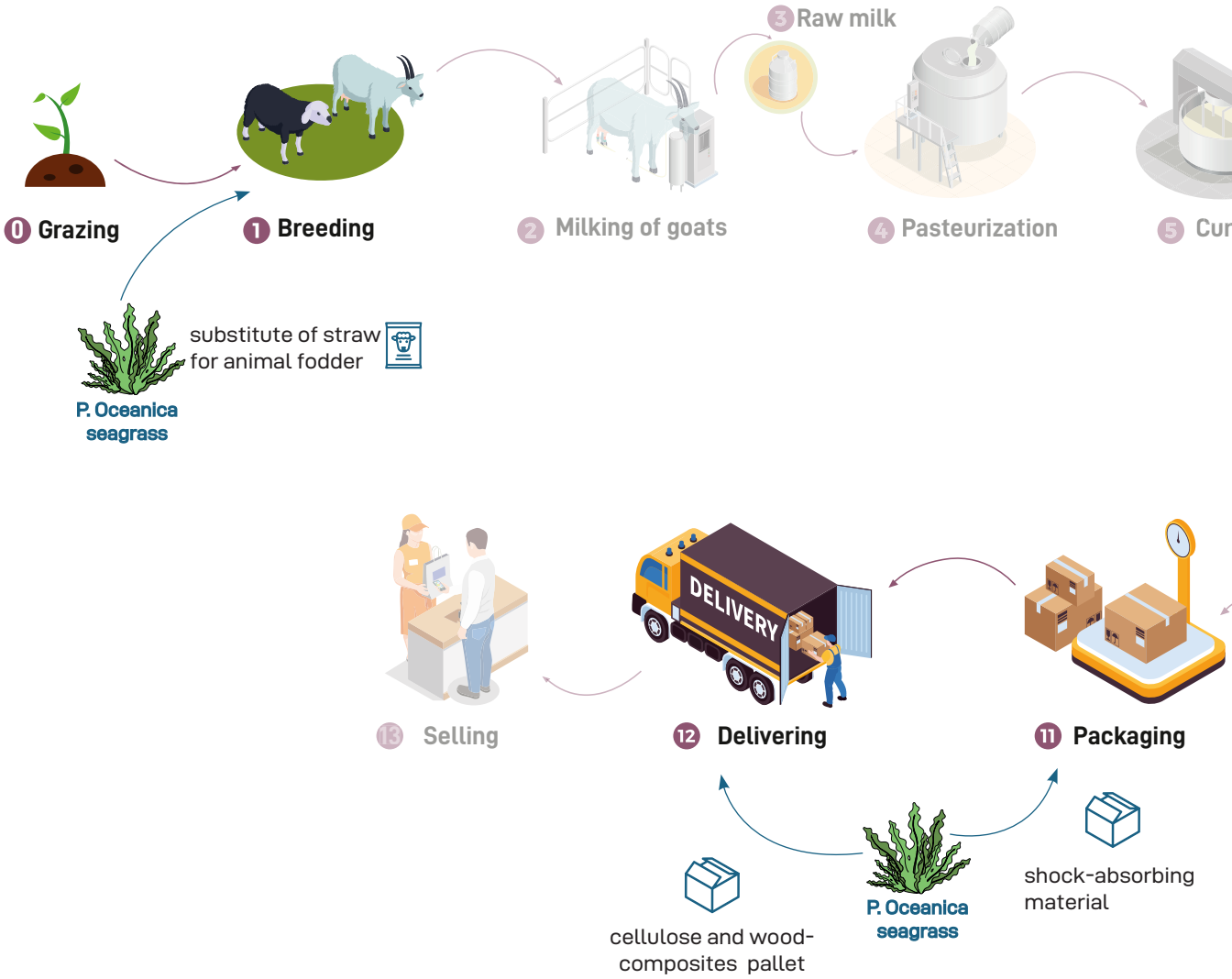
Focus steps

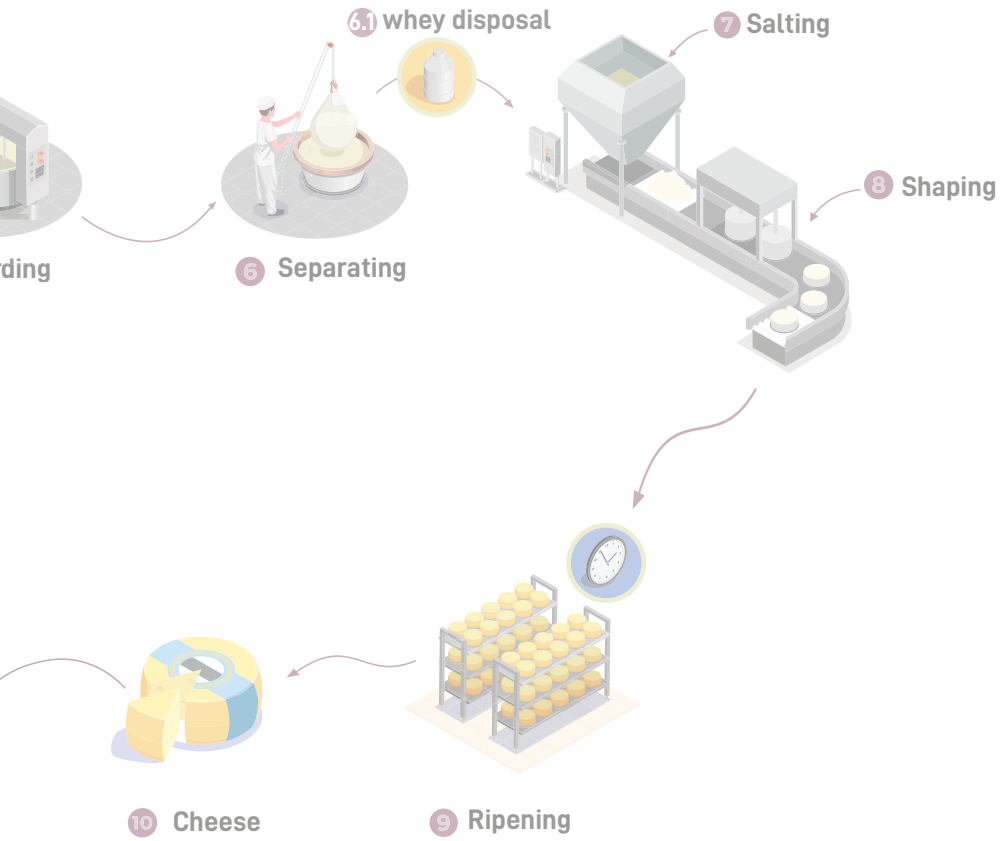

3 Raw milk
0 Grazing
1 Breeding
2 Milking of goats
4 Pasteurization
5 Curding


DELIVERY
13 Selling
12 Delivering
11 Packaging

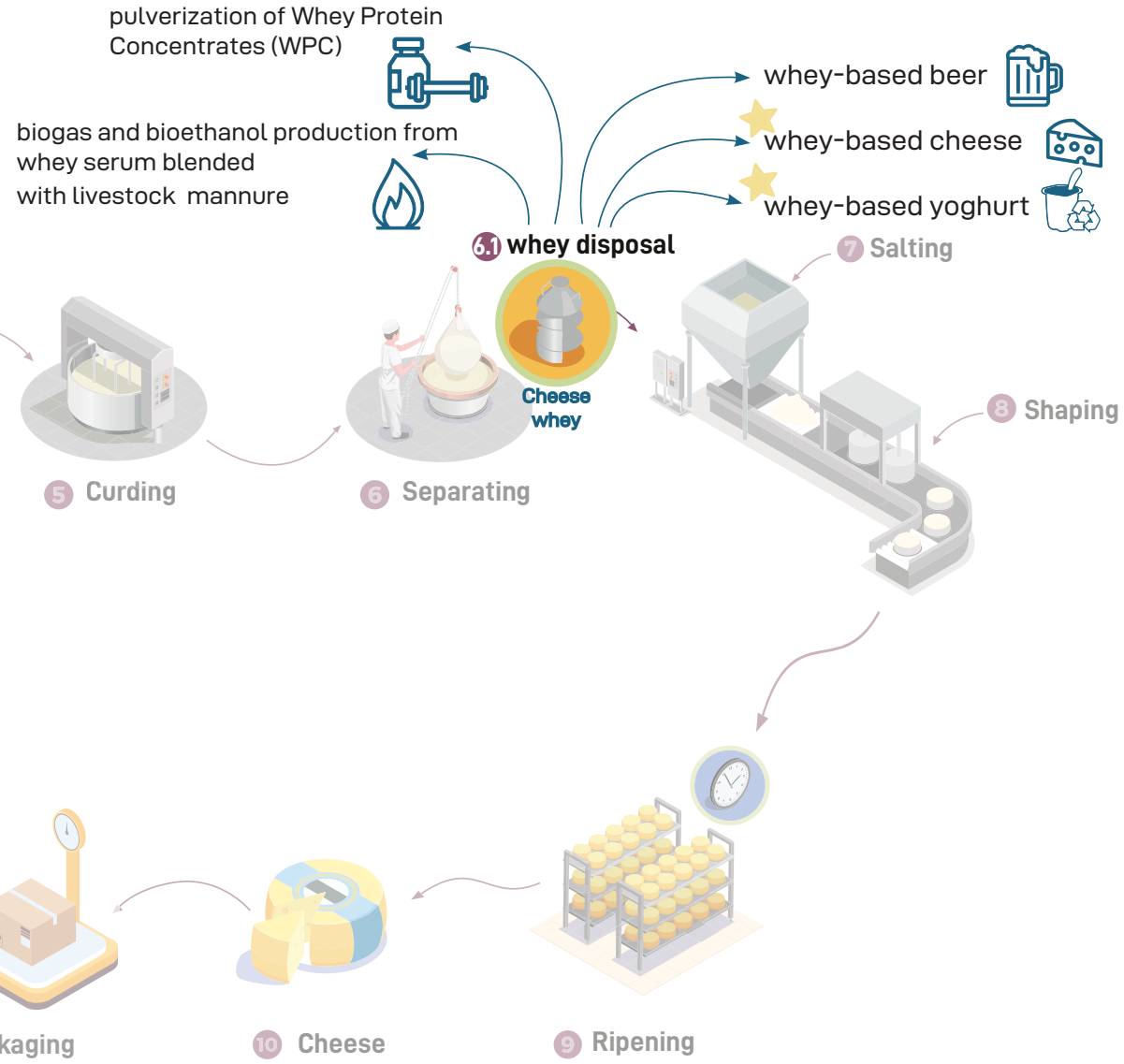

6.1 whey disposal
7 Salting
8 Shaping
6 Separating
10 Cheese
9 Ripening

Introduction of Posidonia Oceanica seagrass

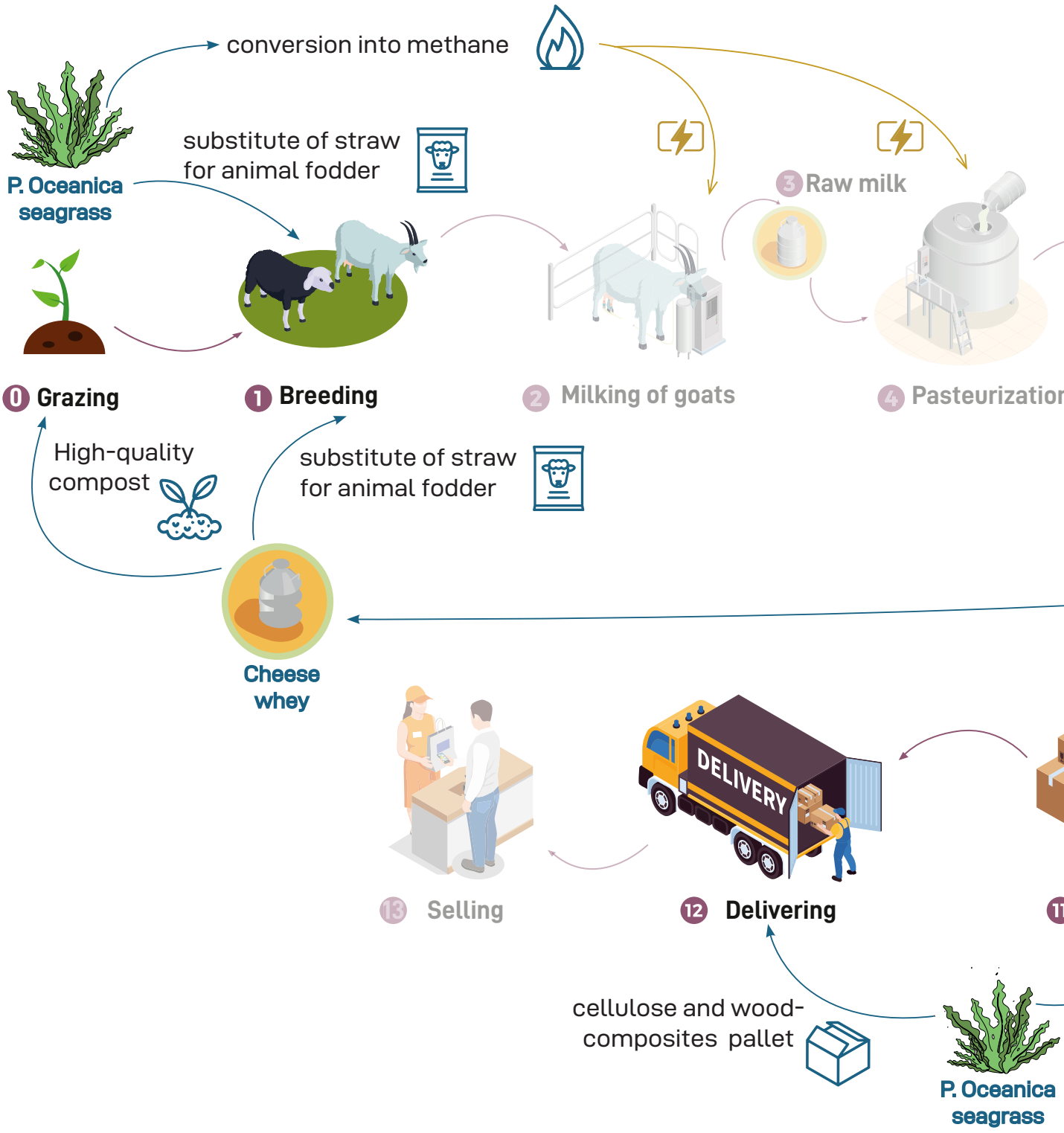


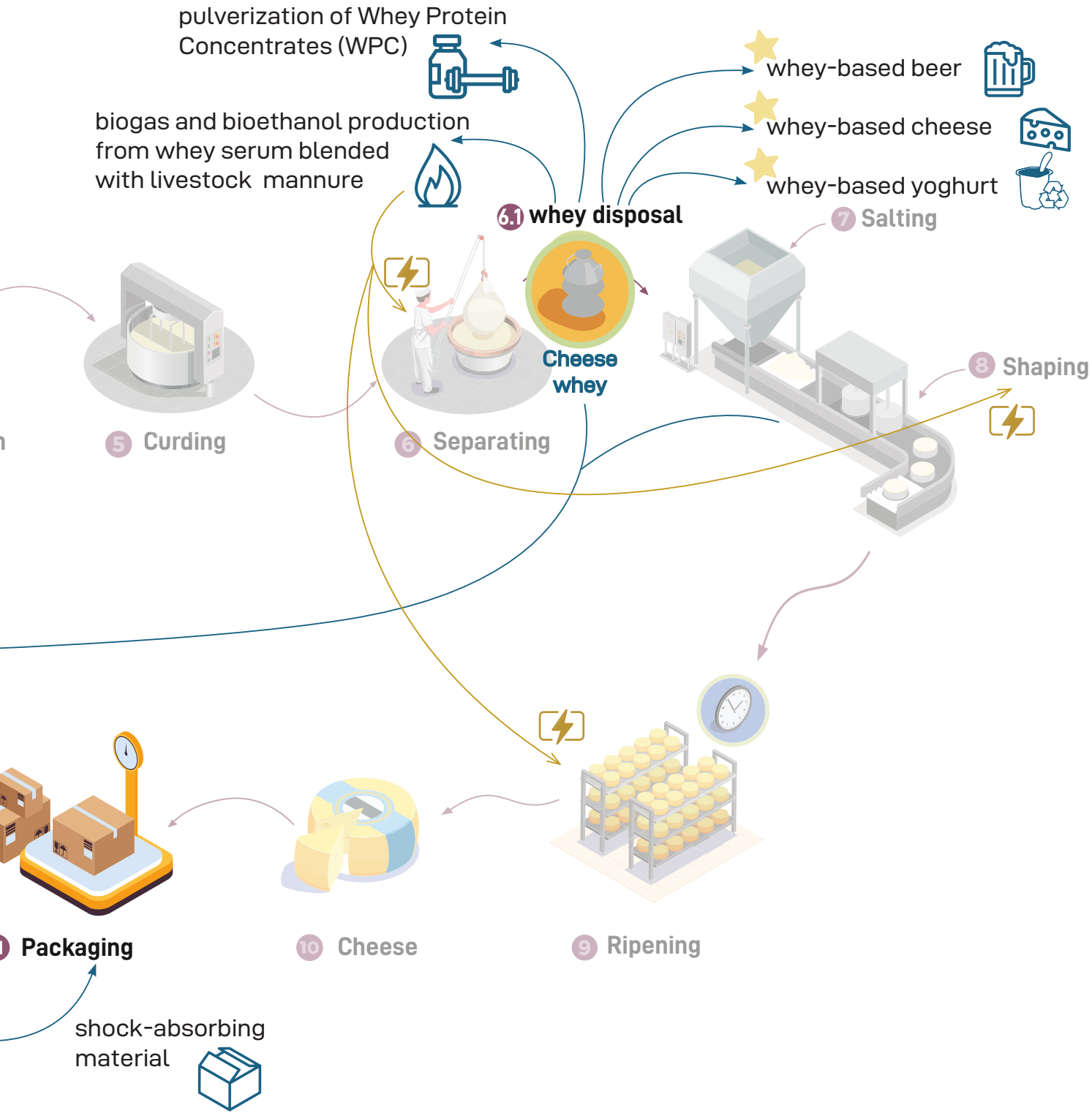

6.1 whey disposal
7 Salting
8 Shaping
rding
6 Separating
10 Cheese
9 Ripening

Recovery of wasted whey


pulverization of Whey Protein Concentrates (WPC)
biogas and bioethanol production from whey serum blended with livestock mannure
whey-based beer
whey-based cheese
whey-based yoghurt
6.1 whey disposal
Cheese whey
7 Salting
8 Shaping
5 Curding
6 Separating
9 Ripening
10 Cheese
kaging

5.5 New circular system




pulverization of Whey Protein Concentrates (WPC)
biogas and bioethanol production from whey serum blended with livestock mannure
whey-based beer
whey-based cheese
whey-based yoghurt
6.1 whey disposal
7 Salting
Cheese whey
8 Shaping
5 Curding
6 Separating
9 Ripening
10 Cheese
Packaging
shock-absorbing material

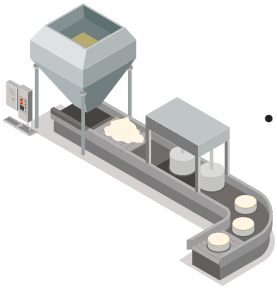
How can we make this proposal endures in time?

- **Biochar** used like soil amendment to increase the carbon fixation of plants and to reduce Co_2 emissions

- Livestock **genetic improvement** via genomic evaluation and selection

- Phyto-depurated **waste water** for irrigation and livestock

- **Ultrasound** technology to increase the shelf-life of milk



- **Ozone** and phyto-depurated **wastewater** to wash the machinery

- **Bio-plastic** from wastewater and algae

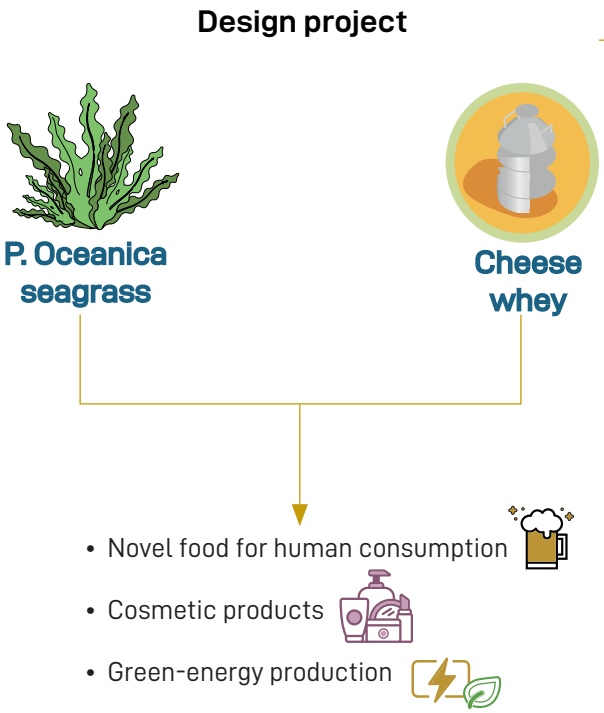
- **Awareness** and promotional **campaigns**

- Dedicated **online platform** to enlarge selling channels

Impact on production chains

novel foods industry
energy industry
cosmetic industry
fertilizers industry
proteins industry
packaging industry

5.6 New by-products brand



Product made through smart and synergetic use of seagrass and cheese whey

New brand

Brand payoff

Φοίνιξ
from waste to wealth

The name of the brand in Greek means **phoenix**, symbolizing the **rebirth from an exhausted situation**. The payoff also proposes the same concept by reformulating the famous phrase **'form cradle to cradle'**.

Concept

Poseidonia Oceanica seagrass

\+

Goat cheese whey

Coloured brand logo

The color and shape of the whey drop gradually becomes an ocean green alga.

Brand Identity

Black and white logotype

Black and white logotype

Color palette

678F41 - green seagrass

FCCD89 - yellow whey

000000 - black

Font

Minion Pro Regular

D-DIN Condensed

Other proposals

Proposals for use

Packaging labeling for products made through smart and synergetic use of seagrass and cheese whey, such as: novel food for human consumption, cosmetic products and green-energy production.


Φοίνιξ
from waste to wealth
nº 016
By purchasing this product you give new value to the industrial waste of the dairy supply chain, contributing to the protection of the local marine environment.

Proposals for use

Yogurt and cheese.

Local players in the sector who could develop the brand
family-run dairies, dairy companies, foodwaste start-up, supermarkets, ice cream parlors


Φοίνιξ
from waste to wealth
NATURAL
100%
Bio
Fresh
Yogurt
By purchasing this product you give new value to the industrial dairy supply chain, contributing to the protection of the local marine environment.

Proposals for use

Yogurt and cheese.

Local players in the sector who could develop the brand
family-run dairies, dairy companies, foodwaste start-up, supermarkets, ice cream parlors


Φοίνιξ
from waste to wealth
WHEY-BASED CHEESE
By purchasing this product you give new value to the industrial waste of the dairy supply chain, contributing to the protection of the local marine environment.

Proposals for use

Beer.

Local players in the sector who could develop the brand
craft breweries, new beer companies, bars, pubs, supermarkets, foodwaste start-up


BEER
BOTTLE
HIGH QUALITY BEER
WHEY-BASED
Beer
BOTTLE
Φοίνιξ

Proposals for use

Cosmetics.

Local players in the sector who could develop the brand
pharmacies, perfumeries, cosmetic industry, supermarkets, beauty start-up

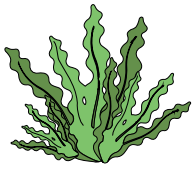
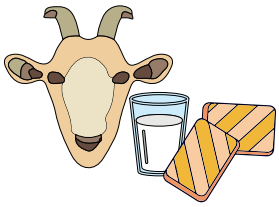

HIGH QUALITY RGEENERATIVE COSMETIC
EVERYDAY FACE CREAM
AMBER GLASS
Φοίνιξ
from waste to wealth
By purchasing this product you give new value to the industrial waste of the dairy supply chain, contributing to the protection of the local marine environment.

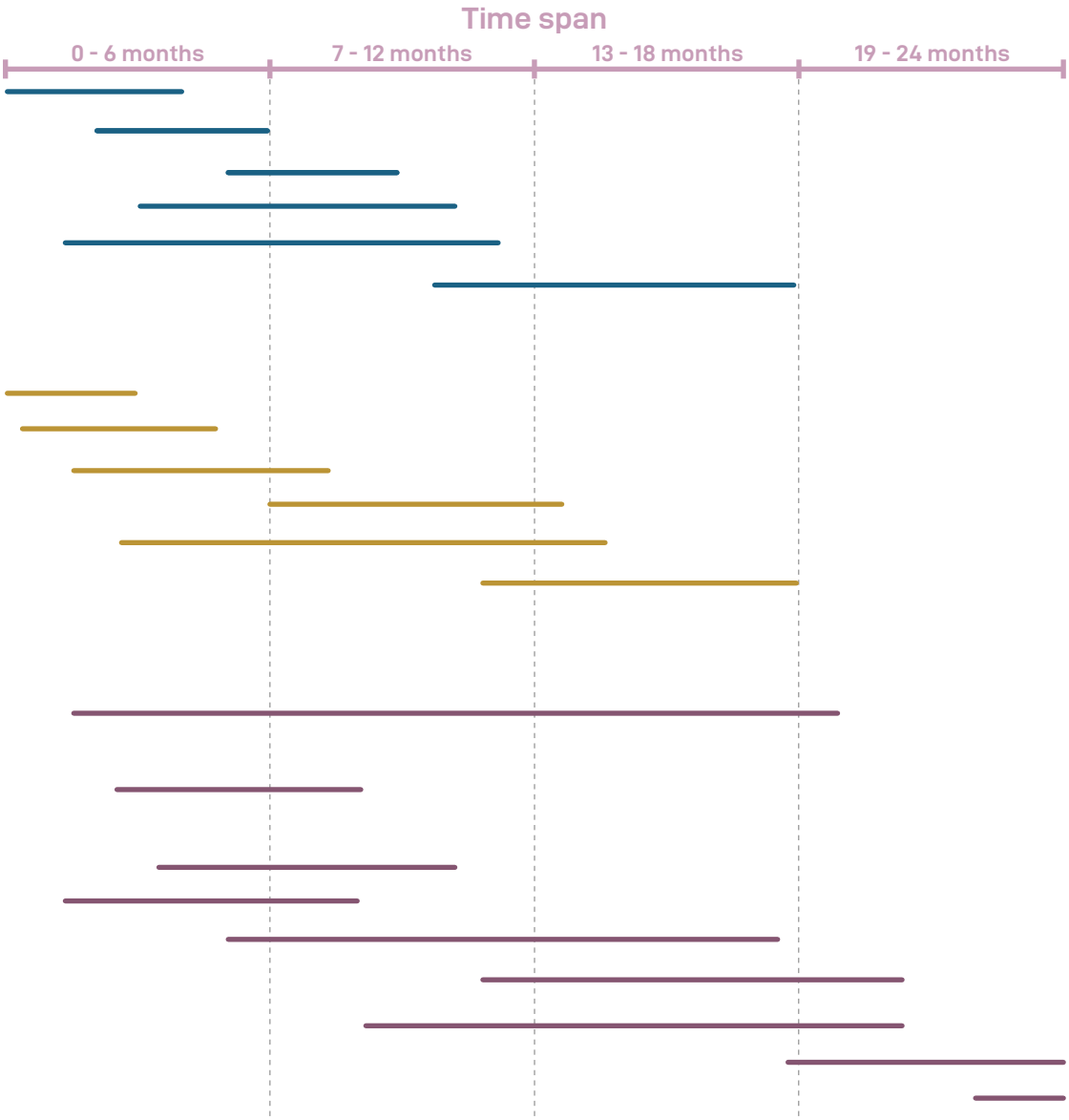
Proposals for use

Cosmetics.

Local players in the sector who could develop the brand
pharmacies, perfumeries, cosmetic industry, supermarkets, beauty start-up

5.7 New start-up ecosystem

Business	Task
 P. Oceanica seagrass	- collection of qualitative and quantitative data on the presence of P. Oceanica on the island - mapping of marine meadows and beach banquettes - identification of the main actors involved in the marine and beach algae management - identification of algae treatment and conservation sites - involvement of possible stakeholders - presentation of the project to lenders
 Dairy goat industry	- collection of qualitative and quantitative data of the Cypriot goat dairy industry - mapping of goat livestocks and goat cheese production sites - goat dairy market mapping - identification of whey treatment and conservation sites - involvement of possible stakeholders - presentation of the project to lenders
Φοίνιξ from waste to wealth Novel businesses	- collection of qualitative and quantitative data regarding willingness and acceptance to adopt new businesses in the Cypriot market - identification and mapping of dairy realities for the production of novel food for human consumption - identification and mapping of innovative cosmetic industry players - identification and mapping of green-energy producers - involvement of possible stakeholders - presentation of the project to lenders - promotion and public awareness of the project - social recognition of the brand - export of branded products


Time span
0 - 6 months
7 - 12 months
13 - 18 months
19 - 24 months

Conclusion

The encouragement of agriculture and **concentration on quality** instead of quantity, central goals are the main goals that are carried out in a new decade. The government has invested heavily in the modernization and restructuring of the agricultural sector in general, with **generous EU funds**, and has given additional support to the sector through various programs and subsidies. As depicted by the concentration of economic growth limited to few sectors, one of the key challenges aimed to be solved by the new growth model is the **need to address diversification and productivity. The project outcomes highiligth a new strategic positioning of Cyprus' primary and secondary sectors** and its traditional sectors driving growth including tourism and ICT, as well as additional new economic sub-sectors.

Endings

The proposed systemic design agri-food project for the Cypriot context, opens up new scenarios, starting with the impetus for innovation and research. The important issues identified in the analysis of linear systems are the change of the current production model to a **circular economy model** and the strength of a systematic approach and **improvement of local resources of knowledge based on choices focused on environmental, social and economic sustainability.** A **holistic approach** was used to analyze the region, highlighting Cyprus' strengths and weaknesses. This part of the study was important in finding all local actors who could work within the agri-food sector. Cross-sectional analysis between case studies, best practices and territorial analyzes allowed to create new networks in the agri-food system. The systemic approach becomes a fundamental experience for the improvement and development of the territory from an economic, social and environmental point of view, and the final strategy aims to **develop guidelines and criteria for intervention within the territory**.

Over the last two years, Cyprus has introduced many initiatives to **boost the agricultural sector** in areas such as water and **waste management, smart farming, environmental protection** and new measures to **ensure better animal welfare**. It is important to keep it. In addition, **the country has a global focus on the protection and promotion of high quality traditional products. "**With the help of **generous EU funding,** the government has invested heavily in the modernization and restructuring of the entire agricultural sector, providing additional support to the sector through various programs and subsidies" (http://www.cyprusprofile.com).
This agricultural sector overhaul is being carried out in a rural development program in which the EU and Cyprus are co-funded by 52% and 48%, respectively. More than € 485 million is expected to come from the **Common Agricultural Policy (CAP)** between 2014 and 2020, with additional funding for modernization and development under the new CAP from 2021 to 2027.
The program is open to all sectors for investment in the primary and secondary sectors, including organic farming, education, promotion, agritourism and applications for a Protected Designation of Origin (PDO) or Protected Geographical Indication (PGI). **Cypriot agriculture is definitely enjoying a renaissance into a more efficient and value-added industry, with the help of innovation and investment in renewable energy and smart technologies**, and with a younger generation with an entrepreneurial spirit eager to conquer new markets around the world and seize the future potential of this sector.

The new market proposed in this thesis for the Cypriot agri-food system is the creation of a valuable chain related to the local goat dairy industry and the removed amount of Posidonia Oceanica seagrass banquettes. Leaving Posidonia beds in the coastal environment is the best option, because their presence on the beach plays an important role for the ecosystems, helping to protect and stabilize coastlines and coastal dunes, improving biodiversity and reduce winter sand erosion. However, it has been recognized that in some situations, especially on the most popular holiday beaches, the presence of numerous seagrass can adversely affect the convenience of the area. Regulators and advisors should instruct local beach managers with operating procedures to mantain, dispose and recycle removed banquettes, developing awareness raising and communication programmes at a local level (e.g. through Blue flag network or through environmental programmes).

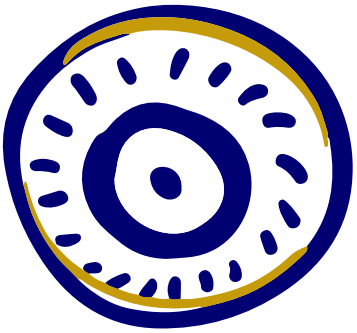
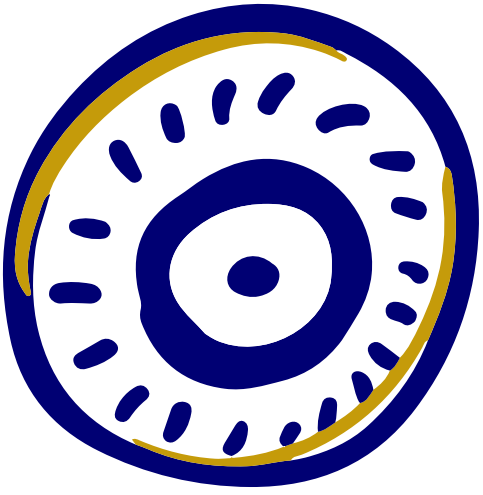
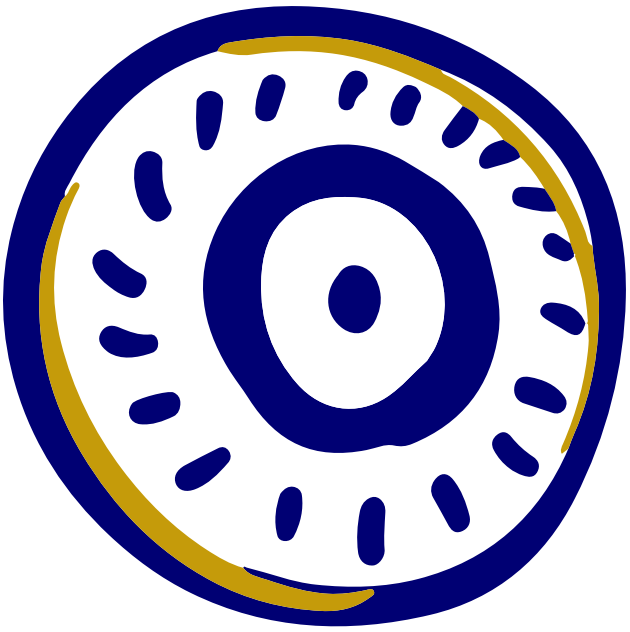
The creation of a new by-products brand like "Phenix - from waste to wealth" allows to work with two different but important supply chains of the Cypriot context **(DPO Halloumi cheese and Posidonia Oceanica seagrass)**, recovering wasted outputs **(cheese whey and dead leaves) to generate a new local circular economy chain able to improve island sustainability fostering its resilience.**
The proposed innovative system **reduces the over-exploitation of peat lands, contributes to the maintenance of meadows** and through a synergistic use of waste and by-products **impacts several production chains**, such as: **novel foods industry, green energy production, cosmetic industry, fertilizers industry, proteins market and packaging industry.**

[69] Savory Allan, How to green the world's deserts and reverse climate change (https://www.youtube.com/watch?v=vpTHi7O66pI), VIDEO

In conclusion, **Cyprus is not self-sufficient in resources and being an isolated system, as an island it must strive to achieve its own sustainability by developing resilience**, understood as "the ability of a system to recover quickly after an external shock, better withstanding environmental, political, economic and social stresses". A common and fundamental aspect of life on the island and all activities on it is water.
At the root of the unsustainability and lack of resilience of the entire island is unsustainable water management. Agriculture, in fact, is the main sector through which to improve access to and supply of water on the island, as it uses about 65% of the available water and has ample scope for project intervention (land stewardship, food-waste recovery, biorefinery, food and wine tourism, etc.). The **introduction of P. Oceanica** in the agri-food system takes place **in the animal feed chain and in transport**, as the seagrass can be used as an anti-shock material. In addition to **absorbing large quantities of CO_2** from the atmosphere, Posidonia, when used as a **substitute for straw in animal fodder**, reduces the volume of water consumed for irrigation. **Seagrass cultivation requires neither water nor fertiliser.** Furthermore, by exploiting the **principles of Holistic Grazing**[69] and using the **goats' highly biological manure as fertiliser**, it is possible to make the soil healthier, more fertile and more spongy, **increasing the water catchment capacity of the soil**: a key factor in combating desertification.

By **intervening in the goat dairy sector**, it is possible to **valorise waste whey**, promoting the creation of **new market value chains (novel foods for human consumption, cosmetics, green-energy production)** and encouraging the **growth of algae in saline wate**r that are **useful for the phyto-purification of waste water** (Chlorella Vulgaris and Spirulina).
In the end, to make an analogy with the 3 P's of sustainability (People, Planet, Profit) let us consider the **3 R's of the water cycle** that can be used to **increase the resilience of the island of Cyprus**:
- **Reduction of water** consumption obtained through the use of **P.Oceanica instead of hay**.
- **Recovery of water** obtained through **phyto-purification by algae grown in the saline liquid** of cheese whey.
- **Recapture of water** obtained through **increased soil fertility and porosity**.

Immensely thanks to Professor Silvia Barbero, supervisor of the thesis project, and Carolina Giraldo Nohra, co-supervisor of it, for the constant support provided necessary for the optimal development of the research project. Thanks also to Roberto Sciffo and Ihsan Malik of ISA Energy, the Statistical Data Department of the Republic of Cyprus, Louis Hadjioannou of the Cyprus Marine & Maritime Institute, without which it would not have been possible to apply the analysis in the real Cypriot context.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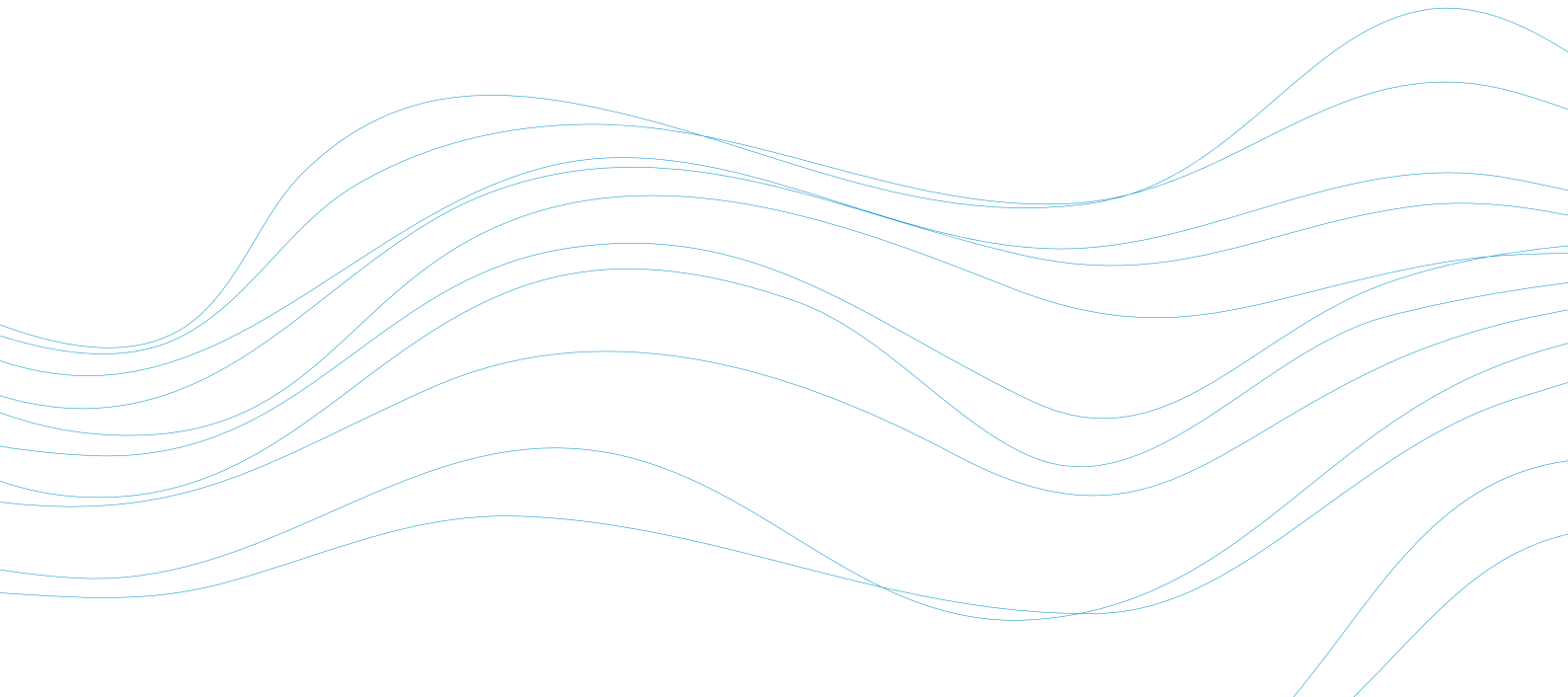

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... getting a new product adopted, even when it has obvious advantages, is often very difficult.

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