

Policy analysis:

Promoting SICS adoption in Keszthely, Hungary

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Executive summary

The main soil threats in the study site “Keszthely”, Hungary are soil compaction, the decline of soil organic matter, soil erosion and contamination from nitrates. Problems are caused by intensive land use without nutrient replenishment, lack of organic fertiliser use, inadequate soil cultivation and tillage equipment, SICS tested at the study site are thought to address these threats and include integrated nutrient management measures (*Organic/inorganic N fertilization, mineral fertilisation in continuous maize cropping*), integrated nutrient management in combination with crop rotations (*organic/inorganic fertilisation in different rotations*), and reduced tillage practices (*Tillage in maize-wheat biculture*). (Organic/inorganic N fertilization, mineral fertilisation in continuous maize cropping) and reduced tillage practices (Tillage in maize-wheat biculture).

Policy shortcomings and opportunities

The use of soil-improving cropping practices is regulated and incentivised through a range of existing regulatory, and economic instruments in Hungary, with the exception of smart weed control as well as smart residue and controlled traffic management (shaded in light green)¹. The analysis shows that several policies cover the SICS trialled at the study site (shaded in dark green): cross-compliance requirements and greening measures established under the CAP incentivise farmers to adopt crop-rotation practices. Nutrient management is regulated through various pieces of water legislation which establish limitations on or requirements or fertiliser (and pesticide). National soil protection legislation mandates the drafting of soil protection plans for a range of agricultural activities and the adoption of measures to protect soil, including reduced/no tillage methods, to mitigate local soil threats.

Table 1: Coverage of SICS in relevant national and regional policies, instruments, and measures in Keszthely, Hungary

Policy	Crop rotation	Green manures, cover crops, catch crops	Integrated nutrient management	Enhanced efficiency irrigation	Controlled drainage	Reduced tillage	Integrated pest management	Smart weed control	Smart residue management	Controlled traffic management	Integrated landscape management
CAP GAEC Cross-compliance Standards											
Act on the General Rules of Environmental Protection											
Rules for Action Program against Agricultural Nitrate Pollution, Data Reporting and Record Keeping											
Decree on the Protection of Waters against Nitrates Pollution from Agricultural Origin											
Decree on Protection of Geological											

¹ See the Annex for a more detailed overview of the policies described in this section.

Policy	Crop rotation	Green manures, cover crops, catch crops	Integrated nutrient management	Enhanced efficiency irrigation	Controlled drainage	Reduced tillage	Integrated pest management	Smart weed control	Smart residue management	Controlled traffic management	Integrated landscape management
Medium and Groundwater against Pollution											
Rules about Agricultural Utilization of Sewage Sludge and Waste Water											
Decree authorizing the placing on the market and use of plant protection products and packaging, marking, storage and transport of plant protection											
Rules about Authorization, Storage, Marketing and Utilization of Fertilising Products											
National Action Plan to Improve Organic Farming											
Ministerial Decree on Preparation of Soil Protection Plan											
Act on Cultivated Land											
Act on the Protection of Cultivated Soil											

Evidence gathered through desk research, interviews and a stakeholder workshop show that different factors contribute to and undermine the uptake of SICS in general, and of the practices tested in Keszthely, Hungary in particular. These include:

- Limited coherence between policies
- Weak enforcement
- Availability of grants/subsidies
- Lack of information

Recommendations for actions to promote the uptake of SICS

Based on the analysis of bottlenecks and opportunities in national policy to facilitate the adoption of Soil-Improving Cropping Systems in Hungary, the following recommendations were formulated:

- **Simplification of the policy framework and better enforcement:** Policies are viewed by stakeholders as complicated, incoherent, and poorly enforced. This makes it challenging for farmers to comply with policy requirements, especially if they observe that they face little consequence for non-compliance. While it is found that there are a number of policies already in place that impact soil, they require simplification both at EU and national level legislation. In addition, they need to be more effectively enforced to produce the intended outcomes and impacts. This also

concerns ensuring policy is coherent and not working towards contradictory goals.

- **Raising awareness of the environmental benefits of SICS:** There is need to provide farmers with information on SICS. There is very little awareness of the benefits of soil bacteria in the soil and what technique can facilitate its maintenance. Information needs to also be aimed at consumers, who should be encouraged to purchase from sustainably managed farms.
- **Using available funding to promote SICS adoption:** Funding opportunities are the main driver for SICS adoption, especially funding from EU level. With the post-2020 CAP, new funding rules funding rules will be introduced. The Good Agricultural Environmental Conditions (GAECs) now offer a greater chance for soil protection. New conditions with the potential to improve soil health have been added, e.g., crop rotation is introduced under GAEC 8. The new agri-environment-climate measures present opportunities to address declining soil health. Key will be for Member States to allocate enough of the budget available to them to soil health measures.

1 Introduction

Soil is increasingly recognised as a crucial resource providing products such as feed, fibre, food and fuel as well as critical ecosystem services including water storage, filtration, and carbon sequestration. Soil is an essential ecosystem and is the foundation for our cities and towns. Despite its recognised importance in sustaining ecosystems functions, human life and economic activities, soil is being over-exploited, degraded and irreversibly lost due to inappropriate land management practices, industrial activities and land use changes that lead to soil sealing, contamination, erosion, and loss of organic carbon.

Agriculture occupies a substantial proportion of European land and consequently contributes significantly to various forms of degradation. The uptake of innovations associated with potential benefits to soil quality, such as precision farming and conservation agriculture is slowly expanding across Europe. However, these are often not adopted to their full potential and in some cases are eventually abandoned, and the question remains as to why support and adoption of these practices by European farmers is still considerably weak (e.g. Lahmar 2010²).

Research aim and questions

The work presented here was carried out as part of the EU-funded SoilCare project.³ The overall aim of SoilCare is to identify, evaluate and promote promising soil-improving cropping systems (SICS). SoilCare defines SICS as cropping systems that improve soil quality (and hence its functions), and that have positive impacts on the profitability and sustainability of agriculture. Cropping systems refer to crop type, crop rotation, and associated agronomic management techniques (see

Table 2).

Table 2: List of promising general SICS⁴

Component	Expected impact
Crop rotation	Improves crop productivity, soil biodiversity and system sustainability; decreases need for pesticides and risk of erosion
Green manures, cover crops, catch crops	Improves Soil Organic Matter (SOM) content, soil structure, soil biodiversity, nutrient use efficiency; decreases nutrient leaching, run-off, erosion
Integrated nutrient management	Improves crop productivity, soil nutrient status and resource use efficiency
Enhanced efficiency irrigation	Improves crop productivity and resource use efficiency; minimizes risks of salinization and desertification
Controlled drainage	Improves crop productivity and resource use efficiency; minimizes the risk of waterlogging

² Lahmar, R. 2010. Adoption of conservation agriculture in Europe: Lessons of the KASSA project. *Land Use Policy* 27(1): 4-10.

³ SoilCare: Soilcare for profitable and sustainable crop production in Europe, <https://www.soilcare-project.eu/>

⁴ D2.1 – A review of soil improving cropping systems, available at : <https://www.soilcare-project.eu/downloads/public-documents/soilcare-reports/75-report-06-d2-1-a-review-of-soil-improving-cropping-systems-wenr-oene-oenema>

Component	Expected impact
Reduced tillage	Reduces energy cost and may enhance SOM content and soil structure; may increase the need for herbicides/ pesticides
Integrated pest management	Improves crop productivity and resource use efficiency; minimizes the loss of biodiversity.
Smart weed control	Improves crop productivity and resource use efficiency; may decrease the need for herbicides
Smart residue management	Reduces evaporation and soil temperature; may increase/decrease the succes of germination
Controlled traffic management	Reduces energy cost and the risk of soil compaction
Integrated landscape management	Improves biodiversty and cropping systems sustainability

The main aim of the work presented here was to formulate policy alternatives⁵ and actions at EU and study site level to facilitate the adoption of soil-improving cropping systems. Understanding common barriers to the adoption of soil improving practices is an important prerequisite for identifying and designing policy measures to encourage farmers to adopt effective soil conservation practices. A second important foundation for developing appropriate policies is an appreciation of the effectiveness of soil conservation policies in agriculture.

A starting point for any policy analysis is to recognise the success and failures of different types of policy – whether they are regulatory instruments, economic instruments, voluntary instruments, or educational/information instruments. There is plenty of academic research available on the efficiency and effectiveness of these instruments in general, and it is beyond the scope of this Country Report to assess them in detail. However, it is important to recognise the limitations of each, as many of the success and failures of national soil policy may be attributed to the fundamental successes and failures of the types of policy. Table 2 below provides a summary of the different types of policies.

Table 3: Summary of policy approaches

Policy approach	Premise	Positive attributes	Negative attributes
Regulatory instruments	Force farmers to adopt SICS	<ul style="list-style-type: none"> Levels the playing field between competitors, as everyone must play by the same rules Fairly consistent (often long-term) 	<ul style="list-style-type: none"> Inflexible regardless of individual situations May be costly to implement Monitoring and enforcement can be costly Discourages innovation
Economic instruments	Incentivise farmers to adopt SICS using payments and	<ul style="list-style-type: none"> Encourages innovative methods Can offset cost of implementation and/or 	<ul style="list-style-type: none"> Can be subject to fluctuations as the market fluctuates High likelihood of

⁵ Policy, loosely defined, is “officially accepted set of rules or ideas about what should be done” or “a system of courses of action with a common long-term objective (or objectives) formulated by governmental entities or its representatives” (see <http://learnersdictionary.com/definition/policy> and <https://www.thefreedictionary.com/policy>). Policy alternative refers to a set of different types of policy options including economic instruments, regulatory instruments, planning instruments and information/knowledge instruments.

Policy approach	Premise	Positive attributes	Negative attributes
	taxes etc.	discourage adverse behaviour <ul style="list-style-type: none"> Allows a certain amount of flexibility 	setting subsidies/taxes at incorrect rate (which leads to inefficiencies) <ul style="list-style-type: none"> Can be subject to game-playing behaviour
Voluntary instruments	Encourage farmers to adopt SICS	<ul style="list-style-type: none"> Sense of “ownership” as the decision was taken freely High degree of flexibility 	<ul style="list-style-type: none"> Does not guarantee implementation
Educational/information instruments	Educate farmers so they understand the importance of SICS	<ul style="list-style-type: none"> Implementation as a result of truly understanding the impacts of the actions High degree of flexibility 	<ul style="list-style-type: none"> Does not guarantee implementation Relies on interest of affected parties Often takes more time to become effective

Against this background, the following research objectives were formulated at the outset of the work:

- A. To identify existing policies and policy instruments at EU-level as well as national and (sub)regional level in the 16 SoilCare countries promoting soil quality, and particularly the adoption of soil-improving cropping systems.
- B. To describe the intended mechanisms and impacts of existing policies, instruments, and practices.
- C. To assess the extent to which existing policies, policy instruments and practices promote the adoption of soil-improving cropping systems.
- D. To identify contextual factors, particularly institutional settings, influencing policy impact on farmer adoption.
- E. To identify existing policies, policy alternatives and complementary actions that could promote the uptake of SICS.
- F. To assess the performance of good policy alternatives, their advantages, and disadvantages.

This report presents an inventory and analysis of bottlenecks and opportunities in sectoral and environmental policies to facilitate the adoption of SICS in Hungary and fits into a larger research initiative involving 16 European countries in total.⁶ Based on this analysis, it presents policy alternatives and actions for the national and/or (sub)regional level with the potential of

⁶ The 16 countries include 13 EU Member States, i.e. Belgium, Germany, UK, France, Czech, Poland, Hungary, Romania, Denmark, Sweden, Greece, Spain, Italy, and Portugal and three non-EU countries, i.e. Switzerland, Norway, and the UK.

promoting the uptake of SICS.

Methods

The research and preparation of this report were undertaken by two groups of researchers – the core team of the task, who were responsible for the preparation and research for EU-level policy and all 16 study sites, working in close coordination with researchers with specific knowledge about the study site – the study site researchers. This approach ensured that there was both consistency between the 16 country reports, of which this Hungarian report is but one, but local knowledge and documents and information in local languages were also well utilised.

Figure 1 illustrates the overall study design and methods, which were applied to answer specific research questions. Whilst each data collection activity focused on a sub-set of the research questions, they are closely related, and the information gathered through the mix of methods applied were used to feed into different research questions.

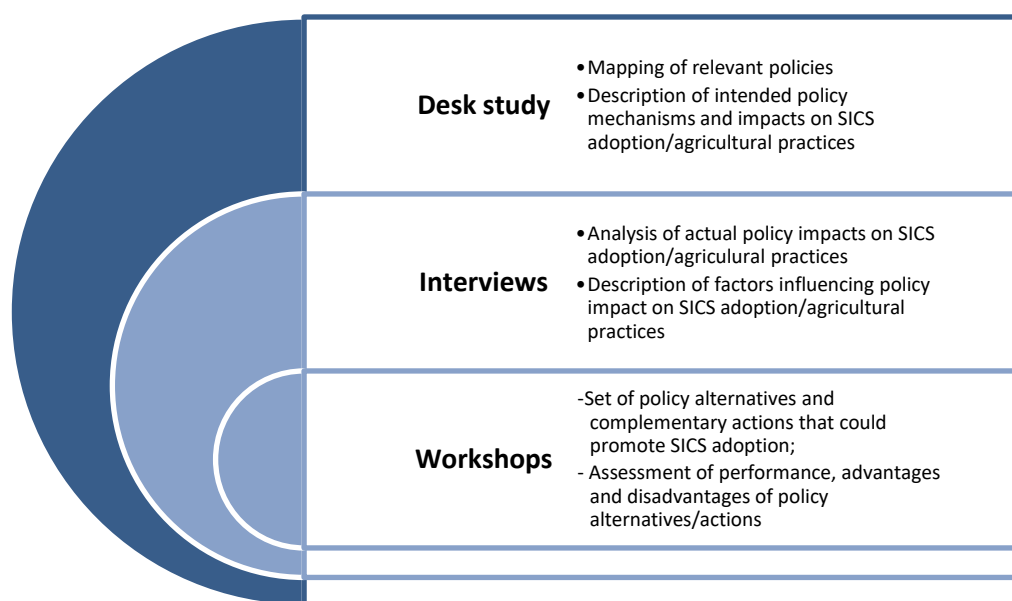


Figure 1: Research strategy

Data collection and analysis involved the following three activities:

- 1) A desk-study of policy documents (in the broadest sense) and relevant literature:** policies potentially impacting the adoption of SICS in the study sites were identified. The aim of this step was to provide a broad overview of soil-related national and regional⁷ policies from which the most relevant policies could be

⁷ The term “region” refers in this context to the sub-national level, particularly the area of the country where the respective study site is located.

selected for in-depth analysis. A draft inventory was compiled, including those national, regional, and sub-regional policies that were linked to a set of pre-selected EU policies (primarily concerning environmental and agricultural topics); however, in the case of regional and sub-regional policies, these were limited to those directly relevant to the study site (i.e. not all regions and sub-regions were included). For each policy, the following information was recorded: date of adoption, governance scale, type of instrument, link to cropping system (components) etc.⁸ Based on the screening done in the first step, the national and regional policies deemed most relevant for the study site were subject to a more in-depth analysis. This was done through desk research carried out by the study site researchers.

- 2) Interviews with selected national and regional policymakers and stakeholders:** based on this analysis, Study Site Researchers then conducted interviews with policy-makers and stakeholders using a semi-structured interview guide. In Hungary, four interviews were carried out (see Table 4)

Table 4: Organisations represented by interview partners

Organisation	Stakeholder category
Conductor of Hungarian Association of Soil Bacteria Producers and Distributors	National
General Directorate of Water Management, Government office - Department of Plant and Soil Protection	National
Members of the Hungarian Parliament (MP) and Head of the Hungarian National Rural Network	National
Conductor of Hungarian Association of Soil Bacteria Producers and Distributors	National

- 3) An adaption workshop with national and regional policymakers and stakeholders:** To develop and assess policy alternatives, the Study Site Research Teams organised a stakeholder workshop in each site, following a common guidance document which detailed the structure and methods for the event. Study site teams mostly invited those stakeholders they were already working with, either within the context of SoilCare or as part of their regular engagement activities. The Hungarian workshop brought together 140 stakeholders, including farmers, interest groups and regional/local government, and the Agricultural and Rural Youth Association.

Report outline and where to find supplementary information

Section 2 of this report presents an analysis of policy instruments relevant for shaping agricultural practices in the canton Thurgau where the Swiss study site is located.⁹ It examines how existing instruments may impact on the adoption of SICS and explores the factors which enable or hamper uptake of these practices.

⁸ The policy inventory is available at: <https://www.soilcare-project.eu/outputs>

⁹ See D7.1 at <https://www.soilcare-project.eu/outputs>

Section 3, on the basis of the previous section, formulates actions which could promote a shift in agricultural practices in the study site region and facilitate a wider adoption of SICS.

A detailed analysis of all relevant EU-level policies as well as national, regional and sub-regional policies in the countries covered by this research is reported in *D7.1 Inventory of opportunities and bottlenecks in policy to facilitate the adoption of soil-improving techniques* for, available at: <https://www.soilcare-project.eu/outputs/deliverables>.

A synthesis of findings and recommendations from the EU-level and cross-country analysis can be found in *D7.2 Report on the selection of good policy alternatives at EU and study site level*, available at: <https://www.soilcare-project.eu/outputs/deliverables>.

Individual country policy inventories can be downloaded from: <https://www.soilcare-project.eu/outputs>

2 Analysis of policy shortcomings and opportunities in Keszthely, Hungary

This section provides a review and analysis of national instruments relevant for shaping agricultural practices in the region of Keszthely where the study site is located (see Table 5). Policies investigated include mainly national and regional policies. The information is drawn from the policy inventories compiled by the Study Site Researchers as well as interviews and an adoption workshop conducted with key stakeholders.

Table 5: Description of the study site

Site Name	Keszthely, Hungary
Climate	Semi-continental with maritime influences, moderately warm, moderately humid, while the number of sunshine hours per year is high.
Temperatures	Long-term annual mean temperature - 10.8 °C
Study site	Phosphorus content of the soil is low, the potassium content medium and the soil organic matter content fairly low. Land use type is arable land
Main soil threats	Soil compaction, SOM decline
Current practices	Conventional tillage, no irrigation, different rates of organic and mineral fertilization, integrated pest management.

The four experiments carried out in the study sited are described below. Each field trial provides evidence on the costs and benefits.

Table 6: Overview of experiments carried out in the Hungarian study site, and the SICS category and cluster under which they are grouped

General treatment category	SICS cluster ¹⁰	Experiments
Crop rotations, reduced tillage, integrated nutrient management	Fertilisation/amendments	1.Organic/inorganic N fertilisation
	Fertilisation/amendments	2.Mineral fertilisation in continuous maize cropping
	Fertilisation/amendments	3. Organic/inorganic fertilisation in different rotations
	Soil cultivation	4. Tillage in maize-wheat biculture

2.1 Which existing policies and policy instruments shape agricultural practices in Hungary?

A policy analysis at the national and regional level identified the following policies which may directly or indirectly shape agricultural practices in the study site region in Hungary¹¹: The overview below provides a description of those policies identified as most important for soil-improving practices and does not intend to provide an exhaustive overview of the policy landscape governing agricultural methods in Hungary.

Agricultural policies

The **EU Common Agricultural Policy (CAP)**, particularly the Good Agricultural and Environmental Conditions (GAEC) which form part of the CAP's cross-compliance requirements impact on farming practices. The national policy documents require the following:

- GAEC 4 - Soil cover must be maintained after summer and autumn on arable crops by: sowing another crop/cover crop; keeping stubble until 30 October or carrying out deep cultivation.
- GAEC 5 - Ban on growing tobacco, sugar beet, potato, or artichoke on land sloping more than 12%. Requirement to maintain terraces in vineyards.
- GAEC 6 - Limitations on crops which can be grown in two, three or four consecutive years on the same piece of land. Restrictions on stubble burning.
- GAEC 7 - Protected landscape features – hedges, ditches, trees, ponds, ditches, field margins, terraces, stone walls.

Greening payments also greatly shape farming methods as they are paid to farmers on the

¹⁰ SICS are grouped into four clusters: (1) Soil-improving crops, (2) Fertilisation/amendments, (3) Soil cultivation, and (4) Alleviation of compaction.

¹¹ See the Annex for a more detailed overview of the policies described in this section.

condition that they undertake practices beneficial to environment. There are three aspects of greening: crop diversification (crop rotation, winter soil cover), which are expected to improve soil quality; maintaining existing permanent grassland; ecological focus areas (terraces, landscape features, buffer strips, agro-forestry and afforested areas).

In addition, there is an ambition to increase the share of land under organic farming. The 2014 – 2020 **National Action Plan to improve Organic Farming** establishes six action points: improvement of the regulatory and procedural framework of organic farming, increase of the production volumes in response to market demand, development of training, research and advisory services, development of uniform and transparent data management systems, promotion of organic farming products and enhancement of cooperation between various stakeholders. The improvement of soil quality is stated as one of the expected outcomes of an increased uptake of organic farming practices.

Water policies

EU water legislation (as well as other environmental Directives) was transposed by amending sections of the 1995 **Act on the General Rules of Environmental Protection**. The Nitrates Directive is transposed in Hungary by the **Decree on the Protection of Waters against Nitrates Pollution from Agricultural Origin** and the **Rules for Action Program against Agricultural Nitrate Pollution, Data Reporting and Record Keeping**. The Decree aims to protect waters against pollution caused by nitrates from agricultural sources and to reduce the existing nitrate pollution of waters. It provides for the designation of zones vulnerable to nitrate pollution, the preparation of programs in relation to zones vulnerable to nitrate pollution and specifies the essential rules on the protection of waters. The Decree prohibits certain activities concerning slurry, dung water, and leachate; sets environment-related rules on construction, or expansion and operation of livestock holdings. The Rules then lay down details concerning the action program necessary for the protection of waters against pollution by nitrates from agricultural sources and the rules on data requirements and record-keeping. Both legislations aim to protect water and the soil protection is an indirect impact. Furthermore, the **Decree on Protection of Geological Medium and Groundwater against Pollution** concerns soils primarily through the link with nitrate and pesticide pollution from agricultural activity.

Chemicals and waste policies

Lastly, several pieces of legislation implementing EU chemicals and waste policies regulate nutrient and pest management practices in Hungary. These include: the **Rules about Authorization, Storage, Marketing and Utilization of Fertilising Products** (implementing the EU Fertilisers Regulation), the **Rules about Agricultural Utilization of Sewage Sludge and Waste Water** (implementing the EU Sewage Sludge Directive) and the **Decree authorizing the placing on the market and use of plant protection products and packaging, marking, storage and transport of plant protection products** (implementing

the EU Plant Protection Regulation) regulate

Soil Policy

In addition to the national transposition of EU legislation, there are several national policies specifically aiming to protect soil on agricultural land. The **Ministerial Decree on Preparation of Soil Protection Plans** requires the drafting of soil protection plans for the following activities

- Improvement of saline soils;
- Landscaping for agricultural purposes;
- Plantation of grapes, fruits and other berries;
- Saving of the top soil layer (humus) in case of an investment of larger than 400 m²;
- Re-cultivation for agricultural purposes;
- Irrigation;
- Use of slurry;
- Use of sludge for agricultural purposes;
- Drainage of agricultural areas;
- Use of non-hazardous and non-agricultural waste on cultivated soil; and
- Implementation of technical interventions to prevent soil erosion.

Other relevant policies include the **Act on Cultivated Land**, which applies to all agricultural land in Hungary. The Act contains provisions on land purchase and land mergers and sets out provisions on land management. Requirements for land users include reporting changes in land cultivation to a registry, use of land for non-agricultural purposes, and payment of specific land contributions. Chapter VI concerns soil conservation and imposes an overall obligation to protect soil, for both the public authorities as well as land users. In eroded areas, land users are required to implement a set of measures identified by the legislation.

In addition, the **Act on the Protection of Cultivated Soil** details soil protection measures that need to be applied by land users depending on the soil threats they face on their land. The Act also introduces a financial penalty aimed at protecting organic matter in soils.

2.2 To what extent do existing policies facilitate adoption of soil-improving practices in Hungary?

The main soil threats in Keszthely study site include, soil compaction, SOM decline, soil erosion, and nitrate contamination from leaching. Problems are caused by intensive land use without nutrient replenishment, limited use of organic fertilisers, inadequate soil cultivation and poor diversity of tillage equipment causing compaction. The SICS trialed at the study site

are thought to address these threats and include integrated nutrient management measures (Organic/inorganic N fertilization, mineral fertilisation in continuous maize cropping) integrated nutrient management in combination with crop rotations (Organic/inorganic fertilisation in different rotations), and reduced tillage practices (Tillage in maize-wheat biculture). This section takes the policies identified in the previous section and evaluates how they can mitigate the soil threats in Hungary

The use of soil-improving cropping practices is regulated and incentivised through a range of existing regulatory, economic and voluntary instruments in Hungary, with the exception of smart weed control as well as smart residue and controlled traffic management (shaded in light green) . The analysis shows that several policies cover the SICS trialed at the study site (shaded in dark green):

- **Crop rotation:** requirements established under the CAP incentivise farmers to adopt crop-rotation practices through cross-compliance standards (GAEC 6). In addition, crop rotation is one of the three types of measures eligible for greening payments.
- **Nutrient management:** is regulated through various pieces of water legislation which establish limitations on or requirements for fertiliser (and pesticide) usage. In addition, the Ministerial Decree on Preparation of Soil Protection Plans requires the drafting of these plans for the use of slurry, sludge for agricultural purposes as well as non-hazardous and non-agricultural waste on cultivated soil which are likely to include sustainable nutrient management measures with a view to protecting soil quality.
- **Reduced tillage:** can be one of the practices land users are required to adopt to mitigate soil threats present on their land as mandated by the Act on the Protection of Cultivated (as well as the Act on Cultivated Land for eroded land).

Interviewees noted that EU-level funding, mentioning the CAP but also other sources such as LIFE¹², and national land protection legislation has helped SICS adoption.

One stakeholder acknowledged the role of current legislation to motivate change by farmers. However, several interviewees criticized that current legislation was too complicated and inflexible, especially when it came to policies relevant for nutrient management practices, such as the rules governing the use of sewage sludge and defining limit values for nitrates in ground water, which has hindered SICS adoption.

Furthermore, one interviewee emphasised that environmental protection and agriculture policy often seemed incompatible.

The summary table below shows that the use of soil-improving cropping practices is regulated and incentivised through a range of existing regulatory, and economic instruments in Hungary, with the exception of smart weed control as well as smart residue and controlled traffic management (shaded in light green). The analysis demonstrates that several policies

¹² The LIFE programme is the EU's funding instrument for the environment and climate action:
<https://ec.europa.eu/easme/en/life>

cover the SICS trialed at the study site (shaded in dark green).

Table 7: Coverage of SICS in relevant national and regional policies, instruments, and measures in Keszthely, Hungary

Policy	Crop rotation	Green manures, cover crops, catch crops	Integrated nutrient management	Enhanced efficiency irrigation	Controlled drainage	Reduced tillage	Integrated pest management	Smart weed control	Smart residue management	Controlled traffic management	Integrated landscape management
CAP GAEC Cross-compliance Standards											
Act on the General Rules of Environmental Protection											
Rules for Action Program against Agricultural Nitrate Pollution, Data Reporting and Record Keeping											
Decree on the Protection of Waters against Nitrates Pollution from Agricultural Origin											
Decree on Protection of Geological Medium and Groundwater against Pollution											
Rules about Agricultural Utilization of Sewage Sludge and Wastewater											
Decree authorizing the placing on the market and use of plant protection products and packaging, marking, storage and transport of plant protection											
Rules about Authorization, Storage, Marketing and Utilization of Fertilising Products											
National Action Plan to Improve Organic Farming											
Ministerial Decree on Preparation of Soil Protection Plan											
Act on Cultivated Land											
Act on the Protection of Cultivated Soil											

2.3 Which factors shape success or failure of policy instruments in Hungary?

Although information from the interviewees was brief, research indicates that there are several factors that shape the success or failure of policy instruments in Hungary. These include:

- Limited coherence between policies
- Weak enforcement
- Availability of grants/subsidies

- Lack of information

While many of these factors are not specific to Hungary, the following section sets out examples identified in the study site region:

Limited coherence between policies

Interviewees mentioned that policies are often complicated and incoherent. Examples cited included environmental policies, for example, promote renewable energy which subsequently require increased fuel crops. These crops require more water than traditional crops, leading to conflicting goals.

Weak enforcement

Policies are often poorly enforced. One interviewee specifically referred to administrative barriers. This means that not only is it difficult for farmers to implement the policies, but there is also less motivation to do so, knowing that the rules are likely to change and that they face little consequence for non-compliance. The Nitrates Directive was specifically highlighted as being inflexible.

Availability of grants/subsidies

Economic factors were mentioned by several interviewees. Funding opportunities were identified by the interviewees as one of the biggest drivers when it comes to SICS adoption, especially funding from EU level. Not only does funding act as motivation, but it also allows farmers to have the financial means to implement the policies. One interviewee noted that the (efficient) subsidies and grants available have a huge impact on agriculture in Hungary.

Lack of information

Stakeholders focused on the lack of information concerning the SICS. One interviewee remarked that all the relevant information is available for the "careful" farmer, but other interviewees gave examples of information gaps. Farmers are focused on singular activities such as increasing the use of nitrogen, rather than focusing on the big picture and considering the overall benefits of the SICS.

One interviewee also mentioned the role of the consumer, suggesting that more should be done to increase the demand for more sustainable products and those produced by family farms (instead of products from intensive farming practices).

3 Recommendations for actions to promote the uptake of SICS

This report presented an inventory and analysis of bottlenecks and opportunities in sectoral and environmental policies to facilitate the adoption of Soil-Improving Cropping Systems (SICS) at the EU-level as well as in Hungary.

The main soil threats in the Keszthely study site include soil compaction and the decline of soil organic matter. The following types of SICS are trialed at the study site: crop rotations and reduced tillage, and integrated nutrient management.

Several recommendations came out of the interviews and other analysis. While it was found that there are a number of policies already in place that impact soil, it was clear that both EU and national level legislation **needs simplifying and better enforcement** – otherwise not real outcomes are seen. This also concerns ensuring policy is coherent and not working towards contradictory goals.

There is also a need to **raise awareness of environmental benefits of SICS** and provide information to help farmers adopt and implement the policies in place. In addition, there is very little awareness of the benefits of soil bacteria in the soil and what technique can facilitate its maintenance. Information needs to also be aimed at consumers, who should be encouraged to purchase from sustainable and less-intensive farms.

It is noted, with regard to the **economic framework**, that funding opportunities are the main driver for SICS adoption, especially funding from EU level. With the post-2020 CAP, new funding rules funding rules will be introduced. The Good Agricultural Environmental Conditions (GAECs) now offer a greater chance for soil protection. New conditions with the potential to improve soil health have been added, e.g., crop rotations are introduced under GAEC 8. The new agri-environment-climate measures (AECM) present opportunities to address declining soil health. Key will be for Member States to allocate enough of the budget available to them to soil health measures.

Annex: Overview of key policies in Hungary

Policy and description	English translation	Scale	EU or MS-based policy	SICS addressed	Description of policy
A földterület jó mezőgazdasági és környezeti állapotára vonatkozó előírások (GAEC)	<i>CAP GAEC Cross-compliance Standards</i>	National	EU (CAP)	Crop rotation; cover crops; integrated landscape management, integrated pest management	'Cross compliance' is a set of rules which farmers and land managers must follow on their holding if they are claiming rural payments. The cross compliance is set in the Common Agriculture Policy Regulations 2014 and further explained in the national policy documents. The national policy documents require the following: GAEC 4 - Soil cover must be maintained after summer and autumn arable crops by: sowing another/cover crop; keeping stubble until 30 October or carrying out deep cultivation at most; GAEC 5 - Ban on growing tobacco, sugar beet, potato or artichoke on land sloping more than 12%. Requirement to maintain terraces in vineyards; GAEC 6 - Limitations on crops which can be grown in two, three or four consecutive years on the same piece of land. Restrictions on stubble burning; GAEC 7 - Protected landscape features – hedges, ditches, trees, ponds, ditches, field margins, terraces, stone walls.
1995. évi LIII. Törvény a környezet védelmének általános szabályairól	<i>Act on the General Rules of Environmental Protection</i>			Integrated Nutrient Management, integrated pest management, integrated landscape management	The Act is relevant for transposition of a number EU Directives (e.g. WFD, EIA Directive, ELD and Nature Directives) into Hungarian legislation. However, the core transposition of the Directives took place in by-laws issued on the basis of the Act
59/2008. (IV. 29.) FVM rendelet vizek mezőgazdasági eredetű nitrátszennyezéssel szembeni védelméhez szükséges cselekvési program részletes szabályairól, valamint az adatszolgáltatás és nyilvántartás rendjéről	<i>Rules for Action Program against Agricultural Nitrate Pollution, Data Reporting and Record Keeping</i>	National	EU (WFD)	Integrated Nutrient Management	The Rules transpose the Nitrates Directive in Hungary. The Rules lay down details on the action program necessary for the protection of waters against pollutions by nitrates of agricultural sources and on the rules of data requirements and record-keeping.
27/2006. (II. 7.) Korm. Rendelet a vizek mezőgazdasági eredetű nitrátszennyezéssel szembeni	<i>Decree on the Protection of Waters against</i>	National	EU (Nitrates Directive)	Integrated nutrient management	The Decree aims to protect waters against pollution caused by nitrates from agricultural sources and to reduce the existing nitrate pollution of waters. The Decree provides for the designation of zones vulnerable to nitrate pollution,

Policy and description	English translation	Scale	EU or MS-based policy	SICS addressed	Description of policy
védelméről	<i>Nitrates Pollution from Agricultural Origin</i>				the preparation of programs in relation to zones vulnerable to nitrate pollution and specifies the essential rules on the protection of waters against nitrate pollution. the Decree prohibits certain activities concerning slurry, dung water, and leachate; sets environment-related rules on construction, or expansion and operation of livestock holdings and on construction and operation of stercoraries
6/2009. (IV. 14.) KvVM-EüM-FVM együttes rendelet a földtani közeg és a felszín alatti víz szennyezéssel szembeni védelméhez szükséges határértékekről és a szennyezések méréséről	<i>Decree on Protection of Geological Medium and Groundwater against Pollution</i>	National	EU (GW Directive)	Integrated nutrient management, integrated pest management	The Decree relates to soils primarily through the link with nitrate and pesticide pollution from agricultural activity.
"50/2001. (IV. 3.) Korm. Rendelet a szennyvizek és szennyvíziszapok mezőgazdasági felhasználásának és kezelésének szabályairól	<i>Rules about Agricultural Utilization of Sewage Sludge and Waste Water</i>	Nation	EU (Sewage Sludge Directive)	Integrated nutrient management	The Rules provide for the application, on agricultural areas, of certain waste waters, treated sludge, including sewage sludge composts collected by waste water drainage instrument and cleaned in waste water treatment unit, as well as the professional conditions for their use, including conditions of agricultural utilisation of collected and treated municipal liquid wastes. The Rules transpose the Sewage Sludge Directive into Hungarian legislation.
"89/2004. (V. 15.) FVM rendelet a növényvédő szerek forgalomba hozatalának és felhasználásának engedélyezéséről, valamint a növényvédő szerek csomagolásáról, jelöléséről, tárolásáról és szállításáról"	<i>Decree authorizing the placing on the market and use of plant protection products and packaging, marking, storage and transport of plant protection products</i>	National	EU (Sustainable Use of Pesticides Directive)	Integrated pest management	Improper use of pesticides in both the environment and health risks. Health, environmental damage resulting from pesticide use and the strategy for sustainable pesticide use is a priority
36/2006. (V. 18.) FVM rendelet a termélnövelő anyagok engedélyezéséről, tárolásáról, forgalmazásáról és felhasználásáról	<i>Rules about Authorization, Storage, Marketing and Utilization of Fertilising</i>	National	EU (Fertiliser Regulation)	Integrated nutrient management	The Rules lay down detailed provisions concerning authorization, storage, marketing and utilization of fertilising products. The Rules define 11 product functions categories (eg. organic fertilizer, national inorganic fertilizer, soil improver etc.) and regulate their placement on the market.

Policy and description	English translation	Scale	EU or MS-based policy	SICS addressed	Description of policy
	<i>Products</i>				
Nemzeti Akcióterv az Ökológiai Gazdálkodás Fejlesztéséért (2014-2020)"	<i>National Action Plan to Improve Organic Farming</i>	National	MS	All SICS	The action plan includes six action points: improvement of the regulatory and procedural framework of organic farming, increase of the production volumes in response to market demand, development of training, research and advisory services, development of uniform and transparent data management systems, promotion of organic farming products and enhancement of cooperation between various stakeholders. The improvement of soil quality is listed as a beneficial outcome of organic farming.
90/2008 (VII. 18) FVM rendelet a talajvédelmi terv készítésének részletes szabályairól	<i>Ministerial Decree on Preparation of Soil Protection Plan</i>	National	MS	Green manures, cover crops, catch crops, integrated nutrient management, enhanced efficiency irrigation, integrated landscape management	The Decree details the requirements of the soil protection plans that need to be prepared in the following cases: Improvement of saline soils; <ul style="list-style-type: none"> • Landscaping for agricultural purposes; • Plantation of grapes, fruits and other berries; • Saving of the top soil layer (humus) in case of an investment of larger than 400 m²; • Re-cultivation for agricultural purposes; • Irrigation; • Use of slurry; • Use of sludge for agricultural purposes; • Drainage of agricultural areas; • Use of non-hazardous and non-agricultural waste on cultivated soil; and • Implementation of technical interventions to prevent soil erosion Annex II of the Decree includes technical details on all issues when a plan needs to be developed.
2013. évi CXXII. törvény a mező- és erdőgazdasági földek forgalmáról szóló 2013. évi CXXII. törvénnyel összefüggő egyes rendelkezésekről és átmeneti szabályokról	<i>Act on Cultivated Land</i>	National	MS	Integrated nutrient management, controlled drainage, reduced tillage	The Act applies to all agricultural land in Hungary. The Act contains provisions on land purchase and land mergers (Chapters II - IV). Provisions on land management are set in Chapter V. This chapter sets out requirements for land users such as reporting changes in land cultivation to a registry, use of land for non-agricultural purposes, payment of specific land contributions. Chapter VI concerns soil conservation. This chapter imposes an overall obligation to protect soil. The obligation is addressed both the the public authorities but also to the land users. The landusers are required to implement measures set in Articles 61 - 69 (e.g. measures applicable to eroded areas).
2007. évi CXXIX. Törvény a termőföld védelméről	<i>Act on the Protection of</i>	National	MS	Integrated nutrient	Chapter III of the Act regulates soil protection. The Chapter specifically lists the soil protection measures that need to be applied by the users of the land and

Policy and description	English translation	Scale	EU or MS-based policy	SICS addressed	Description of policy
	<i>Cultivated Soil</i>			management, controlled drainage, reduced tillage, integrated landscape management	categorises them according to the main threats to soils, e.g. what needs to be done for soils prone to salinization, etc (Articles 35 - 42). The Act also introduces a fee aimed at protecting organic matter in soils.