SCALE UP
community-driven
bioeconomy development

SCALE-UP Information Package

T2.4 Review and preparation of existing scientific and technological information supporting bio-based solutions

Region:	Strumica
Organization:	SDEWES-Skopje
Biomass stream/value chains:	Composting
Bio-based solutions:	Providing service and organising primary and secondary bio-based residues

This information package aims at reviewing and collecting information relevant to the SCALE-UP project and for the regional platforms. Relevant studies should aim at supporting the bio-economy rollout in the SCALE-UP regions and of the specific bio-based solutions.

Information on the following topics will be gathered:

1. EU Policies and legislation
2. Research projects
3. Local policies
4. Technical Information on specific biobased solutions
5. Biomass availability & Nutrient recycling

1. EU Policies & Legislation

Please add the EU policies and legislation that you find relevant to the SCALE-UP project and for your bio-based solution.

Other sources of interest: JRC Knowledge Centre for Bioeconomy (English) JRC Knowledge Centre for Bioeconomy (Macedonian)

List of important EU policies and legislation

	Date of adoption	Name	Link	Translation link (English -> Macedonian)	Summary of contents	Relevance to the SCALE-UP project	Relevance to the specific bio-based solutions
1	20.9.2021	**EU Instrument for PreAccession - Rural Development Programme 2021-2027**	https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R1529	-	IPA is aiming at (1) enhancing farm viability and competitiveness of agriculture and food processing (2) restoring, preserving and enhancing ecosystems dependent on agriculture, fishery and forestry (3) promoting balanced territorial development in rural areas (4) transfer of knowledge and innovation in agriculture, forestry and rural areas	IPARD focuses specifically on rural areas and agri-food sectors of countries in the process of joining the EU. It can strengthen the competitiveness and viability of the agri-food sectors by building an agriculture capable of competing with market forces, ensure sustainable management of natural resources, and increase resilience to climate change.	The framework sets the ground for enhancing investments for rural development.
2	09.03.2022	**Third IPARD Programme for the period 2021-2027**	https://ipard.gov.mk/en/announcement/the-european-commission-has-approved-the-ipard-programme-2021-2027/	https://ipard-gov-mk.translate.goog/en/announcement/the-european-commission-has-approved-the-ipard-programme-2021-2027/?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	IPARD III is oriented to: 1. enhance farm viability and competitiveness of agriculture and food processing - for all types of agricultural and primary food-processing, while progressively aligning with the EU food safety standards, animal welfare and environmental requirements and improving the level of modernisation and technology use. 2. restore, preserve and enhance ecosystems dependent on agriculture, fishery and forestry - focused on promoting the use of environmentally friendly farming practices, protection and enhancement of biodiversity, landscape, water and soil, within high nature value and traditional agrarian areas, as well as mitigation of climate change. 3. promote balanced territorial development in rural areas - aiming to increase the employment possibilities, to create alternative income sources for rural population and to enhance the attractiveness of rural areas through improved living conditions, security of life and private property. 4. transfer knowledge and innovation in agriculture, forestry and rural areas - foreseen to strengthen human capital within rural areas and thereby to address the problem of narrow scope and insufficient training, and lack of information. For the new IPARD 2021-2027, the indicative European Union contribution has been set at EUR 97 million. About two-thirds of the funds are planned for M1 (Investments in physical assets of agricultural holdings) and M3 (Investments in physical assets concerning processing and marketing of agricultural and fishery products), and the remaining funds are planned for M4 (Agri-environment – climate and organic farming).	The IPARD Programme 2021-2027 is a program document that defines the measures and policies of rural development which are also in the focus areas of SCALE-UP. Thus, the total financial support (EU budget) for all measures of the Programme is 97 million euros.	The programme can financially support the bio-based solutions selected for Strumica, thus related to composting, if there is interest from the entrepreneur to apply, after the SCALE-UP innovative support programme is completed and the business models are market-ready.

3	02-2012	**EU bioeconomy strategy**	https://op.europa.eu/en/publication-detail/-/publication/edace3e3-e189-11e8-b690-01aa75ed71a1/language-en/format-PDF/source-149755478	https://op-europa-eu.translate.goog/en/publication-detail/-/publication/edace3e3-e189-11e8-b690-01aa75ed71a1/language-en/format-PDF/source-149755478?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	The 2012 European Bioeconomy Strategy paved the way for a more innovative, resource-efficient and competitive society that reconciles food security with the sustainable use of renewable resources for industrial purposes, while ensuring environmental protection. A comprehensive review concluded that it has been a success, notably at mobilising research and innovation, boosting private investments, developing new value chains, promoting the uptake of national bioeconomy strategies and involving stakeholders.	The EU bioeconomy strategy aims at strenghtening and scaling-up bio-based sectors, as well as deploying local bioeconomies across Europe. Through: -The deployment of the bioeconomy will lead to the creation of jobs, especially in rural areas through the growing participation of primary producers in local bioeconomies. -The bioeconomy strategy sets as one of its main goals to support research and innovation and deployment of innovative solutions for the production of new and sustainable bio-based products. -A Strategic Deployment Agenda will be developed, which will provide a long-term vision on pathways to deploy and scale up the bioeconomy in a sustainable and circular manner. -Enhance synergies between existing EU instruments to support local activities. -CAP to support bioeconomies in rural areas.	Relevant to the specific bio-based solutions: -It aims at increasing the availability of secondary materials (such as feed and biowaste) for further exploitation through conventional technologies (e.g. composting and anaerobic digestion) and innovative ways of extracting valuable substances. Innovation is expected to support markets for bio-based products, where one industry's waste becomes the starting material for another. -It addresses new opportunities for the forestry sector, where non-sustainable raw materials in various sectors are replaced with forestry-based materials and chemicals. -Biowaste and residues can be used as valuable resources and can help reduce food waste by 50% by 2030.
4	2019	**European Green Deal**	https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en	https://commission-europa-eu.translate.goog/strategy-and-policy/priorities-2019-2024/european-green-deal_en?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	European Green Deal is a set of comprehensive and integrated to transform the EU into a modern, resource-efficient and competitive economy, ensuring no net emissions of green house gases by 2050 and economic growth decoupled from reseource use.	The Green Deal includes measures in agriculture on the reduction of environmental and climate foodprint and increase of competative sustainablility from farm to fork (see below). In the energy sector the Green Deal includes measures to promote eco design of products en renewable energy from sustainable biomass resources.	
5		**European Digital Strategy**	https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age_en	https://commission-europa-eu.translate.goog/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age_en?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	The EU's digital strategy aims to make this transformation work for people and businesses, while helping to achieve its target of a climate-neutral Europe by 2050.	EU's digital strategy recognises that digital technologies are profoundly changing our world, and generate an ever-increasing amount of data, which if pooled and used properly, can lead to completely new means and levels of value creation, leading towards more sustainable solutions which are resource-efficient, circular and climate-neutral.	Real time tracking, new, added-value creations, interconnections, boosting bio-based solutions driven by new, high and/or deep technologies
6	02-2020	**European data strategy**	https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-data-strategy_en	https://commission-europa-eu.translate.goog/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/european-data-strategy_en?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	The European data strategy aims to make the EU a leader in a data-driven society. Creating a single market for data will allow it to flow freely within the EU and across sectors for the benefit of businesses, researchers and public administrations.	The EU is creating a single market for data where data can flow within the EU and across sectors, for the benefit of all European rules, in particular privacy and data protection, as well as competition law, are fully respected the rules for access and use of data are fair, practical and clear	By having more information, consumers and users such as farmers, airlines or construction companies will be in a position to take better decisions such as buying higher quality or more sustainable products and services, thereby contributing for example to the Green Deal objectives.

7	01-2023	**Common Agricultural Policy (CAP) CAP 2023-27**	https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-glance_en#cap2023-27	https://agriculture-ec-europa-eu.translate.goog/common-agricultural-policy/cap-overview/cap-glance_en?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=en-US&_x_tr_pto=wapp#cap2023-27	The CAP 2023-2027 must be oriented more than ever to respond to the specific needs of the agricultural sector and rural areas in terms of equity, distribution of support, instruments and characteristics, after the serious health crisis caused by COVID. To achieve these objectives, the CAP is focusing on innovation, CAP Strategic Plans (in line with the objectives and targets of the "Green Deal"), giving the EU a greener and fairer CAP.	The CAP 2023-2027 includes "support for rural development" as one of its focal points through the development of a wide range of tools including: Funding for investment, knowledge creation, innovation and cooperation will in many cases be targeted at environmental and climate-related needs, but will also serve other CAP objectives.	Within the CAP 2023-2027, it is indicated that the improvement of existing requirements is also a necessary condition for the improvement of agricultural sustainability, for this purpose, measures are proposed to improve soil health in the long term, so farmers are required to carry out beneficial crop rotations (among other measures). On the other hand, a wide range of types of action are proposed, including ecosystems that support voluntary actions related to better nutrient management, agroecology, agroforestry, carbon farming or animal welfare (among others).
8	05-2020	**Farm to Fork strategy**	https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy_en	https://food-ec-europa-eu.translate.goog/horizontal-topics/farm-fork-strategy_en?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=en-US&_x_tr_pto=wapp	The Farm to Fork Strategy is a set of measures to accelerate the transition to a sustainable food system that should have a neutral or positive environmental impact help to mitigate climate change and adapt to its impacts, reverse the loss of biodiversity ensure food security, nutrition and public health, making sure that everyone has access to sufficient, safe, nutritious, sustainable food preserve affordability of food while generating fairer economic returns, fostering competitiveness of the EU supply sector and promoting fair trade.	The Farm to Fork Strategy includes measures to promote sustainable food production and processing (including nutrient recycling). This includes measures on the compatativeness of the EU food supply sector including use of residues for bioproducts	

2. Research Projects

Please add Interreg, Horizon 2020, Horizon Europe projects, and other projects that you find relevant to the SCALE-UP project and for your bio-based solutions.

Other sources of interest:	JRC Knowledge Centre for Bioeconomy (English)	JRC Knowledge Centre for Bioeconomy (Macedonian)

List of relevant projects

	Start month	End month	Name	Project website	Translation link (English to Macedonian)	Project summary	Relevance to the SCALE-UP project	Relevance to the specific bio-based solutions	Activities of interest	Comments
1	09-2022	08-2025	**MainstreamBIO**	https://mainstreambio-project.eu/	https://mainstreambio--project-eu.translate.goog/?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	MainstreamBIO sets out to get small-scale bio-based solutions into mainstream practice across rural Europe, providing a broader range of rural actors with the opportunity to engage in and speed up the development of the bioeconomy. Regional Multi-actor Innovation Platforms (MIPs) will be established in 7 EU countries (PL, DK, SE, BG, ES, IE and NL) to enhance cooperation among key rural players towards co-creating sustainable business model pathways in line with regional potentials and policy initiatives.	Innovation support services,Decision Support System, Multi-actor Innovation Platforms, Digitalisation and Practice abstracts.	Some cases related with our 12 bio-based solutions (potential exchange of good practices and Knowledge)	WP4, WP5	SCALE-UP sister project
2	10-2022	09-2025	**RuralBioUp**	https://www.ruralbioup.eu/	https://www-ruralbioup-eu.translate.goog/?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	RuralBioUp will strengthen the cooperation among regional key actors and knowledge holders, empowering them to establish an inclusive and long-lasting ecosystem (the RuralBioUp Regional Hubs) to support the mainstreaming of bio-based business models in rural areas. In particular, RuralBioUp will establish 9 Regional Hubs in 6 EU countries, that will co-design and implement 9 Action Plans on 18 value chains.	9 regional hubs (one multi-stakeholder hub) are established in 6 EU countries (France, Romania, Czech Republic, Ireland, Latvia and Italy). 9 Action Plans will be implemented in 18 value chains.	Biomass value chain development: Biomass logistic, Valorisation, Communities. Lessons learnt	WP4, WP5	SCALE-UP sister project
3	09-2022	08-2025	**BioRural**	https://biorural.eu/	https://biorural-eu.translate.goog/?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	BioRural's goal is to create a European Rural Bioeconomy Network to promote small-scale bio-based solutions in rural areas and support the transition towards a sustainable, regenerative, inclusive and just circular Bioeconomy across all Europe at local and regional scale.	BioRural focusses on EU-level developments, it does not feature any regional case studies.	Rural Bioeconomy Alliance. Network. Cooperate to promote the currently available small-scale bio-based solutions		SCALE-UP sister project
4	04-2019	07-2022	**BE-Rural**	https://be-rural.eu/	https://1-be--rural-eu.translate.goog/?_x_tr_enc=1&_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	BE-Rural aimed at exploring the potential of regional and local bio-based economies and support the development of bioeconomy strategies, roadmaps and business models. To this end, the project focused on establishing Open Innovation Platforms (OIPs) within selected regions in five countries: Bulgaria, Latvia, North Macedonia, Poland and Romania.		Case study in North Macedonia (focussing on Mycelium-based packaging and insulation material); Case study in Latvia (foussing on wood wool)	D5.1 "Briefing paper: Analysing market conditions and designing business models within BE-Rural's OIPs"; D5.2 "Summary report on small-scale bio-based business models and their market potentials"; D5.4 "Note on the development of a sustainability screening for regional bioeconomy strategies"	Power4Bio sister project
5	10-2018	03-2021	**POWER4BIO**	https://power4bio.eu/	https://power4bio-eu.translate.goog/?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	POWER4BIO project aimed at empowering regional stakeholders to boost the transition towards bioeconomy regions in Europe by providing them with the necessary tools, instruments and guidance to develop and implement sound sustainable bioeconomy strategies. POWER4BIO targeted 10 regions with a focus on regions in Central and Eastern Europe.		Case study in Andalusia (focussing on Bioeconomy Strategy and Available Biomass Sources At Regional Level (Olive Biomass, Intensive Horticulture and Seaweed production)) and Mazovia (agricultural residues)	D3.3 "Catalogue with bio-based solutions"; D6.4 "Training design and materials for increasing the bioeconomy capacity of regional stakeholders"	BE-Rural sister project; certain outputs related to the development of bio-based solutions were classified as confidential and are thus not publicly available.

Other relevant projects								
	Start month	End month	Name	Project website	Translation link (English to Macedonian)	Project summary	Relevance to SCALE-UP	Comments
1	09-2022	08-2025	**ShapingBio**	https://www.shapingbio.eu/	https://www-shapingbio-eu.translate.goog/?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	The overall aim of ShapingBio is to support and accelerate bioeconomy innovation and the deployment of new knowledge in the EU and its member states. ShapingBio aims to provide evidence-based and concrete information and recommendations for better policy alignment and stakeholder actions to realize the cross-sectoral potential of the bioeconomy and to reduce the fragmentation across bio-based sectors and food system and policies across regions, domains and governance levels.	Promote innovation in the EU bioeconomy.	ShapingBio focusses on EU macro-regions, it does not feature any rural case studies.
2	07-2022	06-2025	**BioModel4Regions**	https://www.biomodel4regions.eu/	https://www-biomodel4regions-eu.translate.goog/?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	BIOMODEL4REGIONS aims to support the establishment of the innovative governance models at local/regional level to achieve better-informed decision-making processes, social engagement and innovation to support and strengthen EU and international science-policy interfaces to achieve the Sustainable Development Goals.	Support regional bioeconomies.	
3	09-2022	08-2025	**CEE2ACT**	https://www.cee2act.eu/	https://www-cee2act-eu.translate.goog/?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	CEE2ACT will empower countries in Central Eastern Europe and beyond to develop circular bioeconomy strategies and action plans through knowledge transfer and innovative governance models enabling sustainability and resilience to achieve better informed decision-making processes, societal engagement and innovation, building on the practice of experienced countries serving as role models.	Development of bioeconomy strategies.	CEE2ACT focusses on national-level developments, it does not feature any regional/rural case studies.
4	09-2022	08-2025	**ROBIN**	https://robin-project.eu/	https://robin--project-eu.translate.goog/?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	ROBIN aims to empower Europe's regions to adapt their governance models and structures in ways that accelerate the achievement of their circular bioeconomy targets while promoting social innovation and accounting for different territorial contexts. In this context, ROBIN will support 5 regional authorities across Europe (Southern Region of Ireland, Central Macedonia, Andalusia, Baden-Wuerttemberg, Zilina) to adapt their governance models to support the scaling up of the bio-based value chains of their ecosystem.	Regional bioeconomy development, as well as social innovation in the bioeconomy, which is covered in WP5 of SCALE-UP.	
5	06-2022	05-2025	**RELIEF**	https://relief.uop.gr/	https://relief-uop-gr.translate.goog/?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	RELIEF aims to develop and deliver an innovative approach for teaching bio-economy in farming, by developing specific learning resources addressing HEIs students and farming practitioners. RELIEF will deliver a training needs analysis and develop two curricula in bio-economy, for HE students, farming practitioners and farmers exploring the key areas that are critical for the implementation of business models and strategies towards bio-economy in farming.	Training courses on bioeconomy, also covered in WP3 of SCALE-UP.	
6	01-2021	06-2023	**COOPID**	https://coopid.eu/	https://coopid-eu.translate.goog/?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	Wtin COOPID, a network of bioeconomy clusters from 10 European countries has been created, involving a range of stakeholders: primary producers, in cooperatives or associations, within agriculture, forestry and aquaculture; industry; public sector; research and academia. So-called COOPID ambassadors showcased success stories, organised workshops and conducted interactive dissemination and communication campaigns. The focus was on the uptake of sustainable bio-based business models in the primary production sector.	Development of bioeconomy clusters.	D4.2 "Success story factors for biobased Business models"
7	12-2022	11-2026	**P2GreeN**	https://p2green.eu/	https://p2green-eu.translate.goog/?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	P2GreeN will implement and demonstrate innovative N & P recovery solutions based on human sanitary waste from urban settlements and its conversion into safe bio-based fertilisers for agricultural production. The project will test the solutions in three pilot regions on a north-south trajectory.	Nutrient recovery is a part of SCALE-UP.	

3. Regional, National & Local policies

Please add the local policies (including strategies, roadmaps, incentives, subsidy schemes and regulatory information) that you find relevant to the SCALE-UP project and to your bio-based solutions.

List of relevant policies

	Year	Regional/Provincial/National	Title	Title (original language)	Link	Translation link (Macedonian -> English)	Author/Publisher:	Summary of contents	Relevance to the SCALE-UP project	Relevance to the specific bio-based solutions
1	2017	National	**Law on agriculture and rural development**	**Закон за земјоделство и рурален развој**	https://zpis.gov.mk/Upload/Documents/Zakon%20za%20zemjodelstvo%20i%20ruralen%20razvoj%20mart%202017.pdf	-	Ministry of Agriculture, Forestry and Water Management	The Law on agriculture and rural development regulates the planning of agricultural and rural development, the goals of the national agricultural policy, partnership with social and economic partners, support of agricultural markets and national financial support	This law regulates the planning of agricultural and rural development on national level and it is fondation for all plans and programmes related to agriculture.	The document aims at improving the conditions for composting and strengthening the multi-sector partnership.
2	2022 (latest changes)	National	**Law on Agricultural Land**	**Закон за земјоделско земјиште**	https://diz.gov.mk/wp-content/uploads/2021/01/ЗАКОН-ЗА-ЗЕМЈОДЕЛСКО-ЗЕМЈИШТЕ.pdf	-	Ministry of Agriculture, Forestry and Water Management	This law regulates the use, disposal, protection and conversion on agricultural land. The objectives are: rational use of agricultural land as limited natural resource, protection of agricultural land and provision of legal certainty to owners and users of agricultural land.	This law regulates the various aspects on agricultural land, important for the sustainability aspect.	The document provide meaures and suggestions for proper soil fertilization.
3	2021 (latest changes)	National	**Law on Organic Agricultural Production**	**Закон за органско земјоделско производство**	https://diz.gov.mk/wp-content/uploads/2021/01/ЗАКОН-ЗА-ОРГАНСКО-ЗЕМЈОДЕЛСКО-ПРОИЗВОДСТВО.pdf	-	Ministry of Agriculture, Forestry and Water Management	This law regulates the production, preparation, processing, storage, transport, distribution, advertising, the sale, labeling and control of organic products where they are organic production methods used.	This law regulates the various aspects on organic production, important for the potential organic residues quantity.	The document gives recommendation for organic production and its beneficial usage.
4	2021 (latest changes)	National	**Law on quality and safety of fertilizers, biostimulants and improvers of soil properties**	**Закон за квалитет и безбедност на ѓубриња, биостимулатори и подобрувачи на својствата на почвата**	https://www.mzsv.gov.mk/CMS/Upload/ЗАКОН%203А%20КВАЛИТЕТ%20И%20БЕЗБЕДНОСТ%20НА%20ЃУБРИЊА,%20БИОСТИМУЛАТОРИ%20И%20ПОДОБРУВАЧИ%20НА%20СВОЈСТВАТА%20НА%20ПОЧВАТА/Закон%20за%20квалитет%20и%20безбедност%20на%20ѓубриња,%20биостимулатори%20и%20подобрувачи%20на%20својствата%20на%20почвата.pdf	-	Ministry of Agriculture, Forestry and Water Management	This law regulates the conditions for the production of fertilizers, its placement on the market, import, export and use of fertilizers, biostimulators and improvers of soil properties, manure types, identification, quality, composition, sampling, packaging, repackaging, marking, testing, declaring, tracking, registering and other issues related to biostimulators and improvers of soil properties.	This law regulates the various aspects on fertilizers, imporant for identification of bio-alternatives for composting.	The document sets the rules and criteria for organic fertilizers.
5	2020 (latest changes)	National	**Law on Waste Management**	**Закон за управување со отпадот**	https://www.moepp.gov.mk/wp-content/uploads/2018/12/ЗАКОН-ЗА-УПРАВУВАЊЕ-СО-ОТПАД-МКД.pdf	-	Ministry of environment and physical planning	This law regulates the principles and objectives of waste management, strategies, the plans and programs for waste management, the rights and obligations of the legal and natural persons in relation to waste management, the manner and conditions under which it can to collect, transport, reuse, treat, store, processing and disposal of waste, import, export and transit of waste, establishment of the information system, as well as financing and supervision over waste management	This law regulates the principles and objectives of waste management, imporatant for the reduction of bio-residues and enchancing organic waste separation and selection.	The document provide instructions for proper waste management including recycling/improving the properties of organic substances that are not use as solvents (including composting and other processes of biological transformation).

6	2022 (latest changes)	National	Law on Environment	Закон за животна средина	https://www.moepp.gov.mk/wp-content/uploads/2014/10/Закон-за-животната-средина-пречистен-текст.pdf	-	Ministry of environment and physical planning	The objectives of this law are: preservation, protection, renewal and improvement of the quality of enviroment; protection of human life and health; protection of biological diversity; rational and sustainable use of natural resources and implementation and improvement of the measures to solve the regional and global environmental problems.	This law regulates the principles and objectives of environment preservation, setting the measures to reduce the GHG emissions and conserving the biodiversity on national and local level.	This document aims at strengthening the sustainable and circular approach of the selected bio-based value.
7	2021	National	National Strategy on agriculture and rural development for the period 2021-2027	Национална стратегија за земјоделството и руралниот развој за периодот 2021-2027	https://faolex.fao.org/docs/pdf/mac209144.pdf	-	Ministry of Agriculture, Forestry and Water Management	This Strategy, based on the provisions of the national Law on agriculture and rural development, represents a main long-term strategic document on which is based the setting and implementation of goals, policies and measures for the development of agriculture and rural areas in the Republic of North Macedonia for the period from the year 2021 until 2027, with the aim of planning the national agricultural policy in order to achieve related legally defined sectoral development goals. This text reflects the continuity of the state interest in agriculture due to its multidimensional importance and especially for ensuring the sustainability of rural areas.	The strategy is setting the national agricultural policy and measures aligned with the EU requirements.	This document gives an overview of various mitigation measures for climate changes, among which are the usage of non-artificial fertilizers.
8	2019	National	Communication and visibility plan of the rural development network of the Republic of North Macedonia for period 2019-2022	План за комуникација и видливост на мрежа за рурален развој Република Северна Македонија	https://ruralnet.mk/File_Storage/bfd662a2-6f36-49a8-b675-31efb033f2bb_Plan-za-komunikacija-na-MRR-2019-2022.pdf	-	Ministry of Agriculture, Forestry and Water Management	The purpose of the Networks for Rural Development is the exchange of information, easier distribution of information, communication, easy availability of all information to all actors of the rural development in an equal way and at the same time, all because of the complexity of this area and the different character and type of actors (interested subjects) of rural development.	This plan is enchancing the stakeholders networking in the agricultural sector, thus contributing to the engagement in the Quadruple Helix.	This document provide guidline for networking and knowledge exchange between stakeholders, primary producers and businnes sector.
9	2023	Local	Local Environmental Action Plan (LEAP) for the Municipality of Strumica 2024-2029	Локален акционен план за животна средина 2024 - 2029 година	https://strumica.gov.mk/leap/	https://strumica-gov-mk.translate.goog/leap/?_x_tr_sl=mk&_x_tr_tl=en&_x_tr_hl=nl&_x_tr_pto=wapp	Municipality of Strumica	The main regulatory instrument relevant to bioeconomy development in the Strumica region is the LEAP under jurisdiction of the Ministry of Environment and Physical Planning and the Law for environment. Issued in 2023, this plan has a six-year timeframe and supports compliance with environmental requirements in the process of accession to the EU.	This plan has a six-year timeframe and supports compliance with environmental requirements in the process of accession to the EU.	This document encourages the use of organic biomass residues from agriculture for production of compost or energy resources;
10	2022	National	Report on the Status of Organic Agriculture and Industry in North Macedonia	Извештај за статусот на органското земјоделско и индустрија со Северна Македонија	http://www.ekoconnect.org/tl_files/eko/p/Projekte/MOE-Laenderberichte/Country-Report-Organic-NORTH-MECEDONIA-EkoConnect-2022.pdf	-	Association of Agricultural Economists of North Macedonia	Report on various aspect of organic farming. Organic farming in North Macedonia is an emerging sector. With suitable climate and soil conditions, North Macedonia has a significant potential in organic crop production, wild collection, sheep breeding, and beekeeping. Processing is still limited and the market needs to be further developed.	This report complies with the Law on organic production. It provides data for various organic production, their challenges and outlook. Moreover it contains an overview for organic-relevant companies, stakeholders, and products.	This document emphasizes the greater need to introduce the sustainable and organic farming in the education and research sector.
11	2018	National	National Program for Agricultural Development and Rural Development 2018-2022	Национална програма за развој на земјоделството и рурален развој 2018 - 2022	https://dejure.mk/zakon/nacionalna-programa-za-razvoj-na-zemjodelstvoto-i-ruralen-razvoj-za-period-od-2018-2022-godina	https://dejure-mk.translate.goog/zakon/nacionalna-programa-za-razvoj-na-zemjodelstvoto-i-ruralen-razvoj-za-period-od-2018-2022-godina?_x_tr_sl=mk&_x_tr_tl=en&_x_tr_hl=nl&_x_tr_pto=wapp	Ministry of Agriculture, Forestry and Water Management	Operational document for implementing the national policy for agriculture and rural development that connects strategic policy documents, primarily NARDS and multi-year budget planning, with annual operational programs. Overview on the: (1) instruments, measures and activities for their implementation, (2) timetable and deadlines for implementation and (3) indicative financial framework for their implementation. Validity period 2018-2022. Frequently updated.	This programme is operational document for implementing the national policy for agriculture and rural development that connects strategic policy documents, and multi-year budget planning, with annual operational programs	This document complements the National Strategy and indicates potential financial support for rural development.

12	2018	National	**National strategy for biological diversity with action plan for the period 2018 – 2023**	**Национална стратегија за биолошка разновидност со акциски план за периодот 2018 – 2023 година**	https://www.moepp.gov.mk/wp-content/uploads/2014/12/NATIONAL-BIODIVERSITY_MKD.pdf	-	Ministry of environment and physical planning	The document explores North Macedonia's biodiversity, starting with global and national strategies, emphasizing periodic strategy revisions. Analyzing geographical, climatic, and demographic features, it delves into species diversity, ecosystems, and genetic variety, emphasizing the country's regional significance. Turning to challenges, it dissects direct threats, including agriculture and transportation. The positive feedback loop of ecosystem services is introduced. Examining institutional aspects, the document reviews legal frameworks, stakeholders, and financing. Legal safeguards for species, habitats, and designated areas are outlined. The documents provide concise strategic plan with national goals, objectives, and targets. In essence, it offers a brief technical narrative of Macedonia's biodiversity and outlines a strategic path forward.	This document provide overview of the biodiversity on national level, which is one of the main aspeacts condiserated in the project	The focus on nature conservation must involve integrating sustainable development principles into other sectoral policies. This entails identifying mechanisms and alternatives that won't significantly delay planned economic growth. Such measures contribute to ensuring the long-term survival of crucial components of biological diversity, both nationally and internationally. Based on the analysis of threats, some of the key sectors affecting biodiversity are agriculture and forestry.
13	2013	National	**National plan for organic production 2013 - 2020**	**Национален план за органско производство 2013-2020**	http://arhiva.mzsv.gov.mk/files/Nacionalen%20Plan%20za%20Organsko%20Proizvodstvo_2013%20-%202020.pdf	-	Ministry of Agriculture, Forestry and Water Management	This document presents a chronological overview of the development process of the National Organic Production Plan for 2013-2020. It covers the document's objective and structure, assesses the current state and macroeconomic framework, examines the historical development of organic production, and evaluates the implementation of strategic goals. The sectoral analysis encompasses plant production, education, trade, raw materials, processing of organic products, livestock production, control and certification, policy, legislation, and the collection of wild plants and fruits. Furthermore, it gives details on the organic production strategy and the action plan for the period 2013-2020.	This document provide an overview of the organic development plan on national level, thus it delve depeer in the organic producs, need for certifications, etc.	This document could be of improtance for the quality of the agricultural residues, thefore for the quality of the composts and fertilizers.

4. Technical information on specific bio-based solutions

Please add technical information, including scientific information, peer-reviewed articles, reports, and other data or research that you find relevant to the bio-based solutions.

List of relevant technical information

Solution 1: Composting

Solution 2: Agricultural residues and mycelium-based inslulation and packaging solutions

	Date	Author(s)	Title	Link	Translation link (English -> Macedonian)	Organizations	Summary of contents	Relevant to which solution?	Why is it relevant?
1	2017	Centre for development of the South-East region	Study for analysis of composting potentials in domestic conditions in the South-East planning region	https://keep.eu/api/project-attachment/16145/get_file/	-	Centre for development of the South-East region	The study on "Analysis of the potentials of composting in the South-East region" was made within the framework of the project "We are thinking about composting - dedicated to maintaining the organic chain".The purpose of the Study is to investigate, analyze and consider the potentials, but also the challenges for composting organic (biodegradable) waste in domestic conditions, but also at the local level for the municipalities in the Southeast region. The study contains information about the current state of composting in our country, the benefits of composting as a process, and the use of the produced compost.The study also investigates the technical-technological and financial viability, sustainability of composting and suggests future steps needed to prepare the competent municipal authorities and other stakeholders to comply with the requirements of the national legislation in the field of waste management.	Composting	The document gives an extensive overview of region and status quo with the biodegradable waste. It tackles several issues related to waste management such as: residues from vegetable agricultural production, disposal, and available technologies for the treatment of biodegradable waste, types of composting and waste treated by composting. Furthermore, it provides a content of the legal framework and assessment of the potential in the region with possible variants for composting and most suitable composting system. Nonetheless, the study focuses on the sustainability of composting in the region.
2	2008	Liljana Koleva-Gudeva, Dragi Janev	From organic waste to organic compost	http://arhiva.mzsv.gov.mk/files/Brosura_Kompostiranje.pdf	-	Program for Regional economic development in North Macedonia	This study is answering many questions regarding compost, such as why should we compost, what is composting, what does it take to make compost, what is compostable or not, difference between cold and ward composting, good composting site, how is a compost mixture formed, types of composters, necessary conditions for obtaining compost, the most important rules for successful composting , their stages. The documents elabotates about home composting, composting using worms or lumbriculture and finally what is the benefit of composting.	Composting	This document provides the basis on the composting issue, i.e., what it takes to make compost, what is or not compostable, cold, and warm composting, composting sites, types of composters, necessary conditions for obtaining compost, etc. Moreover, it elaborated the stages in composting and ripening of the compost. Also, the study highlights the use of compost and its benefits.
3	2017	Munipality of Strumica	Plan for management waste in Municiplaity of Strumica for period 2017-2022	https://strumica.gov.mk/wp-content/uploads/2020/07/Општински-план-за-отпад-2017-2022.pdf	-	Munipality of Strumica	Waste is one of the main environmental problems taking into account that the amounts of waste are constantly increasing. Most of the waste in the North Macedonia is deposited at the legal and the illegal.Waste recycling in the North Macedonia is very little represented. There should be certain goals in relation to waste and increase of integrated waste management, effective institutional and organizational set-up and improved waste management infrastructure. Priorities in waste management are the following: Avoiding the generation of waste and reducing harmful impacts; Improvement of production technologies which reduces the generation of waste and the use of ecological products and less packaging, Recycling and reuse of waste or in another process for extraction of secondary raw materials or to be used as a source of energy. Mainly the generation of waste comes from production activities, from quarries and mines, from construction, waste from agriculture and forestry, municipal waste, etc. Waste from production and processing activities consists mainly of food, wood, paper, chemicals, non-metallic minerals, base metals,etc. Production and processing activities can play a central role in reducing the amount of generated waste with: Incorporating life cycle analyzes into design and production of goods and services, Promotion of sustainable use of matter and energy, Elimination or reduced use of substances and materials that are dangerous for human health and the environment.	Composting	This document focuses on the waste management in the municipality of Strumica, with a overview of the different waste type management, waste collection and transport. More importantly, this plan identifies the barriers that exist on local level in order to enhance waste management, thus defines measures and projections for future waste generation. The plan provides guidelines for waste selection and instructions for reduction of generated waste, reuse, treatment and composting of the waste.

4	2022	Liucheng Penga et al.	**Development and characterization of mycelium bio-composites by utilization of different agricultural residual byproducts**	https://www.sciencedirect.com/science/article/pii/S2369969822000731	https://www-sciencedirect-com.translate.goog/science/article/pii/S2369969822000731?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	College of Food Science and Technology, Shanghai Ocean University, Shanghai 201306, China	Mycelium bio-composites was developed by incubating Pleurotus ostreatus fungi on different substrates from agricultural residual byproducts, including rice straw, bagasse, coir-pith, sawdust, and corn straw. The scanning electron microscope (SEM) results showed that the hypha of composite derived from bagasse was the densest, and the diameter of hypha was the biggest (0.77 μm), which was presumably due to the existence of cellulose in bagasse in the form of dextran and xylan. The maximum and minimum compression strength for sawdust substrate and corn straw substrate were 456.70 and 270.31 kPa, respectively. The flexural strength for bagasse substrate and rice straw substrate were 0.54 and 0.16 MPa, respectively. The two composites derived from rice straw and bagasse exhibited higher hydrophobic properties than others. In comparison, mycelium bio-composite derived from bagasse showed the best comprehensive properties. Except for a little worse anti-creep ability and waterproof performance, other properties of mycelium biocomposites could be comparable to commercially expanded polystyrene (EPS) packaging material. Derived from this study, mycelium material provided a good way to use agricultural residual byproducts and could be a good alternative to non-biodegradable materials for packaging applications.	Agricultural residues and mycelium-based insulation and packaging solutions	This document provided in depth analysis of different types of agricultural residues with their technical properties, significant for selection of the residues available in the region.
5	2020	Kshitij Joshi et al.	**Fabrication and Characterization of Bioblocks from Agricultural Waste Using Fungal Mycelium for Renewable and Sustainable Applications**	https://www.researchgate.net/publication/339572951_Fabrication_and_Characterization_of_Bioblocks_from_Agricultural_Waste_Using_Fungal_Mycelium_for_Renewable_and_Sustainable_Applications	https://www-researchgate-net.translate.goog/publication/339572951_Fabrication_and_Characterization_of_Bioblocks_from_Agricultural_Waste_Using_Fungal_Mycelium_for_Renewable_and_Sustainable_Applications?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp&_x_tr_hist=true	Indian Institute of Technology Roorkee Mukesh Kumar Meher	Recent advances in the field of biomaterials and an ever-growing need to curb the alarming rate of pollution levels have led to the utilization of biodegradable waste to fabricate sustainable materials with tunable properties. The current study investigated the growth kinetics and morphology of Pleurotus ostreatus (P. ostreatus) mycelium grown on different agricultural wastes such as wheat bran, sugarcane, sawdust, and the mixture of these substrates. Further, it delineated the fabrication process of biodegradable “bioblocks” from such agricultural waste using a green synthesis approach and mycelium P. ostreatus as a natural adhesive material. The fabricated bioblocks showed excellent thermal stability, hydrophobic properties, and mechanical strength. The compressive strength of these bioblocks was approximately 6.0–7.5 N/mm2 , which is 5–6 times higher than that of the routinely used polystyrene packaging material. These properties of the bioblocks render them fit to replace the non-biodegradable materials that are commonly used in packaging applications, wall paneling, and filtration of toxic wastes	Agricultural residues and mycelium-based insulation and packaging solutions	This document analysis the sustainable applications with the mycelium and agricultural resides combination. It is vital for choosing the proper application relevant to the market needs in the region.
6	2021	Institute of Agriculture, Faculty of Agricultural Sciences and Food, Hans Em Faculty of Forest Sciences, Landscape Architecture and Environmental Engineering	**Climate change vulnerability and adaptation agriculture, forestry and land use**	https://api.klimatskipromeni.mk/data/rest/file/download/7e77d1acb9ea1677e56fb75cfbefd79b7d97f2b26ed0177fc4e02aebcfc011a1.pdf	-	Ss. Cyril and Methodius University in Skopje	The Sectoral Report on Agriculture and Forestry for North Macedonia's Fourth National Plan on Climate Change offers a concise overview of the current status and challenges in the agricultural and forestry sectors. It addresses crucial elements such as GHG emissions scenarios, vulnerability assessments, and adaptation strategies. The report examines the demographic landscape of the agricultural sector, including depopulation and aging issues, along with a focus on education. Climate change impacts on agriculture, from temperature fluctuations to extreme weather events, are analyzed, emphasizing soil vulnerability. In addition to agriculture, the report extends its insights to livestock vulnerability, featuring a case study on cattle, and evaluates the impact of climate change on the forestry sector, covering forest fires, ecosystem services, and forest management. The economic aspects of vulnerability, particularly in soil and crop sectors, are explored through sustainable irrigation and cover crops economics case studies. The report concludes with a summary of recommended adaptation measures, stressing the importance of implementing national policies related to climate change in the agricultural sector. It serves as a comprehensive guide for policymakers in formulating effective climate change mitigation and adaptation strategies in North Macedonia's agricultural and forestry domains.	Composting	This document is very relevant to the SCALE-UP project, as it provides essential insights into climate change impacts, adaptation measures, and economic aspects, offering a valuable resource for regional actors aiming to overcome bioeconomy bottlenecks, enhance capacity, and promote sustainable transitions in their regions.
7	\	Ministry of Agriculture, Forestry and Water Management	**Database of the unified register of agricultural holdings**	https://app.powerbi.com/view?r=eyJrIjoiYzEzYzYwODAtZDAzMy00YzU1LWI1YTMtNTc0ZmE2MjM3ZmEwIiwidCI6IjgwY2NjMDM5LTg0NWQtNDA4Zi1iYmU5LWVhNGZhM2I4ZjkwOSIsImMiOjh9	https://app-powerbi-com.translate.goog/view?r=eyJrIjoiYzEzYzYwODAtZDAzMy00YzU1LWI1YTMtNTc0ZmE2MjM3ZmEwIiwidCI6IjgwY2NjMDM5LTg0NWQtNDA4Zi1iYmU5LWVhNGZhM2I4ZjkwOSIsImMiOjh9&_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=nl&_x_tr_pto=wapp	Ministry of Agriculture, Forestry and Water Management	The Unified Register of Agricultural Holdings, managed by the Ministry of Agriculture, Forestry, and Water Management, provides a comprehensive database for each of the municipalities in North Macedonia, including the municipality of Strumica. It includes information on the number of registered agricultural holdings, the quantity and area of cadastral plots, and the sizes of farms within the region. This database serves as a valuable resource for monitoring and managing agricultural activities in the specified municipality.	Composting	This register provides solid overview of the key data input required for futher analysis in the scope of agriculture and forestry sector in municipality of Strumica
8	2017	Construction Institute "Macedonia" a.d. – skopje	**Report on strategic environmental assessment of the environment in the regional waste management plan for the southeastern planning region**	https://southeast.mk/wp-content/uploads/2021/10/СОЖС-за-управување-со-отпад-ЈИ-регион.pdf	-	Center for development of the southeast planning region	The report on the Strategic Environmental Assessment (SEA) for the Southeastern Planning Region's Waste Management Plan provides a detailed overview. It covers SEA principles, the content of the planning document, and an action plan. The characteristics of the region, including geography, climate, and socio-economics, are examined. The current environmental state is outlined, emphasizing air quality, water conditions, and waste management. The report defines main planning objectives, considers potential environmental impacts, proposes mitigation measures, explores alternatives, and introduces a monitoring plan.	Composting	This document provides overview of the current waste management and plans how to improve the waste management, including the biodegradable waste, and therefore it links with the project and its bio-based value chain, the composting and agricultural residues.

9	2017	NGO Planetum, Alliance One	Impact of some agricultural activities on the environment and biodiversity in the Strumica region.	https://www.planetum.mk/images/b8.pdf	-	NGO Planetum, Alliance One	This document covers various aspects related to biodiversity and environmental challenges in the Strumica region. It starts by defining biodiversity and highlighting its significance in the region. The focus then shifts to water pollution, irrigation water quality, and the impact of pesticide use on groundwater and biodiversity. The document also explores the environmental consequences of stubble burning, both generally and specifically in the Strumica region. It touches upon the production of staple crops like real grains and concludes by examining the climate characteristics of the Strumica basin. Overall, it provides a concise overview of the environmental landscape and biodiversity considerations in the Strumica region.	Composting	The topics of water pollution, pesticide use, and stubble burning are relevant to composting as they can directly impact the quality of compost. Contaminated water sources and pollutants from pesticides or burning practices may introduce harmful substances into the compost, affecting its suitability for agricultural use. Understanding and addressing these environmental factors is crucial to ensure that compost remains a safe and effective soil amendment.
10	2020	Center for development of the southeast planning region	Biodiversity Strategy and Action Plan for the Southeastern Planning Region	https://southeast.mk/wp-content/uploads/2021/07/Стратегија-за-биолошка-разновидност-и-Акционен-План-за-Југоисточен-плански-регион-финално.pdf	-	Center for development of the southeast planning region	The document introduces a comprehensive strategy for biodiversity conservation in the Southwestern Planning Region. It covers global and national strategic perspectives, assesses geographical characteristics, identifies biodiversity threats, and presents an extensive action plan. The plan includes measures for monitoring, education, and public awareness, emphasizing the importance of both formal and informal education in achieving conservation goals.	Composting	The document on biodiversity in the Southwestern Planning Region may not have direct relevance to composting, as its primary focus is on biodiversity conservation strategies. However, composting can indirectly benefit from such initiatives by promoting healthier ecosystems and soil conditions, which, in turn, can positively impact composting processes and contribute to sustainable waste management practices. Biodiversity conservation efforts often emphasize sustainable land use and environmental practices, aligning with broader goals of responsible resource management, which can include composting practices.
11	2016	PointPro Consulting - Skopje	Area of the strumica river basin river basin management plan 2016 – 2027	https://www.moepp.gov.mk/wp-content/uploads/2015/01/RBMP-Strumica-2016-2027_MK.pdf	-		This document outlines strategies and actions for the sustainable management of the Strumica River Basin over the specified timeframe. It likely includes assessments of the basin's water resources, potential threats such as pollution or overuse, and proposed measures to protect and enhance water quality and quantity. The plan aims to address environmental concerns, promote efficient water usage, and ensure the long-term health and resilience of the river basin ecosystem.	Composting	The "Area of the Strumica River Basin River Basin Management Plan 2016 – 2027" outlines strategies for sustainable management of water resources, environmental protection, flood prevention, water quality improvement, and fostering sustainable development within the Strumica River Basin over the specified timeframe.
12	2015	Stojan Georgiev, Sonja Stojkova, Gjorgi Dimitrievski	Operational plan for protection and defense against flooding for the endangered areas of the territory under the jurisdiction of the "municipality of strumica" for the year 2015	/		Municipality of Strumica	The operational plan outlines strategies for protecting and defending against flooding in vulnerable areas within the jurisdiction of the Municipality of Strumica. It identifies key endangered areas and proposes measures to mitigate the risk of flooding, safeguarding both infrastructure and communities. The plan likely includes provisions for early warning systems, infrastructure improvements, emergency response protocols, and community engagement initiatives. By implementing this plan, the Municipality aims to enhance resilience to flooding events and ensure the safety and security of its residents and resources.	Composting	The operational plan in the Municipality of Strumica focuses on safeguarding against flooding, indirectly benefiting composting by supporting agricultural resilience and protecting composting infrastructure from potential damage. The plan's emphasis on effective resource management, including water resources, aligns with responsible composting practices. By implementing flood protection measures, the Municipality aims to ensure the continuity of composting activities and enhance overall agricultural resilience in vulnerable areas.

5. Biomass availability studies and nutrient recycling

Please add biomass availability and nutrient recycling studies that you find of interest to the deployment of your bio-based solutions.

List of relevant studies

Solution 1: Composting

Solution 2: Agricultural residues and mycelium-based inslulation and packaging solutions

	Year	Author(s)	Title	Link	Translation link (English -> Macedonian)	Summary of contents	Relevant to which solution?	Why is it relevant?
1	2021	D. Hidalgo, F. Corona & J. M. Martín-Marroquín	Nutrient recycling: from waste to crop	https://link.springer.com/article/10.1007/s13399-019-00590-3	https://link-springer-com.translate.goog/article/10.1007/s13399-019-00590-3?error=cookies_not_supported&code=d7dd7400-0367-4dd0-8db5-19c089454d97&_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=en-US&_x_tr_pto=wapp	Within the transition to a bio-based economy from a fossil reserve-based world, we face the vital dare of closing nutrient cycles and moving to a more practical and balanced resource management, taking into account not only the economical but also the environmental perspective. The manufacture and transportation of mineral fertilizers are activities that require large amounts of fossil energy. Therefore, the dependence that agriculture has on fertilizers based on mineral reserves (mainly P, N, and K) should be considered as a very serious threat to human food security and climate change. On the other hand, the existing forecast on phosphorus reserves is pessimistic. According to the latest published figures on population growth and estimated demand for nutrients in the future, depletion of this material is expected to occur within a maximum of 300 years. At the same time, the agricultural demand that exists for mineral fertilizers is constantly growing. The main reason is the increase in the world population, together with the increase in meat consumption and the popularity of energy crops. Despite these negative perspectives, the processing or elimination of waste streams causes uncontrolled dispersion in the environment of a large amount of minerals. Thus, a new global effort is needed to draw a new scenario where improved nutrient use efficiency and, at the same time, reduced nutrient losses provide the bases for a more circular economy, to produce more necessary inputs, as food or energy, as the same time as decreasing environmental impact.	Composting	This paper will show the process options which can "upcycle" and recover residual nutrients to high-quality end-products, defined by efficient nutrient use and will reveal the key issues to face with novel biofertilizer products and changing policies.
2	2017	EIP-AGRI Focus Group	Nutrient Recycling	https://ec.europa.eu/eip/agriculture/sites/default/files/eip-agri_fg_nutrients_recycling_final_report_2017_en.pdf	-	The dependency of agriculture on fossil-based mineral fertilisers (especially N, P, and Potassium: K) must be regarded as a very serious threat to future food security. Furthermore, estimates of remaining phosphorus reserves are highly uncertain. Based on population growth and future demand for nutrients, the scarcity of phosphorus at a global level and the absence of geological reserves on the European continent mean that this a future threat requires much attention. For these reasons, the EC has placed phosphate rock on the list of Critical Raw Materials (CRMs). These CRMs are materials with a high economic importance to the EU which also have a high risk associated with their supply. European agriculture therefore needs to progress towards more closed loops concerning the provision of nutrients. This can be envisaged both within the agricultural sector and the mineral fertiliser industry where recycled nutrients can be used as input. It must not be forgotten that nutrient recycling can allow farmers to be less dependent on imported and purchased fertilisers - and so less exposed to price variations or supply issues. Nutrient recycling can also create rural jobs in processing, marketing and distribution of recycled nutrient products.	Composting	This document is cricial as it describes the importance of the nutrient recycling, but also provides a technology review, market need aspects and legal framework. Furthermore, it identifies the research gap and provides good practises that can be replicated in Strumica region.
3	2014	Francesco G. Ceglie and Hamada M. Abdelrahman	Ecological Intensification through Nutrients Recycling and Composting in Organic Farming	https://link.springer.com/chapter/10.1007/978-3-319-08004-8_1	https://link-springer-com.translate.goog/chapter/10.1007/978-3-319-08004-8_1?error=cookies_not_supported&code=28a41000-71a7-40f4-a137-fc4454deb2b1&_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=en-US&_x_tr_pto=wapp	In organic agriculture fertilizers are permitted in organic forms, as defined by regulation. Mineralization of organic fertilizers is a biological decomposition that release plants' available nutrients; hence soil microbial communities are vital in the organic cropping systems. Composting microorganisms can work for the farmer's benefit recycling agricultural organic wastes into materials that contribute to healthy and biologically active soil. Composting process has been deeply described to highlight the link among starting mixture, process factors and final resulting compost. Composting and crop residues incorporation are fundamental to recycle resources at farm level to improve the nutrients use efficiency and to decrease the off-farm input needs. In the organic farming a balanced combination of compost application and crop residues incorporation increases the microbial carbon use efficiency, which regulates the soil organic matter decomposition and nutrients mineralization resulting both to increase the yield and to decrease the negative impact on the environment.	Composting	This document is suitable for obtaining more details on crop residues recycling, nutrients use efficiency and C/N ratio.

4	2021	Centre for development of the South-East region	Programme for development of the South-East Planning Region 2021-2026	https://southeast.mk/wp-content/uploads/2021/04/Програма-за-развој-на-Југоисточниот-плански-регион-2021-2026.pdf	https://link-springer-com.translate.goog/chapter/10.1007/978-3-319-08004-8_1?error=cookies_not_supported&code=057e70c1-22f2-41be-988e-f325919f8b63&_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=en-US&_x_tr_pto=wapp	Programme for development of the South-East Planning Region 2021-2026 is a mid-term planning document which defines the regional development goals (for investments, modern and quality education, health and social sectors, preserved and improved environment, agriculture and rural development facilities), as well as the priorities and measures which will contribute to the achievement of the mid-term goals.	Composting	This programme is mid-term planning document which defines the regional development goals in several rural aspects. It depict the status-quo of the agricultural sector and possibilities how to utilize the residues.Furthermore, it outlines the quantities of biodegradable waste and the urge for an institutionalized approach of management to such residues.
5	\	State Statistical Office	Database for agriculre production	https://makstat.stat.gov.mk/PXWeb/pxweb/en/MakStat/MakStat_Zemjodelstvo/	https://makstat-stat-gov-mk.translate.goog/PXWeb/pxweb/en/MakStat/MakStat_Zemjodelstvo/?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=en-US&_x_tr_pto=wapp	The State Statistical Office database for agriculture and forestry provides critical data on various key aspects, including agricultural area categorized by use in hectares, as well as detailed information on the area and production of grain, forage crops, and vegetables. Additionally, the database includes valuable insights into yields for these crops. Furthermore, it offers essential figures such as the number of fruit and fruit-bearing trees, along with production statistics for fruit. Lastly, the database covers forest area by type, offering a comprehensive overview of the agricultural and forestry landscape.	Composting	This database provides all neccesary key data input required for futher analysis in the scope of agriculture and forestry sector in municipality of Strumica
6	2022	Prof. dr. Ljupcho Mihajlov - Agricultural faculty at the State University "Goce Delchev" in Shtip	Analysis of the current situation with the agricultural residues in Bregalnicki region	https://eastregion.mk/wp-content/uploads/2022/02/Анализа%20за%20состојба%20со%20пожетвени%20остатоци%20во%20Брегалнички%20регион.pdf	-	The study focuses on the biomass of post-harvest residues in the Bregalnica region, examining types and quantities of cultivated cereals, grain production, and previous experiences with post-harvest biomass treatment. It highlights the harmful consequences of burning these residues and explores legal regulations related to agro-environmental measures. The paper suggests alternatives for handling post-harvest residues, including using them as renewable energy sources, organic fertilizers, and in compost production. Specific applications, such as rice straw compost for mushroom production and using rice straw for animal feed, are discussed. The study concludes with recommendations for good agricultural practices in managing post-harvest residues in the Bregalnica region.	Composting	Althought this study is not for originally conduted for the target region, it provides a set of good practices for utilization of agricultural residues that could be replicated in the Strumica region along with several recommendations applicable for cosiderated area.
7	2016	Prof. Dr. Dushko Mukaetov	Project for the Restoration of the Strumica River Basin - Soils	https://southeast.mk/wp-content/uploads/2020/12/Integralna-zastita-brendiran-v2.pdf	-	This document covers the fundamental aspects of soils, starting with an introduction. It delves into the water-physical and chemical properties of soil, including the presence of calcium carbonate. Additionally, it explores fertilizers and fertilization, encompassing organic fertilizers such as manure, green fertilization methods like cover cropping, composting, and vermiculture, as well as mineral fertilizers.	Composting	This documents provide a great summary of the type of soils and different fertilizers how they can be utilized in the Strumica region.
8	2018	GIZ GmbH and Rural Development through Integrated Forest and Water Management	Management of Natural Resources in SEE: Forests, Soils, and Waters	https://seerural.org/wp-content/uploads/2018/02/NRM-Report-Macedonian.pdf	-	This document comprises two parts focusing on regional aspects relevant to forest, soil, and water resources in Southeastern Europe (SEE) and an overview of natural resource management in Macedonia. The regional analysis assesses key issues, status, and EU policies for forest, water, and soil resources in SEE, offering recommendations for integrated management. The section on Macedonia provides insights into the country's forestry, water, and land management, along with project overviews, trend evaluations, and recommendations for improved national resource management.	Composting	The relevance of this document for composting lies in its comprehensive analysis of regional aspects related to soil resources in NM. The insights provided into soil management practices, along with evaluations of trends and recommendations for integrated natural resource management.
9	2016	Biljana Kovacevic	Investigation of groundwater quality in the strumica region as an important agricultural resource production	https://eprints.ugd.edu.mk/17006/	https://eprints-ugd-edu-mk.translate.goog/17006/?_x_tr_sl=en&_x_tr_tl=mk&_x_tr_hl=en-US&_x_tr_pto=wapp	The investigation delves into assessing the quality of groundwater in the Strumica region, emphasizing its significance as a crucial resource for agricultural production. Through this study, researchers aim to understand the current state of groundwater quality in the area and its implications for agricultural activities. By examining various parameters and contaminants present in the groundwater, the study seeks to provide valuable insights for sustainable agricultural practices and resource management in the region.	Composting	The investigation into groundwater quality in the Strumica region is crucial for composting as it informs the nutrient content and potential contaminants in the water used for the process. The study's focus on sustainable agriculture aligns with composting objectives, ensuring that composting practices contribute positively to soil health. Knowledge of groundwater quality enables informed decisions on resource management, particularly in the sustainable use of water for composting in the region.