Mapping of EU Member States' / regions' Research and Innovation plans & Strategies for Smart Specialisation (RIS3) on Bioeconomy

Task 3

Case Study Report Emilia-Romagna (Italy)

Contract: RTD/F1/PP-03681-2015

November 2016

t33

1. Short Regional Bioeconomy Profile

Name of the case region/country	Emilia-Romagna (ITH5)
Member State	Italy
GDP – Euro per capita (2014)*	32 400
Total ESIF Research & Innovation per capita per year*	2.98
Total H2020 per capita per year*	11.02
Value Chain Approach to the Bioeconomy**	**Broad priorities:** Biomass supply and Waste, Biomass processing and conversion **Specific priorities:** Crop-based primary production, Animal-based primary production, foods and beverages, Bio-energy and fuel from biomass, Biorefinery
Thematic Focus of the Bioeconomy Approach**	**Broad priorities:** Agro-Food, Bio-based Fuel and Energy **Specific priorities:** Food Processing, Crop Production, Horticulture, Biorefinery, Biochemical products
Research and Innovation Fields highlighted for the Bioeconomy**	**Broad priorities:** Logistics and Packaging, Processing, Water and Natural Resources Management, Primary Production with quality **Specific priorities:** Logistics and Packaging, Machine tools and equipment supply, Nano Technologies, New Materials
Bioeconomy Activity Level**	High
CASE STUDY SUMMARY	
Bioeconomy Approach	E-R has an articulated Bioeconomy sector mainly based on agro-food and bio-plastics
Bioeconomy Ecosystem	E-R efforts have already been focused on the creation of a favourable ecosystem to bioeconomy, the sector is already quite developed even if improvements are still required.
Bioeconomy Policy Support	Main policy support comes from E-R RIS3 strategy, EARDF RDP, ERDF and ESF OPs, National Programmes and other regional policy documents. Financial support is granted by ESI, H2020, national and regional funds. Mechanisms for funds synergies and integration are available.
Successful initiatives and Good Practices	E-R participates to Vanguard Initiative; the project PLASTICE on bio-plastics has been concluded in 2013; Green Lab Valley promotes the use of agro-

	industry biomasses in health and packaging industry
Main Needs, Gaps and Bottlenecks	Increased public acceptance/awareness of bioeconomy potentialities, development of new intersectoral clusters and further development of large-scale projects.

* Source of the data: S3 – Regional Viewer: http://s3platform.jrc.ec.europa.eu/synergies-tool

** Data collected by this Study project in Task 1.

2. Regional Bioeconomy Ecosystem

This chapter describes the general characteristics of the regional bioeconomy ecosystem, its origins, main stakeholders and driving forces. It gives an overview on the recent evolution and trends on bioeconomy-related issues in the area and some of the main activities and initiatives.

2.1 Origin of Interest of the region in the Bioeconomy

Emilia-Romagna (E-R) is characterized by an extremely dynamic productive system that relies on the specialization processes, knowledge accumulation, cooperative relationships, common sources sharing, mutual competition and a consequent strong innovation capacity. The regional entrepreneurial sector (very developed and articulated) has been progressively focused on broad areas (**technological basins**[1]) made up of **Productive Districts/Poles**, large enterprises, cooperatives and widespread entrepreneurship. Technological basins are supported by a network of intermediate bodies (e.g. administrative bodies, representative organizations, associations) and technical facilities (e.g. service centres, schools and education centres, markets and trade fair and exhibition centres).

In the last years, based on its past experiences, E-R has focused its efforts on the design of a regional innovation system strongly linked with the entrepreneurial system and based on collective (several stakeholders involved) and continuative innovation dynamics. In the region there are some **scientific and industrial excellences** and in the last years the institutions driving regional policies had great care to the necessities of bioeconomy-related industrial areas. E-R has a strong knowledge and a developed industrial asset in the **bioeconomy sector** able to compete at a national and European scale.

[1] E-R's Technological basins are made up of Productive Districts/Poles, large enterprises, cooperatives and widespread entrepreneurship. Productive districts are homogeneous local production systems characterized by high concentration of industrial companies (mainly SMEs) and high production specialization. (e.g. Diary Parma District, Parma Ham Agro-food District).http://www.osservatoriodistretti.org/category/regione/emilia-romagna

Figure 1 – Strategic positioning of the Regions with respects to the three main pillars of bioeconomy (blue growth, agrofood, bio-based industry)

Map source: BIT-Bioeconomy in Italy (Italian bioeconomy strategy)

E-R bioeconomy-related technological trajectories[2]

- **Blue economy**

Food processing, ecosystem services, Habitat and biodiversity preservation, climate-change risks prevention

- **Agro-food**

Nutritional valorization of agro-food, precision agriculture, food-safety new technologies, agro-food integrated value chain sustainability, production systems modelling and optimization

- **Bio-based industry**

High-performing packaging, evolution of production systems and materials, resources and energy use optimization, bio-energies, industrial bio-materials.

Within this context, it is worth noting that E-R host every year the international fair "**Ecomondo**" in Rimini, i.e. a relevant technological platform dealing with the Green and Circular Economy in the Euro-Mediterranean area. The event promotes the connection between actors operating within the sector and gives the possibility to learn about national and EU funding opportunities.

Furthermore, to complete the picture and illustrate the role played by the region in the EU agro-food panorama, note that the **European Food Safety Authority** (EFSA)[3] is located at Parma.

Below are briefly described the major sectors related to bioeconomy in E-R.

Agro-food sector

This sector represents a pillar of the regional economy. The agro-food chain, spread across all the E-R territory, is the most articulated of the region and its productions are quality and heterogeneous. The value of the agro-food sector in E-

[2] Conferenza delle Regioni e delle Province Autonome (2016), "Documento delle Regioni e delle Province Autonome di posizionamento sulla bioeconomia in attuazione della Strategia Nazionale di Specializzazione Intelligente (SNSI)", 16/129/CR08a/C11.

[3] http://www.efsa.europa.eu/it

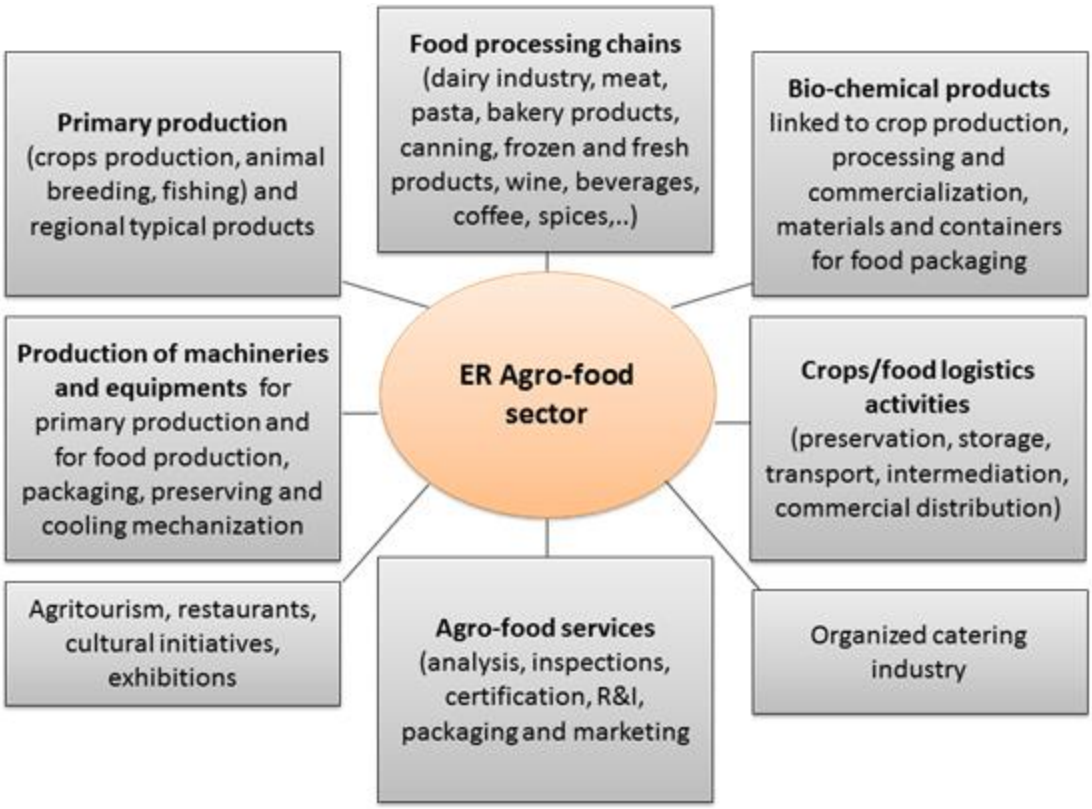
R amounted around 25 billion euro in 2014, representing 17.3% of the regional GDP[4]; placing the region at the first position in Italy for agricultural and food production. The region is also highly specialized in food processing, in agricultural mechanical technologies, in food packaging and in quality catering industries. Several enterprises[5] with a worldwide relevance working in the areas of food processing, food technologies, food packaging, cooling chain, integrated logistics, quality-food & wine production have their headquarters in E-R.

Agro-food sector in E-R is characterized by a high level of integration (see figure below), with:

- numerous sectors and stakeholders involved and linked by direct/indirect collaborative/competitive relationships,
- a strong integration of the segments of the supply chain, from agriculture products to commercialization;
- different typologies of organisations involved in territorial productive districts: micro-enterprises, SMEs, large enterprises often linked to multinational corporations, cooperatives, mixed public-private forms, etc.

4 http://www.regione.emilia-romagna.it/notizie/2015/maggio/presentato-in-regione-il-rapporto-agroalimentare

5 http://www.clusteragrifood.it/it/soci/imprese.html



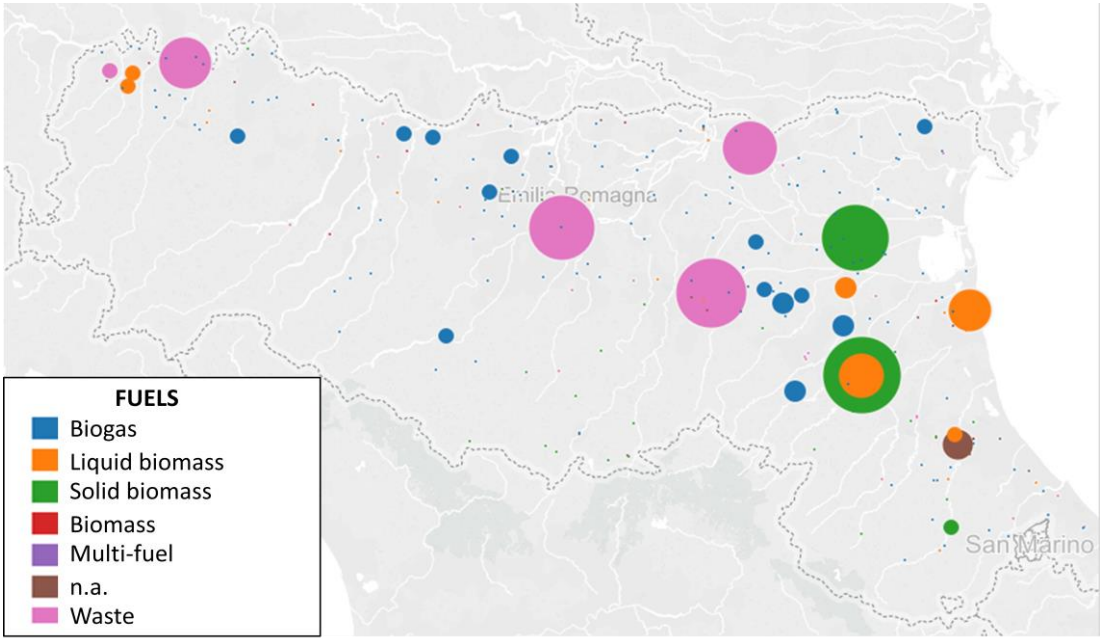
Source: t33 elaboration on Emilia-Romagna RIS3 strategy 2014-2020 contents.

Biorefinery

Biorefinery includes a set of processes converting biomass into a spectrum of marketable bio-based products (e.g. food, feed, fibers, materials and chemicals) and energy (fuel, power, heat). In E-R the biorefinery sector is quite developed and it relies on several biomass typologies (wastes, residues and by-products coming from urban, agricultural, forestry, agro-industrial activities)

E-R equipment already includes several biogas, bio-energy and bio-methane plants (e.g. using maize and manure), moreover the developed fermentation pathway allows to convert biomasses (e.g. vegetable oils: palm, rapeseed and sunflower oils) into biodiesel, bio-plastics and several bio-chemical products.

Figure 2 – Map of the bio-energy power plants in E-R



Source: InSymbio portal[6]

- **Biomass from waste and forests**

  In E-R, the annual production of biomass from urban wastes, agricultural, zootechnical and agro-industrial residues and forest residues after forest cleaning is estimated to be approximately 20 million tons (Mton/y), of which about 1 Mton/y is wood biomass from forests and forest residues[7]. Currently only a small part of this biomass is used to produce energy, high added value materials or other sustainable bio-compounds. E-R annual biomass residues potentially exploitable for energy production has been estimated around 2.6 million tons of ligno-cellulosic biomass and 16 million tons of food and animal waste. This potential could be exploited by different supply chains depending on the type of biomass, the technology used and the desired output products

- **Used cooking oils**

  They represent a potentially very polluting waste whose collection and recovery is still not fully operational in E-R (therefore it still difficult to assess the amount of oil produced yearly). An improved exhausted oils

[6] InSymbio is a national digital marketplace for biomass and agricultural waste: http://wwww.insymbio.com/index.php

[7] http://www.plastice.org/fileadmin/files/Plastice_TheBiorefining_E-R.pdf

collection in the region may represent an opportunity to increase the production of biodiesel, lubricants for agricultural machinery, fats for industry, energy, glycerin for saponification, release agents for construction and other industrial products.

Marine resources (blue growth)

Maritime sector in E-R has a significant economic relevance especially in coastal provinces (Rimini, Ravenna). In 2014 there were around 13000 enterprises and around 58600 employees working in the sector[8].

Marine resources represent a concrete potentiality for a further bioeconomy sector development: e.g. marine-based energy, deep-sea-mining: (i.e. use of organisms, minerals and other resources coming from sea depths), production of bio-chemicals with algae biomass, use of marine microorganisms in chemical transformation, production of bio-materials for ships constructions, etc.

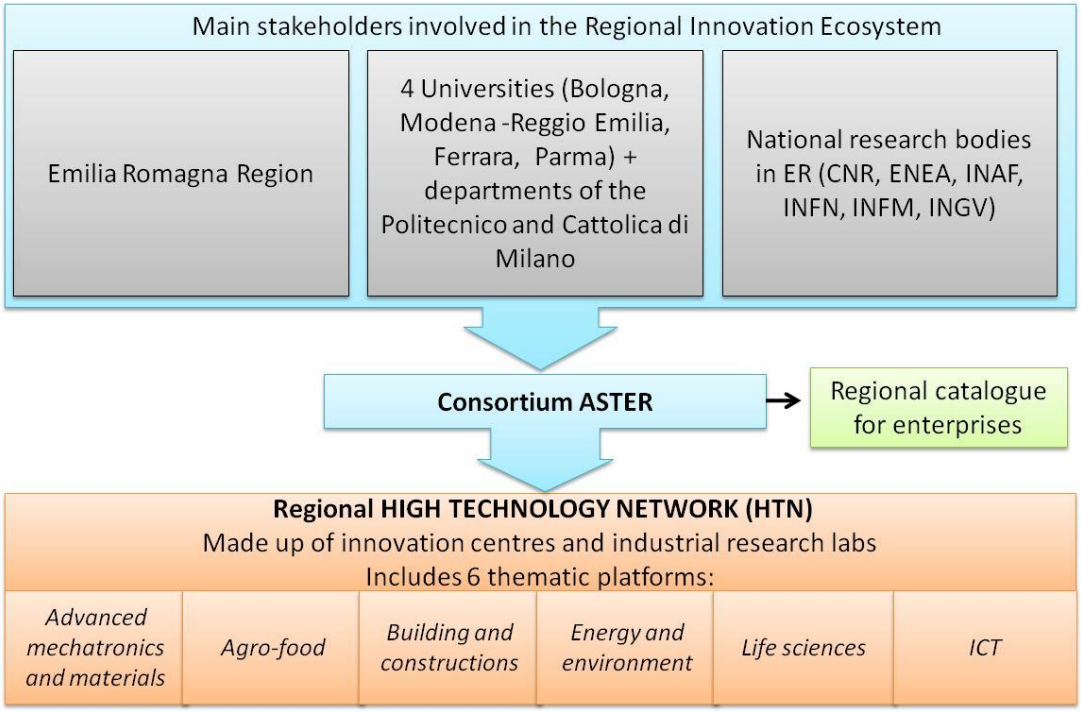
2.2 Bioeconomy Stakeholders

The **Regional Innovation System** is governed by the regional **High Technology Network** (HTN)[9] composed of 88 different organisations. The Network is coordinated by **ASTER**[10], the consortium for innovation and technology transfer; which includes among its members the E-R regional administration, regional universities, research institutes and the chamber of commerce system. The network has developed **6 industrial research thematic platforms,** some of them directly related to the bioeconomy fields of research.

[8] http://territorio.regione.emilia-romagna.it/sviluppo-coesione-e-cooperazione-territoriale/cooperazione-territoriale-europea/macroregione-adriatico-ionica-1/seminario-bologna-17-novembre-2015/stefano-valentini

[9] http://www.retealtatecnologia.it

[10] http://www.aster.it



Source: t33 elaboration on Emilia-Romagna RIS3 strategy 2014-2020 contents.

HTN is represented on regional territory by a **"techno-poles" regional network** made up of industrial research centres and technological transfer infrastructures localized in the larger cities and in universities/research poles.

At national level, E-R contributes through the HTN to 8 **National Technological Clusters**; **3 out of them are** -at least partially- **bioeconomy related,** namely: Agro-food cluster "CLAN"[11], Green Chemistry cluster "SPRING"[12], (see the two boxes below), Life-science cluster "ALISEI" (partially involved)[13]. Other **4 National Clusters**[14] are currently under development and will likely contribute in the next year to the bioeconomy sector. Among them the **"Design, creativity and Made in Italy" Cluster** will give its contribution to the made-in-Italy- agro-food sector, **"Energy" Cluster** will support sustainable energy production and distribution while **"Sea economy" Cluster** will deal with Blue-growth.

Another important stakeholder for the bioeconomy sector in E-R is the ***Alma Mater Studiorum*** **- Bologna University**. In bioeconomy field, the University of Bologna's

[11] http://www.clusteragrifood.it/en/
[12] http://www.clusterspring.it
[13] http://www.clusteralisei.it
[14] Decreto Direttoriale 3 agosto 2016 n. 1610 "Avviso per lo sviluppo e potenziamento di nuovi 4 cluster tecnologici nazionali" del Ministero dell'Istruzione, dell'Università e della Ricerca

major goals is to strengthen the internal network and create interdisciplinary critical masses of scientists. The University of Bologna has identified 7 **Interdepartmental Centres** dedicated to industrial research; all contributing to the E-R HTN. **Alma Food** IRT and **Alma Sequencing** IRT are teams specialized in the bioeconomy fields of research:

- **Alma Food IRT**[15] research activities cover all sectors of the food chain, from agriculture, food economics and consumer behaviour, including issues regarding environment and health. Its main bioeconomy-related goals are:
    - develop methods to improve plant use (arable and vegetable crops, fruit trees and woody plants) and related agricultural techniques for food production purposes;
    - investigate interactions among crops, environment and management systems, to find the best economic and environmental solutions for farmers;
    - promote food safety and quality;
    - increase the value and quality of typical/traditional products (with the identification of molecular or chemical markers eventually related to the production area),
    - optimize the fermentation processes and the enzymatic activities and their applications for production of foods and additives as well as for processing of by-products
- **Alma Sequencing IRT**[16]**:** research activities deal with human, animal, plant and microbial genome. The research scientists associated with Alma Sequencing IRT work on different research areas including bioeconomy-related aspects, e.g:
    - Sustainable livestock and crop production;
    - Dynamics of marine ecosystems for a sustainable blue growth;
    - Improvement of food proprieties through controlled breeding schemes to select for inheritable traits such as fat deposit and meat quality;
    - Biotechnology applications of biomaterials.

Bologna University has been the first Italian university for the attractiveness of European funding for research (mainly in agro-food topic) in the period 2007-2012 and it is active within several H2020 bioeconomy-related initiatives: e.g. Joint Programming Initiatives (JPIs) and Knowledge and Innovation Communities (KICs.

[15] http://www.irt.unibo.it/en/alma-food
[16] http://www.irt.unibo.it/en/alma-sequencing

Foodbest Consortium member). Within the Bologna University, Full Professor Fabio Fava plays a relevant role in promoting the regional bioeconomy sector by participating to several projects and holding several related positions, e.g.: he is the EC Italian Representative in

- the Horizon2020 Programme Committee of *Societal Challenge 2: European Bioeconomy Challenges: Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and inland water research* (DG RTD)
- the BLUEMED initiative (Chair of the Strategic Board)(DG RTD and DG MARE),
- the "State Representative Group" (as vice Chair) of the Public Private Partnership "Biobased Industry" (BBI JU) (Brussels).

National Agro-food Cluster "CLAN"

The cluster is a partnership between enterprises, public/private research centres, sectoral association and stakeholders of the agro-food supply chain that has been established to promote a sustainable economic growth based on R&I. Its main goal is to increase and promote the agro-food supply chain competitiveness. It has been promoted by Federalimentare (Italian Food-industry Federation), ASTER, Bologna University, ENEA (Italian National Agency for new technologies, Energy and Sustainable Economic Development) and other 22 members of the Cluster's Coordination and Management Body. Currently ASTER holds the vice-presidency position of the cluster.

The cluster's activities are focused on four strategic areas: Nutrition and health, Food security, Production and Sustainability. The latter bioeconomy-related area aims to reduce waste production in the food supply chain, to valorise by-products, to reuse wastes/by-products in other processes, to reduce the agro-food industry impact. Among the bioeconomy-related projects activated by the Agro-food cluster **SO.FI.A.** aims to increase the national agro-food industry sustainability through the innovative technological solutions research dealing with the main productive supply chains and affecting the whole production, transformation and consumption cycle. In particular, it focuses on:

- The salvage and re-use of by-products and waste from food processing (fresh cut products, wine, dairy and meat industry) for the production of high added-value molecules, new products and energy recovery systems;
- New food processing methods and innovative treatments for their conservation (mild technologies) in order to increase the overall sustainability of the agricultural and food-supply chains and reduce waste.

National Green Chemistry cluster "SPRING"
(Sustainable Processes and Resources for Innovation and National Growth)

SPRING cluster is a non-profit association that has been promoted by Federchimica (Italian Food-industry Federation) and three industrial companies: Biochemtex, Novamont and Versalis (ENI group). Among its partners there are several large industrial players, SMEs, universities and all the major Italian public research organizations working in the biomass processing and collection sector, regional innovation poles, technological parks, consortia, sectoral associations, developments agencies, foundations, etc.
E-R SPRING partners are: ASTER, Bologna University, Parma University, UniMORE, Biolchim, Biotec SYS, Coopbox group, C.R.P.A, Eridania-Sadam, Fondazione Raul Gardini, Temix Oleo.
The Cluster has the objective of triggering the growth and the development of bio-based industries in Italy:

- supporting a continuous interaction among its members and other actors active in the field of bioeconomy;
- re-launching the creation of public-private partnerships;
- promoting the testing and demonstration of prototypes and pilot plants for the production of biochemicals and biomaterials;
- encouraging synergistic integration processes among the sectors of chemistry, engineering design, food processing, agriculture and waste management.

2.3 Bioeconomy – strategies, plans and projects

In E-R the bioeconomy sector is currently driven and promoted by several policy documents and successful initiatives. The **Research And Innovation Strategy For Smart Specialisation** strategy is the key document currently designing the development guidelines of the agro-food sector for the next years. The **Plastice project** (concluded in 2014) promoted the development and use of environmentally friendly and sustainable solutions in the packaging and end-user industries, particularly by use of biodegradable plastics. Moreover Plastice project promoted in turn the **BiorefER project** that assessed the degree of development and potentialities of the regional bio-refining supply chains (focus on biodiesel and bio-plastics).
Besides the already existing documents and projects, it is likely that in the next years the main document that will provide a wide boost to the regional sector will be the new **National Bioeconomy Strategy** In addition to this, specific support will be conceivably provided by the **Vanguard pilot project on bioeconomy** that will implement and demonstrate synergies in new bio-based value chains and by the **Green Lab Valley**

Strategic Project that will lead to the creation of a Consortium Research Lab "Biomass HUB" converting agro-industry biomasses in high added value product to be used in health and packaging industry.

3. Bioeconomy policy support

This chapter gives a brief account of the existing policy instruments and action lines to support the bioeconomy in the area.

3.1 General support framework

The general support for the bioeconomy sector in E-R is provided by the new National Bioeconomy Strategy, the RIS3 strategy, ESIF OPs (ERDF, EARDF and ESF) and H2020.

- The **National Bioeconomy Strategy** "Bioeconomy in Italy" (BIT)[17] aims to increase the Italian bioeconomy turnover (from about EUR 250 billion/y to 300 billion/y, +20%) and jobs (from about 1.85 million people to 2.2, +19%) by 2030 promoting the production of new knowledge, technologies, services, capacity building, related to the major sectors of Italian Bioeconomy. The BIT strategy identifies in the R&I Agenda the main R&I needs and opportunities for boosting Italian Bioeconomy.

The R&I Agenda Priorities		
Priorities	1. Sustainable agriculture and forestry	a) Boost sustainable and resilient primary production Improve Resource management via R&I, b) Improve Multiple functions and benefits of land and rural areas, c) Improve Multiple functions and benefits of land and rural areas, d) Improve Human and social capital and social innovation.
	2. Sustainable and competitive agri-food sector for a safe and healthy diet	a) Improve Healthy diets, healthy people, b) Improve Food safety, security, defense, and integrity, c) Boost Sustainable, competitive, and innovative food manufacture d) Boost Food policies, supply chains, markets, and communities.
	3. Bio-based industries	a) Boost production of biobased products and biofuels in the framework of a circular economy, b) Foster 'Demonstration plants/test beds for

[17] Document under consultation until 23/12/2016, consultation draft at: http://www.agenziacoesione.gov.it/opencms/export/sites/dps/it/documentazione/NEWS_2016/BIT/BIT_EN.pdf

		cascading use of biomasses.
	4. Aquatic living resources and marine and maritime bioeconomy	a) Boosting sustainable exploiting of marine resources, b) Fostering the marine environment and biodiversity.

Source: consultation draft of the BIT

- Within the regional **Research And Innovation Strategy For Smart Specialisation (RIS3)**[18] strategy 2014-2020 bioeconomy is a recurrent theme touching S3 transversal drivers (mainly "sustainable development") and different Strategic Priorities. The main bioeconomy-related priority deals with the regional "Agro-food system". Some bioeconomy issues are also addressed indirectly through other priorities: the "Building and construction system" (promoting the use of sustainable/environmental-friendly/renewable sources-based materials); by the "Mechatronics and engine design system" (envisaging ecological solutions e.g. low environmental impact vehicles) and by the "Health and wellness industries" priorities.
- **EARDF Rural Development Plan**[19] promotes several aspects of bioeconomy sector:
  - Measure 1 - it supports professional training and skills acquisition in order to trigger innovative processes aiming to increase agricultural productivity, competitiveness, and environmental-sustainability and to promote integration and synergies between agro-food enterprises and the R&I sector.
  - Measure 3: Promotes food quality
  - Priority 5C (to which contribute the measures M01, M02, M06, M16) "Encourage the supply and use of renewable energy sources, by-products, waste and residues and other non-food raw material for bio-economy purposes"
- **ERDF OP**[20]: The ***Axis 1*** "Research and Innovation axis" promotes bioeconomy indirectly since it aims to strengthen R&I infrastructures and to develop links and relationship between enterprises, R&D centres and high education system. Similarly, ***Axis 3*** "Productive system competitiveness and attractiveness" lays the basis for the bioeconomy sector development as it promotes entrepreneurship, the economic exploitation of new ideas and the establishment of new

[18] http://www.regione.emilia-romagna.it/s3

[19] http://agricoltura.regione.emilia-romagna.it/psr-2014-2020/doc/testo-del-psr-e-allegati

[20] http://www.regione.emilia-romagna.it/fesr/por-fesr/por2014-2020/documenti/documenti-por-fesr-2014-2020

companies. Finally, ***Axis 4*** aims to enhance energy efficiency, smart energy management and the use of renewable energy in private and public buildings.

- **ESF OP**[21] supports transversal themes including blue growth. Axis 3 on education and training aims to increase the quality and efficiency of high education system (investment priority 10.2) and to increase the adherence between educational/training systems and labour market (investment priority 10.4).
- **HORIZON 2020**

  Bioeconomy is referred to in different pillars of Horizon 2020 programme. The "Societal Challenges" pillar refers directly to bioeconomy; while the pillar "Industrial Leadership" mentions the key enabling technologies – KETs. Finally, Horizon 2020 also supports Joint Technology Initiatives- JTI – which are public-private partnerships between industry and the European Commission where partners co-fund specific calls on the topic. The most bioeconomy-related JTI is "**Bio-based Industries**" (**BBI JU**)22 that is a Public-Private Partnership (PPP) between the EU and the Bio-based Industries Consortium (BIC) representing the industrial partner.

  To support the innovation and the growth of the bio-based-products sector, E-R participates to the JTI/PPP BBI through the consulting board of the States Representatives Group[23]. BBI aims to convert the 30% of the EU chemical production into bio-based productions (reaching a 50% conversion rate for high added value chemical products). E-R aims to reach this target by investing in the valorization of agro-waste that is largely available in the region.

3.2 Bioeconomy policy support

Beside bioeconomy general support, in E-R there are also other **national/regional** bioeconomy-related specific policy instruments (laws, plans, programmes, strategies and roadmaps) driving specific fields of the bioeconomy sector.

- Environmental Annex to the National Stability Law 2014 "Measures for promoting green economy and limiting the excessive use of natural resources".

[21] http://formazionelavoro.regione.emilia-romagna.it/sito-fse/POR-2014-2020/documentazione/documentazione-regionale
[22] http://bbi-europe.eu
[23] ASTER (2016) "Le reti dell'innovazione – Le reti della chimica verde e dell'innovazione in Emilia-Romagna", Ecoscienza N.4, 2016. Authors: Picone S., Sani D., Ausiello F. P..

- National Programmes of Ministry of Education, Universities and Research (MIUR) and of the Ministry of Economic Development (MISE)
- National Program for Waste Reduction
- National Energy Strategy
- National Plan for Climate and Energy
- National Marine Strategy
- The Regional Energy Plan (2013)
- The Regional Programme for productive activities (2012-2015)
- The Regional Programme for industrial research, innovation and technological transfer (2012-2015)
- The Regional Plan for waste management (2016)
- Intermediate documents of the E-R RIS3 (e.g. "Technological Scenarios for Emilia-Romagna" on green economy)
- National bioeconomy-related Clusters Roadmaps (and regional documents that contributed to national roadmaps development):
    - Green chemistry "SPRING" roadmap[24]: it is both a political and a technical document stating the development guidelines of the sustainable chemical sector.
    - Agro food "CLAN" roadmap[25]: it has been prepared involving Universities, public/private research bodies, food-enterprises, territorial representatives, sectoral associations and training bodies. The document indicates 6 development technological trajectories to guide the development of agro-food sector.
    - Life sciences cluster "ALISEI" strategic plan[26].

3.3 ESIF and H2020 resources for the Bioeconomy

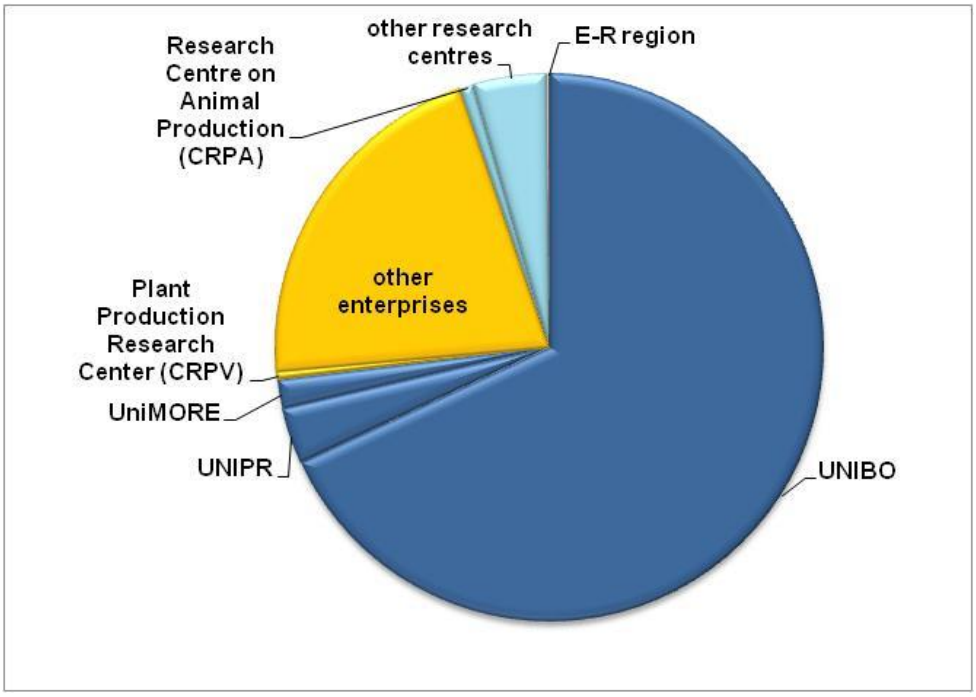
Since the programming period **2007-2013** E-R regional stakeholders (mainly private ones) demonstrated to be very active in attracting resources to boost the bioeconomy sector. In fact during this period E-R resulted the second region in Italy (after Lazio region) with the highest number of projects implemented under the 7th Framework Programme – KBBE *Specific Programme "Cooperation" - Food, Agriculture and Biotechnology* (112 projects[27], representing the 17.6% of national projects) and

[24] http://www.clusterspring.it/news/una-roadmap-strategica-per-il-cluster-spring/
[25] http://www.clusteragrifood.it/en/activities/roadmap.html
[26] http://www.clusteralisei.it/piano-strategico/

[27] List of projects at: http://first.aster.it/_aster_/viewFocus?focus=16&pagina=kbbe

contribution received (24.18 M€, i.e. 18.4% of total national contribution[28]). E-R stakeholders coordinated 10 of these projects.

Figure 3 - E-R 7th FP - KBBE (2007-2013) contribution allocated to regional participants: universities (blue), enterprises (yellow), research centres (light-blue) and E-R Region (public participation, white).



Source: t33 elaboration on data requested to APRE/ASTER help-desk

In the programming period **2014-2020** bioeconomy sector in E-R is mainly funded by **ESIF funds** and **H2020.**

As detailed in the E-R RIS3 strategy, the "Agro-food system" is funded by ERDF, ESF, EARDF, Sectoral Regional Funds and other national and European funds (Horizon 2020). Hence, in E-R, the total funding available for the agro-food sector is estimated around 740 million euro over the period 2014-2020.

Table 1 - Agro-food sector funding as reported by E-R RIS3 strategy

Research funding for agro-food sector		Public funding	Private co-financing
ESIF funding	R&D and ERDF (I)	21.08	-
	R&D and FEASR (I)	92.5	-
	ERDF - competitiveness	14.4	-

[28] This data does not include the contribution received by National Research bodies having offices in E-R region (e.g. ENEA, CNR, CREA, UNICATT and POLIMI)

	EARDF – Competitiveness	220	–
	ESF – Advanced training	17.25	–
	Total	365.23	184.09
Regional funding	"Regional Programme for productive activities" and "Regional Programme for industrial research, innovation and technological transfer"	15	–
	Total	15	18.33
Other national and EU funding	H2020 and other EU Programmes (estimation)	112.5	–
	National Programmes "MIUR" –"MISE" (estimation)	16	–
	Total	128.5	32.06
Total		**508.73**	**234.48**
Total RIS3		**743.2**	

In 2014, the Region (through OT1 of ERDF OP) financed HTN techno-poles Labs for the realization of feasibility studies aiming to improve the quality of projects submitted under the new Horizon 2020 Programme.

E-R holds a very high **H2020** ranking position considering the number of approved and coordinated projects within H2020 and a large amount of the approved projects are bioeconomy-related.
According to an analysis carried out by the APRE help-desk on the EU Open Data Portal, E-R in the period 2014 (May) 2016 was participating to several H2020 Programmes and linked initiatives. Among them there is the *Societal Challenge 2 – Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy* (overall available budget 3.851 billion€ 2014-2020) and the related initiative *BBI – Bio Based Industries PPP.* Other programmes/initiatives –at least partially- related to bioeconomy to which E-R participates are:

Horizon 2020 Programmes:

- SC2 – Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy
- SME INSTRUMENT
- MARIE CURIE
- NMPB – Call for nanotechnologies, advanced materials, biotechnology and production
- SPREADING EXCELLENCE

- ENVIRONMENT

Linked initiatives:

- BBI – Bio Based Industries PPP
- FACCE-JPI ERA-NET

The main **actor** channelling information on ESIF, ERDF, Rural Development and H2020 funding opportunities for bioeconomy sectors is ASTER Consortium (through the FIRST service, the SIMPLER project and the E-R APRE help-desk).

FIRST initiative

In 1999, the Consortium ASTER promoted the **Financing for Innovation, Research and Technological development "FIRST"** initiative[29]. FIRST is an informative service on EU, national, regional (mainly Emilia-Romagna) financing opportunities in R&D fields in favour of the regional system of innovation.

SIMPLER Consortium

In Emilia-Romagna **the Enterprise Europe Network (EEN)**[30] is represented by **SIMPLER Consortium**[31] (*Support services to improve innovation and competitiveness of business* – Lombardia and Emilia-Romagna) coordinated by Finlombarda Spa (Milano) and including 12 members (including ASTER). SIMPLER provides free services to SMEs and their associations, public/private research centres, universities and public bodies and it has been funded by the EC and the regions Lombardia and Emilia-Romagna. SIMPLER, among its services, provides information and assistance on the funding opportunities envisaged by the EU programmes.

E-R APRE help-desk

E-R territory is covered by the **Agency for the Promotion of European Research (APRE) Help Desks Network** as ASTER plays the role of APRE help-desk for E-R[32]. The latter gives to public/private regional bodies (enterprises, research bodies and individual researchers) useful information on to participates to EU programmes on R&I. In addition it provides assistance and training on the design, submission and management of research projects. E-R APRE help-desk is

[29] http://first.aster.it/_aster_/home

[30] EEN is the most important EU network (co-funded by the EC) assisting enterprises (mainly SMEs, that need to promote their products and to access new markets) through information activities on opportunities provided by EU.

[31] http://www.simplernet.it/16

[32] http://first.aster.it/_aster_/apre

therefore a focal point to access information on Horizon 2020 and other funding opportunities in the R&I sector (e.g. COST – European Cooperation in Science and Technology and AAL – Active and Assisted Living).

Besides direct funding, bioeconomy sector may also benefit from **synergies** between different funding sources. To this regard within E-R Region structures the "*Department for the coordination of European policies for development, education, professional training, universities, research and business*" coordinates the synergies between EU funds; providing support in the programming and implementation phases of ESIF.

The main mechanism allowing funding synergies in the region is the **Seal of Excellence**[33] quality label that is awarded to project proposals which were submitted for funding by one or more SMEs under Horizon 2020, passed stringent selection and award criteria but could not be funded due to budget constraints. It highlights proposals which deserve funding from alternative sources. According to Eurostat[34] Emilia-Romagna has an high number (between 70 to 144) of SMEs that have been awarded (within June 2016) by the Seal of Excellence Scheme; resulting one of the EU regions with the highest number of certified SMEs.

The **European Fund for Strategic Investments** (EFSI)[35] may represent another opportunity to provide support the bioeconomy sector in E-R. In fact In July 2015 the European Investment Fund (EIF) and Banca Popolare dell'Emilia-Romagna (BPER) have concluded the "**InnovFin agreement**" to enhance the loans granting to innovative SMEs and mid-cap companies. It has been the first operation carried out in Italy to benefit from EFSI support. The new agreement allowed BPER to start providing resources (on the whole 100M€ between 2016 and 2017) to innovative companies. During this period the loans will be covered by a **EIF guarantee** set up through the InnovFin initiative with the H2020 financing support.

[33] https://ec.europa.eu/research/regions/index.cfm?pg=soe

[34] https://ec.europa.eu/research/regions/index.cfm?pg=soe_who

[35] The European Investment Plan invests in innovative SMEs and projects through the European Fund for Strategic Investments (established by EIB). Public/private promoters of projects in the area of RDI may access to EFSI funding registering their projects in the "European Investment Project Portal" (EIPP) and using the consultancy services of the "European investment advisory hub" (EIAH) in order to reach potential investors all over the world. EFSI can support operations that are coherent with the EU policies, preferably in the RDI field and related to H2020 pillars: scientific excellence, industrial leadership (SMEs innovation) and societal challenges (sustainable agriculture and forestry, bioeconomy, etc.).

EFSI can be combined with other complementary financing resources: ESIF, H2020 and **InnovFin–EU Finance for Innovators** (which belongs to the new generation of EU financial instruments and consultancy services promoted by the EC in H2020 frame).

4. Successful Initiatives and Good Practices

This chapter highlights successful initiatives and good practices to promote research and innovation in bioeconomy-related fields.

4.1 Vanguard Initiative

VANGUARD INITIATIVE **New growth through Smart Specialization** ***"Bio-Economy – Interregional cooperation on innovative use of non-food Biomass"* pilot project** www.s3vanguardinitiative.eu	
General description	VANGUARD Initiative (VI) is an European network of 30 industrial regions dedicated to advance industrial innovation in Europe by improving the alignment between regional areas of strength and enabling co-investment, on the basis of regional smart specialisation strategies. Each region cooperate to offer platforms for businesses, clusters, knowledge institutions to meet and join forces and find EU innovative solutions. The VI activates synergies with other instruments and EU (BBI and EIB)/regional (ERDF) funding sources. The VI network has initiated five thematic interregional pilot projects in the following domains: • **Bioeconomy**; • Advanced manufacturing for energy applications in harsh environments;; • Efficient and sustainable manufacturing; • High performance production through 3D-printing • New nano-enables products. The VI pilot project on bioeconomy (presented in 2016) is called "**Bio-Economy – Interregional cooperation on innovative use of non-food Biomass**" and it focuses on the implementation and demonstration of synergies in new bio-based value chains across the regions based on their smart specialisations. In particular this pilot project aims to develop demonstrative activities promoting new bio-based value chains. Since the 1st July 2016 (until the end of 2016) Emilia-Romagna holds the presidency of VI. The participation of Emilia-Romagna region to VI is supported by ASTER Consortium. Through the Vanguard Initiative, Emilia-Romagna aims at the establishment of a platform for knowledge sharing and mainstreaming innovation and competitiveness, both at regional and European level.

Objectives	The VI pilot project on bioeconomy aims to promote the development of new bio-based value chains in Europe, by taking pilot and demonstration activities, thereby creating more critical mass, exploiting complementary assets and accelerating technological developments. E-R is involved in all 7 pilot cases currently under development (relevant stakeholders have been identified and business plans are in development phase): 1. Biobased aromatics 2. Lignocellulose refinery: European value chains for second-generation sugar and lignin 3. Turning (waste)gas into value 4. Biogas beyond energy 5. Aviation biofuel 6. High value food and feed from agrofood Waste 7. Food and feed ingredients from Algae These pilots cases will have a significant economic relevance since they will be developed at a transnational scale.
Actors involved	The VI pilot project on bioeconomy is led by Randstad Region (NL) and Lombardy region(IT). **Emilia-Romagna** region is among participating/interested regions together with East-Netherlands (NL), South-Netherlands (NL), Scotland (UK), North-Netherlands (NL), Tampere (FI), Flanders (BE), West Finland and Central Finland (FI), Wallonia (BE), North Rhine-Westphalia (DE), Skåne (SE), Andalusia (ES), Värmland (SE), Navarra (ES), Brandenburg (DE), Basque Country (ES), Baden-Württemberg (DE), Lodzkie (PL), Asturias (ES), Malopolska (PL) and Basilicata (IT).
Original Problem to be solved by project	Common challenges across EU industrial sector are: find partners, achieve critical mass, access to funding, overcome co-investment and collaboration barriers and share the early stage risk of pursing new, innovative and collaborative opportunities.
Timing and Duration	The VI was founded in November 2013
Activities	On 21 June 2016 the **two leading European bioeconomy players**, the Bio-based Industries Consortium (**BIC**) and the Vanguard Initiative have signed a **Memorandum of Understanding** (MoU) for better interregional cooperation on the bioeconomy. The collaboration will support: - improved access to funding and awareness-raising activities, - marrying BIC's bioeconomy expertise with the Vanguard Initiative's regional network to help steer Europe away from its fossil-based past

	- develop novel products for new markets creating more jobs.

4.2 Plastice project – Innovative value chain development for Sustainable plastics in Central Europe

PLASTICE: **Innovative value chain development for sustainable plastics in Central Europe** http://www.plastice.org/home/	
General description	The interregional PLASTiCE project promoted development and use of environmentally friendly and sustainable solutions in the packaging and end-user industries, particularly by use of biodegradable plastics. PLASTiCE aimed to break the existing circle of mistrust regarding bio-plastic in Central Europe and build a critical mass for implementation of innovative and more environment-friendly solutions through targeted actions.
Objectives	• Raising awareness among target groups on the issue of biodegradable plastics (information activities, certification system set up, events) • Improving technology transfer and knowledge exchange mechanisms in biodegradable plastics end-user industries (set up of the Transnational Advisory Scheme tool) • Improving access to scientific knowledge and the use of already existing knowledge as well as adapting knowledge to the requirements of biodegradable polymer and plastics producers (set up of the Joint R&D Scheme to bring together complementary research capacities from different organizations) • Intensifying application-oriented cooperation between research and industry (development of a Roadmap for research and commercialization of new biodegradable polymers)
Actors involved	The project involved EU Member States and 13 partner:

<table>
<tr><td></td><td>


PROJECT PARTNERS:
<table>
<tr><td>SI</td><td>- National Institute of Chemistry, Ljubljana (lead parner)
- SLOPAK, Packaging Waste Management Company, Ltd.
- Plasta, production and trade Ltd.
- Mercator Group
- Center of Excellence Polymer Materials and Technologies</td></tr>
<tr><td>IT</td><td>- University of Bologna, Department of Chemistry 'G. Ciamician'
- ASTER S. Cons P.A.
- NOVAMONT S.p.A.</td></tr>
<tr><td>SK</td><td>- Polymer Institute of the Slovak Academy of Sciences
- Slovak University of Technology in Bratislava
- HrKo Holding, PLC</td></tr>
<tr><td>PL</td><td>- Polish Academy of Sciences Centre of Polymer and Carbon Materials
- Polish Packaging Research and Development Centre</td></tr>
</table>
</td></tr>
<tr><td>Original Problem to be solved by project</td><td>The production, use and disposal of conventional plastic is responsible of significant environmental burdens and once in the environment plastic takes decades or centuries to degrade and its long-term effects are completely unknown.
Central Europe (Italy makes exception with a considerable bio-plastic production and a strong legal support) lags in all applied aspects connected to biodegradable plastics since the region does not possess any large-scale production capacity and use is marginal. The reason for this situation is a combination of several factors: e.g. higher prices of biodegradable plastics, lack of legal recognition and a partial mistrust among end-users. Despite this, Central Europe has a strong scientific base in the area of biodegradable polymers which obviously disconnected from the</td></tr>
</table>

	production and application reality.
Origin of Funding	The project was implemented through the CENTRAL EUROPE Programme 2007-2013 co-financed by ERDF. Total budget of the project: € 2.552.178,00, ERDF contribution € 2.110.927,80.
Timing and Duration	The project lasted 3 years: April 2011 – March 2014
Activities	To improve the acceptance and use of bio-plastic the following activities were undertaken within the project: - Numerous **events and presentations** were organized including 4 International conferences that brought together key representatives of European R&D, associations and industry working in the field. - Project partners organized **national seminars** focusing on audiences such as NGOs and industry to raise awareness and understanding of the full potential of bioplastics. - Awareness in a wider audience promoted through thought-provoking **movies** such as Trashed and Plastik Fantastik. - **Students' debate competition** on the topic of plastics was carried out.
Achieved Results	- Preparation of **documents** (5 languages) containing unbiased information on key issues (e.g. biodegradation, standardization and certification, biobased materials etc.). These documents were made available online (www.plastice.org, www.sustainableplastics.eu) and in printed form. - Guide dealing with the **Transnational Advisory scheme** "Bioplastics – Opportunity for the future" (5 languages) that gives comprehensive background information to companies or others interested in using bioplastics in their operations. - Establishment of a **certification system** of bioplastics in Slovenia and Slovakia. - Introduction of National Information Points (www.sustainableplastics.eu) in all four participating countries (constituting a **Information Point Network**) that offer unbiased and scientifically supported information about sustainable plastics to consumers and industrial users. - Case studies gathered in a **Roadmap** for joint R&D Scheme involving partners outside the project group (5 languages): 12 case studies throughout the value chain have been carried out with industrial partners within and outside the partnership to record practical examples useful in to facilitating a wider uptake of the new opportunities offered by bioplastics. - ASTER publication "**The biorefining opportunities in Emilia-**

	Romagna" implemented trough the PLASTICE project. It describes the regional availability of feedstock from wastes, residues and by-products, the current destination of used cooking oils, the current use of biomass in the agriculture sector and the regional potential products. - Plastice project supported, together with the Consortium for Innovation and Technology transfer in Emilia-Romagna (ASTER), the **BiorefER project** that aimed to: 1) assess the sustainability and completeness of bio-refining supply chains in the Emilia-Romagna region, 2) explore regional potentialities to develop new industrial synergies through a Geodatabase including all the regional actors (enterprises, research centres, public bodies) and the identification of regional clusters. The survey referred three supply chains: biodiesel produced from exhausted vegetal and animal oils/fats, bio-plastics from agro-food industry wastes and bio-plastics form dairy industry wastes.
Transferability to other EU regions?	The blueprint of the established certification system of bioplastics was made available for use in other countries. The network of national information points was already extended even beyond the region to include 17 countries and could be further extended in the future.

4.3 Green Lab Valley

GREEN LAB VALLEY: **Strategic Project** http://www.aster.it/green-lab-valley	
This Strategic Project aims to promote the creation of a **Consortium Research Lab** "**Biomass HUB**" to convert biomasses produced by agro-industry in high added value product to be used in health and packaging industry. The Consortium Research Lab will provide a service to support: - SMEs in optimizing their bio-chemical production . - large companies carrying out specific/niche studies. The CRL will merge biomasses of its member enterprises and it will adjust the biomass mixtures to be used in fermentation and gasification processes. In fact in E-R there is a great availability of biomass waste from agricultural and agro-industrial waste that can be used by SMEs to produce "niche chemical products" and to approach the bio-chemistry sector and by large companies which	

need low-cost raw materials.

The Lab will rely on excellence skills (mainly in biomass and polymers sector) already developed in the E-R region by HTN.

Green Lab Valley Prototype

In 2015 the E-R Region founded (regional funding exclusively) a prototype-phase (within the "Green Lab Valley Prototype" project) to perform a small-scale test on the most appropriate technologies to be used in the Biomass HUB and to attract enterprises toward the consortium. The G.L.V. Prototype is carried out under the "Ferrara University" scientific coordination and the ASTER operative coordination. G.L.V. Prototype partners: Universities (Ferrara, Bologna), Advanced Polymer Materials Lab and ASTER.

G.L.V. Prototype includes 5 steps (from the biomasses collection until the experimentation of commercial polymers synthesis) simulating the Consortium Research Lab functioning.

The expected results of G.L.V. Prototype are:

- the technical and economic validation of Consortium Lab model,
- identification of the higher added value products that can be obtained from a certain waste biomass,
- identification of possible areas of cooperation of existing facilities/services.

5. Needs, Gaps and Bottlenecks to Deploy the Bioeconomy

This chapter describes the main needs of the area to further deploy the bioeconomy in the near future, as perceived by the regional stakeholders and in the revised documents. In particular, the gaps and bottlenecks that hamper the development of research and innovation for specific bioeconomy-related business areas are described.

For the next years, the following **trends** are expected to be observed within E-R bioeconomy sector:

- An enhanced valorisation of agro-food and urban waste,
- Reconversion of industrial areas (chemical pole in Ferrara and Ravenna, within the "chemical quadrilateral") towards a bio-based industry,
- Increased use of forest biomasses,
- Further development of bio-methane and bio-gas supply chains.
- Strengthened linkage between food, health and environment in the agro-food sector. Agro-food research efforts will be likely focused on technological development, food security and traceability, processes sustainability, food preservation techniques and on new possibilities offered by green-chemistry and bioenergy sectors.

The main **challenges** that have to be address in the agro-food sector are:

- overall conversion of the agro-food chain towards sustainability (e.g. responsible use of natural resources, integrated territory management, sustainable productions, etc.),
- improvement of resources use efficiency and lower environmental impact of production,
- closing of productive cycles (through green chemistry and material reuse for constructions, bio-energy or bio-fertilizers production),
- optimize water management along the supply chain (e.g. reduce use of water and reuse water used in food-chain processes, application of filtration and ultrafiltration techniques with biodegradable nanomaterials and anaerobic membrane, etc.)
- promote sustainable agriculture (e.g. biomass management)
- valorise by-products and wastes in the food chain: industrial symbiosis and circular economy, application of enzymatic processes and bioconversion of

by-products, application of green chemistry to food ingredients composition and techniques for the stabilization and conservation.

- use of sustainable processes for the food industry: e.g. cooling chain management,
- production of innovative and sustainable packaging: e.g. smart and environment-friendly materials for packaging.

While the **main obstacle** to a full development of a bioeconomy sector in a long term is mainly related to cultural aspects. It appears necessary to increase the awareness among citizens from the benefits the bioeconomy can generate over time. Public opinion awareness raising should aim also avoiding further opposition of citizens to bioeconomy-related interventions[36] and reduce potential conflicts among traditional and bio-based industries. The development of large scale projects and a better integration of downstream (biomass production) and upstream (processing and commercialization) supply chain processes is also required to strengthen the potential of bio-economy sector in E-R.

[36] In the past biogas production has been perceived to be linked to landfills and dangerous wastes disposal issues, for example.

6. Information Sources

Literature and Documents:

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- Conferenza delle Regioni e delle Province Autonome (2016), "Documento delle Regioni e delle Province Autonome di posizionamento sulla bioeconomia in attuazione della Strategia Nazionale di Specializzazione Intelligente (SNSI)", 16/129/CR08a/C11.
- ASTER (2016) "Le reti dell'innovazione – Le reti della chimica verde e dell'innovazione in Emilia-Romagna", Ecoscienza N.4, 2016. Authors: Picone S., Sani D., Ausiello F. P..

Relevant websites:

- S3 Smart Specialization Strategy Emilia-Romagna 2014-2020
  http://www.regione.emilia-romagna.it/s3
- Consortium ASTER
  http://www.aster.it
- Bologna University
  http://www.irt.unibo.it/en/alma-food/bioeconomy-unibo
- Regional High Technology Network (HTN)
  http://www.retealtatecnologia.it

- Green Lab Valley
  http://www.aster.it/green-lab-valley
- Bio-based Industries Consortium news
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- PLASTICE project
  http://www.plastice.org/home/
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  http://www.energia-ambiente.unibo.it/attivita-di-ricerca/biorefer
- Bio-on
  http://www.bio-on.it/index.php
- Italian national agri-food cluster "CLAN"
  http://www.clusteragrifood.it/it/
- Italian national cluster on green chemistry "SPRING"
  http://www.clusterspring.it
- Italian national cluster on Life Sciences "ALISEI"
  http://www.clusteralisei.it
- FIRST service website (Financing for Innovation, Research and Technological development)
  http://first.aster.it/_aster_/home
- Contacts details of networks and associations related to bioeconomy
  http://www.aster.it/chi-siamo/reti-e-associazioni
- Bioeconomy blog
  https://ilbioeconomista.com

Interviews and Contact details:

Name	Position	Institution/ Organisation	Phone	Email	Interview Date
Silvano Bertini	Responsible of OT1 of ERFD ROP 2014-2020	Regione Emilia-Romagna	+39 051 5276426	sviluppoeconomico@regione.emilia-romagna.it	No interview
Francesco Paolo Ausiello	ASTER and GLV referent	ASTER		francescopaolo.ausiello@aster.it	No interview
Daniela SANI	ASTER and SPRING	ASTER/Cluster SPRING	+39 051	daniela.sani@aster.it	17/11/2016

	referent		63981 48		
Patrizio Bianchi	Alderman	Department for the coordination of European policies for development, education, professional training, universities, research and business (E-R Region)	+39 051 52 73029	lavoroform @regione.emilia-romagna.it	No interview