



I4-GREEN

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**D2.1 – SME and ecosystem
engagement report**

D2.1

31/01/2023

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Entity

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1. INTRODUCTION

I4-GREEN ecosystem has already detected “anchors” belonging to the green processing tech and mining, allowing for a “wide net” to be cast across the EU regions covered by the project. I4-GREEN targets come from the refined tech and application scope, so it is intended to attract top SME performers to join to the project innovation upscale call and its Ecosystem.

The steps that will be needed (T2.1) for the creation of the ecosystem are the following ones (Figure 1).

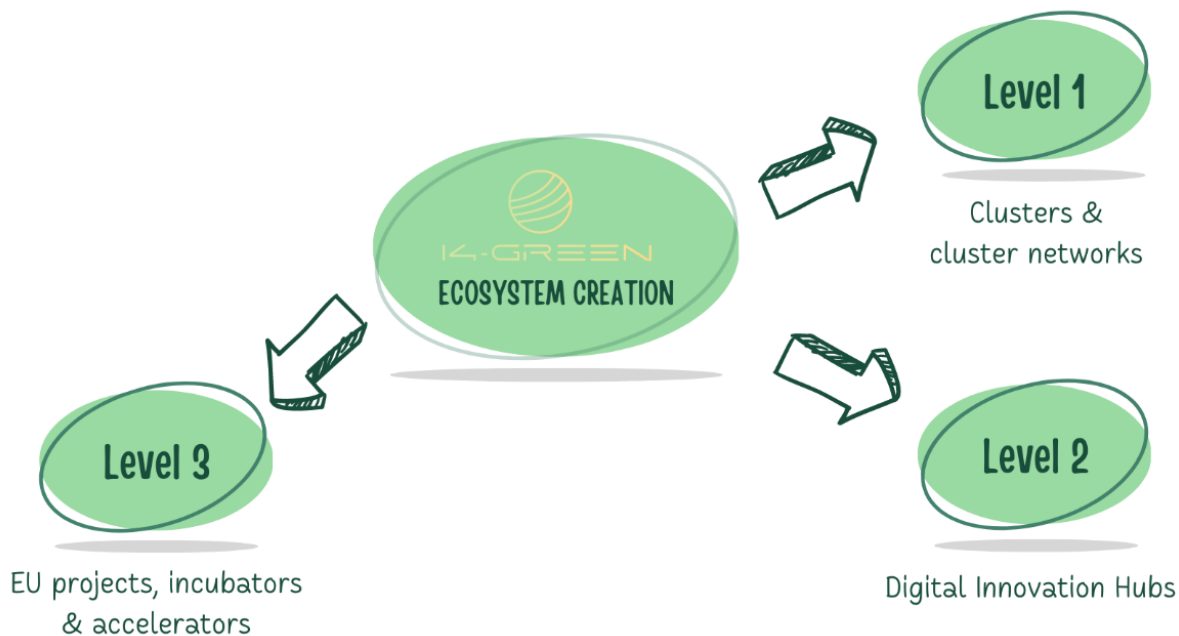


FIGURE 1 - LEVELS OF I4-GREEN ECOSYSTEM CREATION

1) Leveraging clusters and cluster networks, considering:

- Members of Networks such as cluster driven ICEI Alliance (on industrial circular economy investment), ERMA, EIT, TSSP, ECCP, and multiple other EU networks who will diffuse our call and promotional material;
- Existence of historical agreements with cluster partners who will play the role of magnifiers to reach SME champions. They will be asked to share promotional materials through newsletters, social media, etc. Role of ISMC, ACPMR and the Governments of Castilla y León, Andalusia and Extremadura will be pivotal here.

2) Leveraging EU projects and Digital Innovation Hubs (DIH):

We coordinate communication and on-boarding efforts with other relevant projects we are directly involved in (e.g., INNOSUP) as well as nodes from DIHs that will be established thanks to the direct participation of regional Governments in I4-GREEN, starting with those in which I4-GREEN partners such as ISMC, ACPMR, ICAMCYL (i.e., MINE.THE.GAP, Digital Innovation Hub in Castilla y Leon region, etc.).

3) Detection and contact of relevant projects, accelerators, incubators, etc.

Figure 2 shows some of the background consolidated initiatives and projects supporting I4-GREEN.

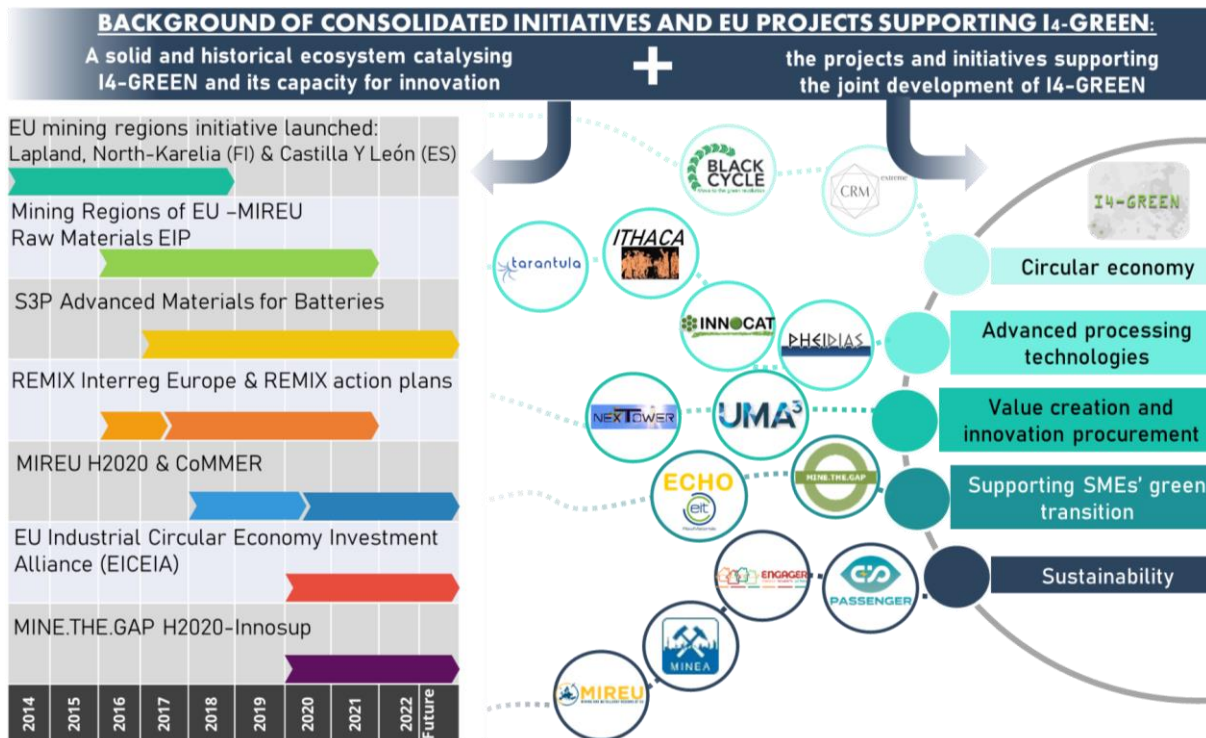


FIGURE 2 - BACKGROUND OF CONSOLIDATED INITIATIVES AND EU PROJECTS SUPPORTING I4-GREEN

This deliverable is related to SME Engagement and Interregional Industrial Ecosystem creation and, as a result, D2.1 is intended to include the identification of the different contexts in the regions targeted in I4-GREEN for the creation of the interregional ecosystem that will be built and where SMEs will be engaged. The following sections will serve to establish the analysis of the green processing tech and mining SMEs conforming the regions covered by the project: Castilla y León, Andalusia and Extremadura in Spain and Alentejo in Portugal.

2. I4-GREEN TARGET REGIONS ANALYSIS

I4-GREEN is constructing a EU interregional lighthouse that will benefit and boost the recovery of the underdeveloped regions of Alentejo (with ACPMR as nexus), Andalusia, Extremadura and the region of Castilla y Leon (a region in transition, immersed in the Just Transition, ICAMCyL, ISMC) (Figure 2).

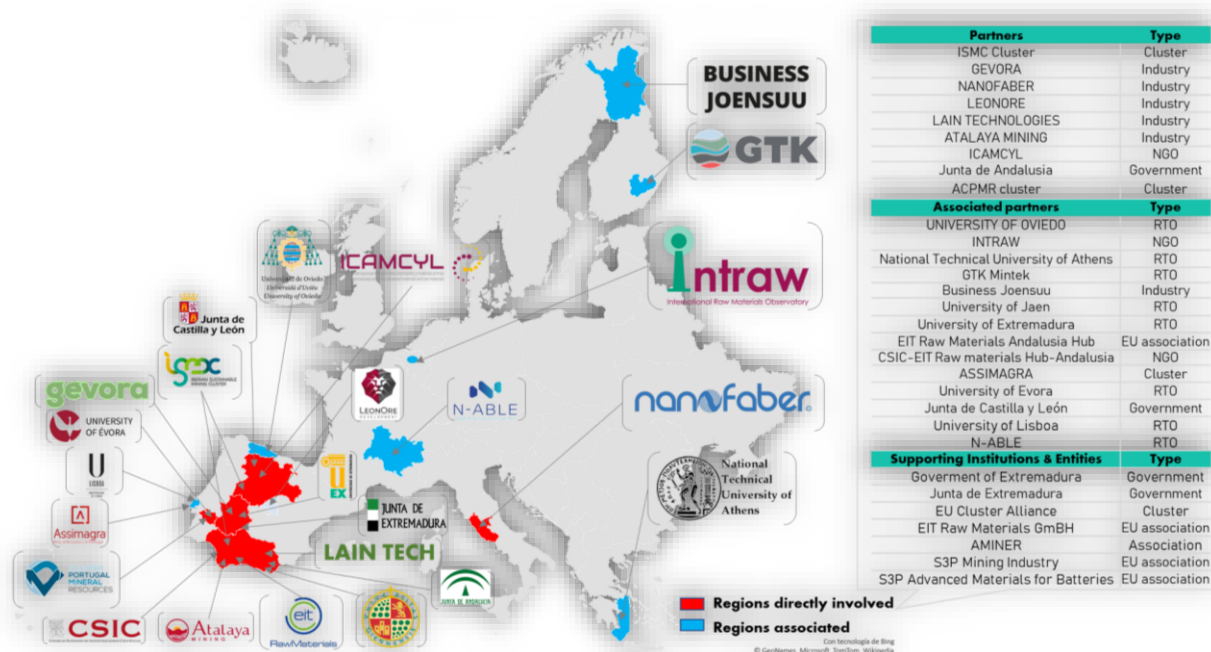


FIGURE 3 - I4-GREEN INVOLVED REGIONS AND QUADRUPLE HELIX ECOSYSTEM

The following subsections depict the characteristics and context of the regions mentioned for the detection of similarities and characteristics that will lead to construct the I4-GREEN ecosystem. An interregional system that will grow organically with investors, tech partners, regional governments (which bring their own resources to I4-GREEN), and other enablers ready to align regional investments to improve green mining.

2.1. I4-GREEN REGION 1: ALENTEJO (PORTUGAL)

2.1.1. ALENTEJO CHARACTERISATION: ECONOMICS, COMPANIES AND INVESTMENTS

Portugal is divided into 7 NUTS2 that are equivalent to "regions" - North; Center; Lisbon Metropolitan Area; Alentejo; Algarve, Autonomous Region of Azores and Autonomous Region of Madeira. Alentejo, Center and North Regions are the largest territorial areas in the Portuguese country. North, Center and Lisbon Regions concentrated about 84% of the Portuguese population in 2014. The national GDP per capita (in ppp) corresponded to 79% of the EU28 average. By region, only the Lisbon Metropolitan Area (110%) exceeded the European average, while in the Center region reached 68%. (Table 1).

TABLE 1- POPULATION AND GDP IN PORTUGAL. SOURCE: INE PT¹

Regions NUTS2	Active population	Total population	GDP	GDP per capita	
(2013)	Thousands	Thousands	Million€	Million€	UE28=100
Portugal	5 226	10 375	171 211	16,4	79
Norte	1 834	3 622	48 668	13,3	64
Centro	1 170	2 264	32 123	14,0	68
Área Metropolitana de Lisboa	1 383	2 809	63 902	22,7	110
Alentejo	358	733	11 275	15,1	73
Algarve	227	441	7 310	16,5	79
RA Azores	122	246	3 694	14,9	72
RA Madeira	131	259	4 071	15,5	75

Non-financial companies (which represent close to 98% of the Portuguese business industry and 90% of the GVA) suffered a decrease of their main economic indicators in the period 2010-2013, with the number of companies went down at an annual average of 1.4 % annual in the period, Business Volume 3.1% and GVA 4.9% (Table 2).

TABLE 2- COMPANIES AND INVESTMENT DATA IN PORTUGAL. SOURCE: INE² PT

Regions NUTS2	Companies	Labour Productivity	Investment rate	Exports of goods		Imports of goods	
(2013)	Thousands	Thousand€/person	%	Thousand€	%	Thousand€	%
Portugal	1 097	21,71	15,81	48 177 135	100,0	58 853 826	100,0
Norte	374	18,20	14,66	18 255 781	37,9	12 838 399	21,8
Centro	239	18,16	16,28	9 235 728	19,2	7 358 071	12,5
Área Metropolitana de Lisboa	305	28,96	15,12	15 475 020	32,1	31 932 608	54,3
Alentejo	76	17,85	28,43	2 880 826	6,0	2 210 679	3,8
Algarve	55	13,10	16,27	145 397	0,3	214 874	0,4
RA Azores	25	17,38	19,27	101 962	0,2	132 127	0,2
RA Madeira	23	18,67	13,14	123 796	0,3	120 950	0,2

Alentejo is currently an uncongested, preserved and safe territory, with a history marked by the rich heritage and culture that give it identity and a potential force for competitiveness, differentiating the region based on consolidated activities and the emergence of new niches of productive and smart specialisation; amongst others, Alentejo has products of world-renowned excellence like cork, wine and olive oil and dimension stones and metallic minerals. The development of accessibility and connectivity infrastructure reinforces the importance of the Alentejo's geoeconomic positioning in the context of national and international economic relations and constitutes an important factor in attracting investment and hosting businesses. Taking advantage of its geographical position, the significant improvement in national and international accessibility and the dynamics of economic integration in the European and world space, Alentejo is a region that is functionally more open to the

¹ Instituto Nacional de Estatística - Região Alentejo em números : 2013. Available at https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_publicacoes&PUBLICACOESpub_boui=139483&PUBLICACOESmodo=

outside world and with objective conditions to intensify economic relations and reinforce its insertion in markets with greater territorial amplitude.

Alentejo asserts itself as a sustainable territory with a strong regional identity, supported by a polycentric urban system, guaranteeing adequate levels of territorial cohesion and affirming a reinforced integration with other national and international spaces. Territorial sustainability is based on valuing endogenous resources, namely natural and landscape values, and on developing increased levels of strategic coordination and functional cooperation.

The development of the Sines port platform, consolidating the Iberian and European vocation, based on its privileged geostrategic position in relation to the crossing of major world maritime transport routes, is an important factor for the international affirmation of the region and the country, jointly with Beja Airport represents an international connectivity and logistical platform, logistical support and inducer of new economic activities, namely in the aeronautics area, taking into account the characteristics of this airport infrastructure and its positioning in the international affirmation of Alentejo.

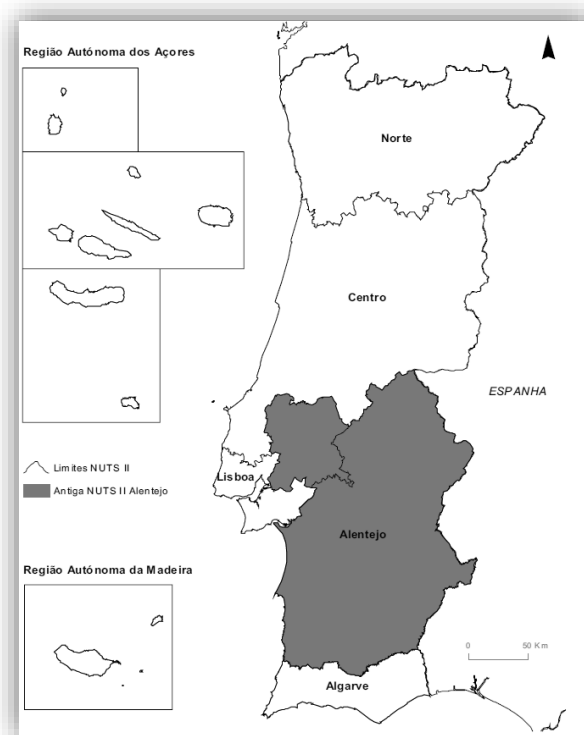


FIGURE 4 - ALENTEJO REGION IN PORTUGAL, NUTS2. SOURCE: INE PT³

2.1.2. RIS 3 STRATEGY ALENTEJO 2030: STRUCTURAL OBJECTIVES AND LINES OF ACTION⁴

The 3 lines of action in Alentejo RIS3 linked to I4-GREEN engagement are the following ones.

a) INCREASE SUSTAINABILITY AND TERRITORIAL COHESION. It includes:

- Development of R&D with a view to improving indicators linked to biodiversity and regional assets, as well as the sustainable enhancement of key production systems in the region such as the Extractive

³ Instituto Nacional de Estatística - Região Alentejo em números : 2013. Available at https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_publicacoes&PUBLICACOESpub_boui=139483&PUBLICACOESmodo=2

⁴ ESTRATÉGIA REGIONAL DE ESPECIALIZAÇÃO INTELIGENTE EREI2030. RIS3 ALENTEJO. CCDRA, 2020

Industry, the Ecosystem of the Mediterranean Forest, the Irrigation Systems and the Sea and Freshwater Ecosystems Incorporation of R&TD in the economy that impacts on the energy transition (decarbonization) and on the transition from linear models to circular models (efficient use of soil and water resources, reinforcement of the use of materials secondary and waste reduction).

- Attractiveness of Alentejo based on its heritage elements and amenities provided by ecosystems, with a view to environmental citizenship and a high quality of life (economic, environmental and social).

b) REINFORCE THE VALUE OF REGIONAL PRODUCTION CHAINS: Incorporation of R&D in production chains that impact on “chain failures”, thus creating more efficient processes “complete” (from extraction to commercialization) and with greater added value for the region Increased anchor and spill-over effects on structural projects in the region, reinforcing their interrelationship with the set of regional production chains and/or creating new business opportunities Incorporation of R&TD in the regional economy that positively impact components such as valuation of products and services, on internationalization and on the weighted evolution of product sales high tech

c) INCREASE THE QUALIFICATION OF REGIONAL HUMAN RESOURCES (TALENT). It covers:

- Regional investment in RDI actions that allow, based on strengthening the link between the Institutions of Higher Education, technology enhancement and transfer centers, companies and institutions, construction of applied/applied knowledge/solutions and the creation of open digital and creative ecosystems, which are conducive to attracting talent and creating qualified jobs Regional investment in R&D and training/qualification/digital literacy (lifelong) that are capable of produce positive effects on dynamics such as the evolution of qualifications at regional level, the reduction of inequalities access to employment, the evolution of patent registration, the evolution of applied innovation production and the evolution of business investment in highly qualified human resources.

- Development and prototyping of Experimental Public Policies and R&D solutions that, based on the characteristics distinctive features of the region, are capable of generating high technology products, goods and services within the scope of different regional domains (transversal and specialisation).

2.1.3. ALENTEJO SMEs: CHARACTERISATION OF THE MINING SECTOR

According to the General Directorate of Energy and Geology, mines, quarries, mineral & spring waters and main target industries represent a Gross Value Added of 5000M€, accounting for 2.3% of Portugal GDP. The sector employs 200.000 workers, a of the Portuguese labour population. 1.000M€/year are produced in mines, quarries and mineral and spring waters, while 6.000M€/year are produced and exported from geological resources in the main target industries⁵.

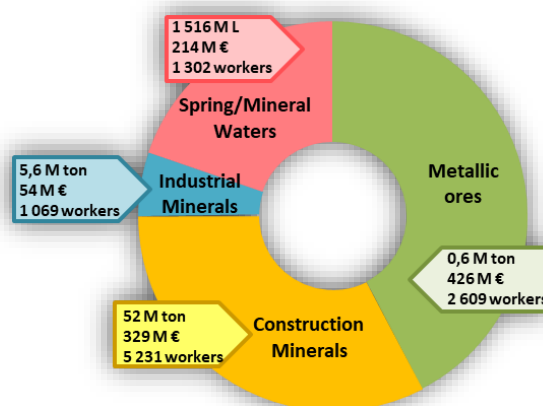


FIGURE 5- NATIONAL PRODUCTION OF THE PORTUGUESE MINING SECTOR

⁵ Portugal Geological Resources: A glance at the sector, DGEG. <https://www.dgeg.gov.pt/>

The Iberian Pyrite Belt (IPB), the world's largest occurrence of volcanogenic massive sulphides, containing more than 2500 Mt of massive sulphides extends for more than 250 km, in a band 20 to 70 km thick, between southwestern Portugal (Alentejo region) and Spain (Extremadura region) (Figure 6). Resulting in the largest and best-known massive sulphide occurrences in the world, such as Rio Tinto (Spain) and Neves Corvo (Portugal), characterized for being a massive polymetallic sulphide deposits, disseminated polymetallic deposits (Fe, Cu, Mn, Pb, Co, Ag, Au) and stockwork type deposits (Cu, Fe, Zn, Ag, Au)⁶.

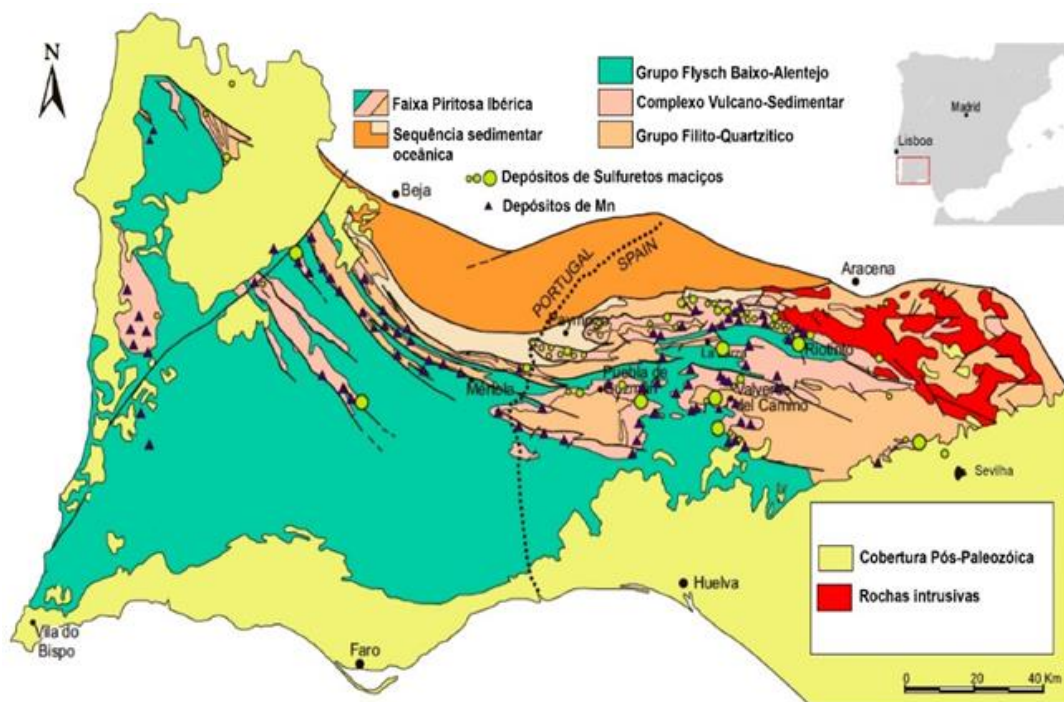


FIGURE 6 - SIMPLIFIED GEOLOGICAL MAP WITH GEOGRAPHICAL LOCATION OF THE IBERIAN PYRITIC BELT⁷

This geological occurrence results in one of the most important metallogenic provinces in the world, constituting the core of the European Region Alentejo–Algarve–Andalusia. In this territory geological continuity favoured economic and social development throughout its history and culture, focused on the exploitation of its metallic resources. This factor favoured a demography and economy strongly dependent on the extractive sector, which is the region's unifying element.

However, the Alentejo region mining industry is not only focused in the metallic minerals sector, but also dimension stone and industrial minerals and rocks extraction and transformation with an extensive mineralogical occurrence portfolio (Figure 7).

⁶ Rona, P. A., 1984. Hydrothermal mineralization at seafloor spreading centers. *Earth-Science Reviews*, 20(1), 1-104.

⁷ Almodóvar, G. R., Yesares, L., Sáez, R., Toscano, M., González, F., & Pons, J. M., 2019. Massive Sulfide Ores in the Iberian Pyrite Belt: Mineralogical and Textural Evolution. *Minerals*, 9(11), 653.

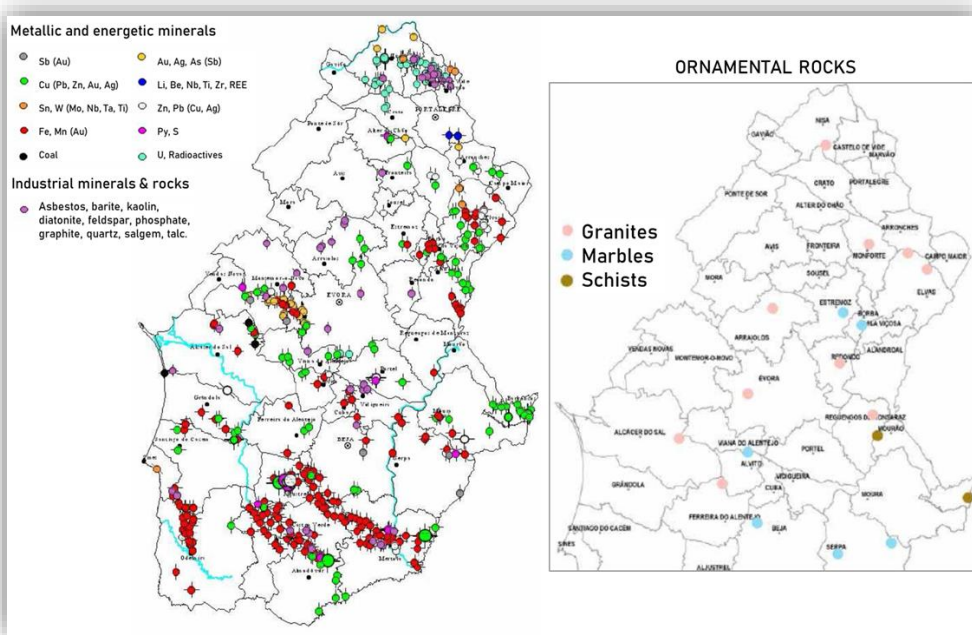


FIGURE 7 – MINERALS AND ORNAMENTAL ROCKS OCCURRENCE IN ALENTEJO. SOURCE: LNEG⁸

The Portuguese General Directorate of Energy and Geology published by September 2022 the annual statistics in the production of metallic minerals in Alentejo, showing that the produced value in million euros is under constant increase, accounting for 646.440 tons of non-ferrous metallic minerals (1.292.880 tons in total of material produced) and an equivalent of 547.620.000€ value (1.095.239.000€ in total of material produced) (Figure 8).

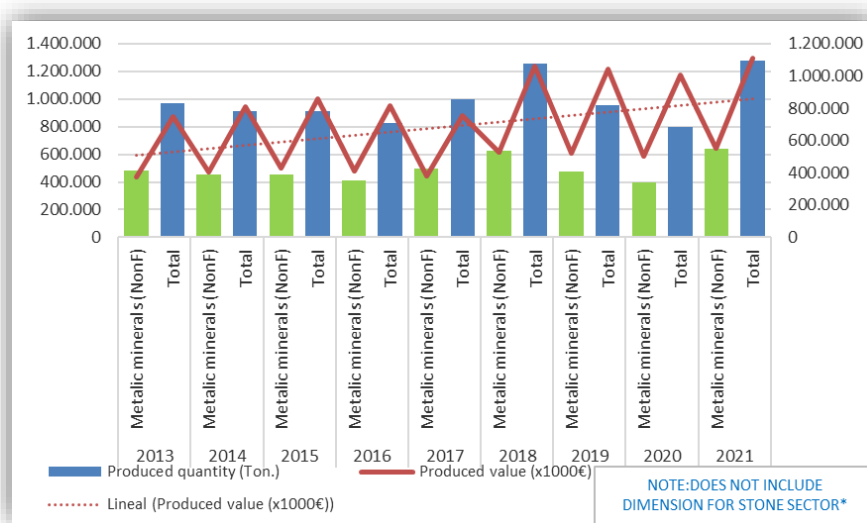


FIGURE 8- PRODUCTION OF NON-FERROUS METALLIC MINERALS IN ALENTEJO. SOURCE: DGEG PT⁹

⁸ Mineral resources in the region of alentejo. potential and Spatial Planning. Afonso Catrapone and Jorge Carvalho. CCDR Alentejo

⁹ DGEG - DSEF-RG Geological Resources Statistics: Mines - Production by districts in 2021.

It is important to mention the **Marbles Zone**: The 'Zone of Alentejo marbles' corresponds to the largest productive area and the most important deposit of marbles of the Portuguese country, known as 'Anticlinal de Estremoz' (Figure 9). In this area are located the main national producers of ornamental marble in Portugal, where there are traces of its exploitation since the roman period.

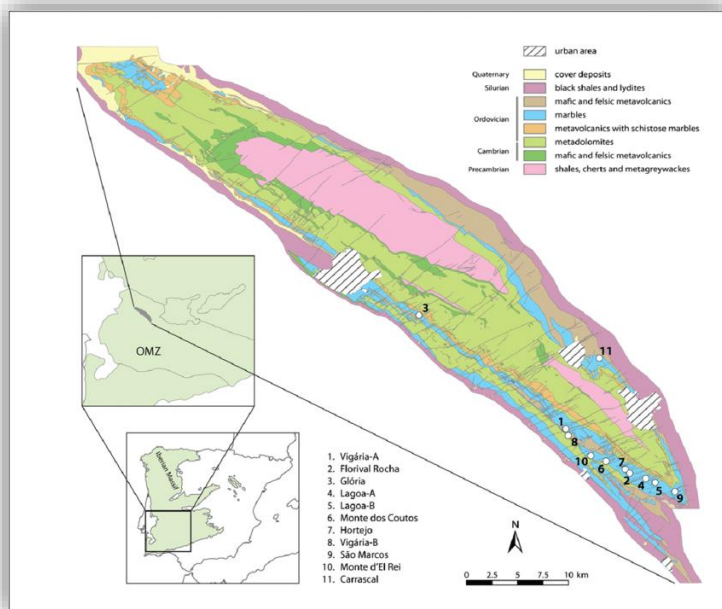


FIGURE 9 - GEOLOGICAL MAP OF THE ANTICLINAL OF ESTREMOZ, SCALE 1: 25.000¹⁰

This well-known extractive region of Portuguese territory, there is an intense marble extraction activity for purposes ornamental plants, the result of the existence of the largest and most important marble quarry in the country. The high economic growth and value of marble in this region led to the definition of a captive area destined to the exploration of this specific area. In 2018, there were 53 companies from the Extractive Industries in Central Alentejo. According to the Bank of Portugal, the weight of Central Alentejo in terms of the number of companies was 35.5% of the total. In 2017, the 43 extraction companies in the marble sector from Central Alentejo generated a Gross Production Value of €17.1 million and a total of Service Provisions of 1.8 million Euros. This GPV represented 97.6% of the total Amount of Production of the 'Extractive Industries' and 99.6% of the VBP of Service Provisions¹¹.

Moreover, the production of waste represents one of the main constraints of the dimension stone industry, both in its extractive and transforming component. Currently, in the captive area of the Zona dos Mármore (Marbles Zone) are found in 290 dumps, which occupy a total area of 325 ha and make up a volume around 28 million cubic meters of passive material, which constitutes one of the most relevant economic and environmental problems in the natural stone, since its transportation and storage severely burdens the costs of production and its unplanned deposition a strong impact mainly of a landscape nature, causing severe constraints on the activity production (in terms of accessibility to fronts extraction, high handling costs, the degradation of the quality of the rock mass by fracturing due to the weight of dumps, among other factors), in some cases affecting it in a irremediable, with increased risk and insecurity, contributing to the degradation of the image of the sector¹² (Figure 10).

¹⁰ Moreira, J., & Vintém, C. (1997). Carta Geológica do Anticlinal de Estremoz, escala 1: 25.000: Dept. Prospeção de Rochas e Minerais Não Metálicos, Instituto Geológico e Mineiro, Lisboa.

¹¹ Fase I - Plano de Desenvolvimento Estratégico para a 'Zona dos Mármore Alentejanos, ACPMR, ASSIMAGRA, UNOVA.

¹² FASE II: Caracterização das escombrelas no quadro da Indústria Extrativa da Zona dos mármore, ACPMR, ASSIMAGRA.

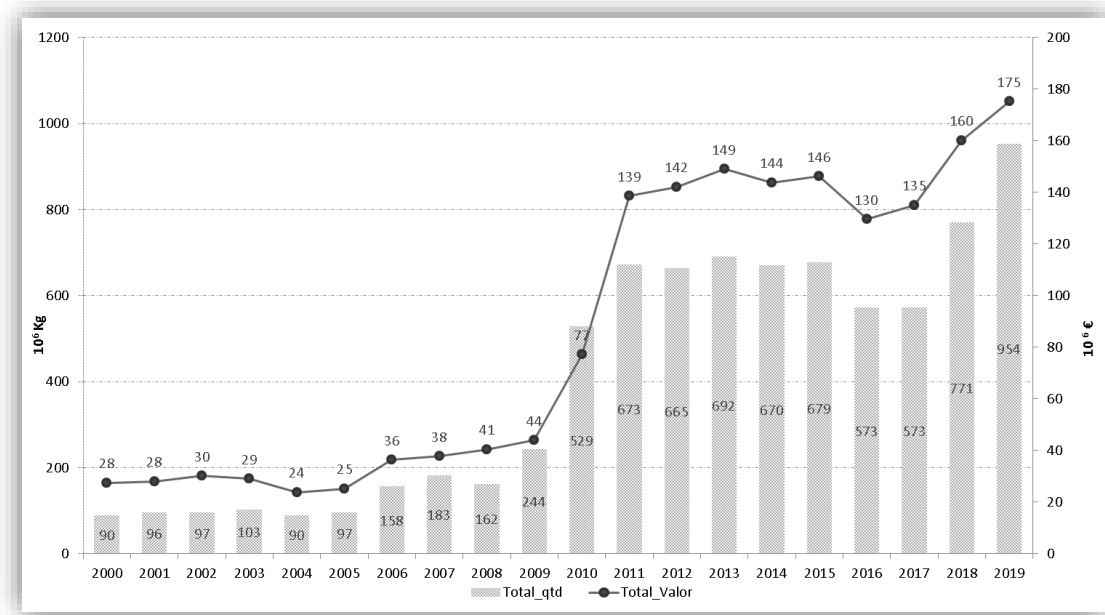


FIGURE 10 - VALUE AND QUANTITY OF MARBLE EXPORTED FROM PORTUGAL RESOURCES. SOURCE: ACRPMR⁷.

2.2. I4-GREEN REGION 2: ANDALUSIA (SPAIN)

2.2.1. ANDALUSIA CHARACTERISATION: ECONOMICS, COMPANIES AND INVESTMENTS

Andalusia, with an area of 87,599 km², is one of the largest Communities in Spain and between the top 10 regions (NUTS2) with the largest number of inhabitants accounted for 16,5% of the EU's population. It counts with population of near 9 million inhabitants, which implies it is the first Spanish Community in terms of population. With a population density of 97 inhabitants per km², is in the average of the population density of the country.

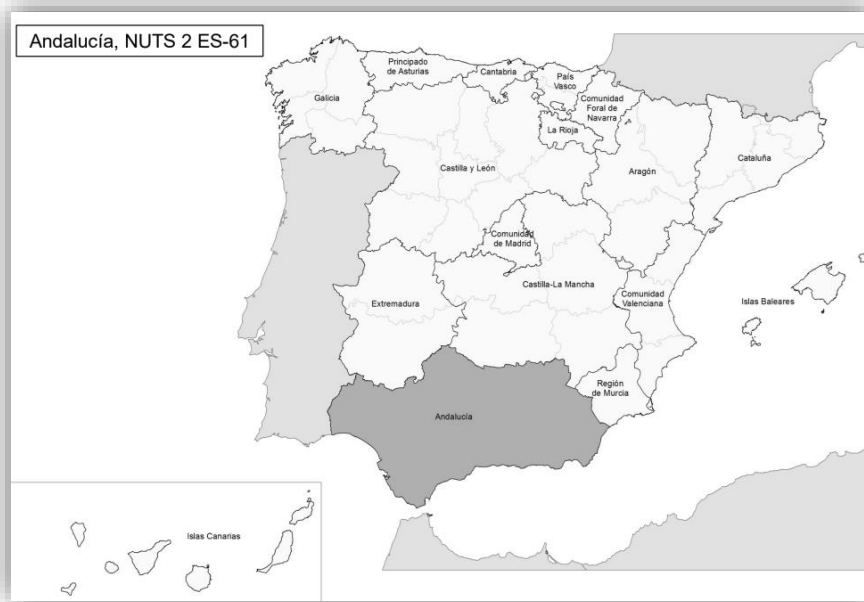


FIGURE 11 - ANDALUSIA REGION IN SPAIN, NUTS2.

Andalusia counts with 19% of unemployment rate applicable to the active population, a higher rate than the national one. Andalusia GDP is 160.747M€, the 3rd economy in Spain by volume of GDP. Regarding GDP per capita, which is a good indicator of quality of life, in Andalusia in 2021, it was €18,906 euros, compared to €27,910 euros of GDP per capita in Spain. It is in 19th place with respect to the total number of Autonomous Communities, which indicates that its inhabitants have a low standard of living compared to the average of Spain.

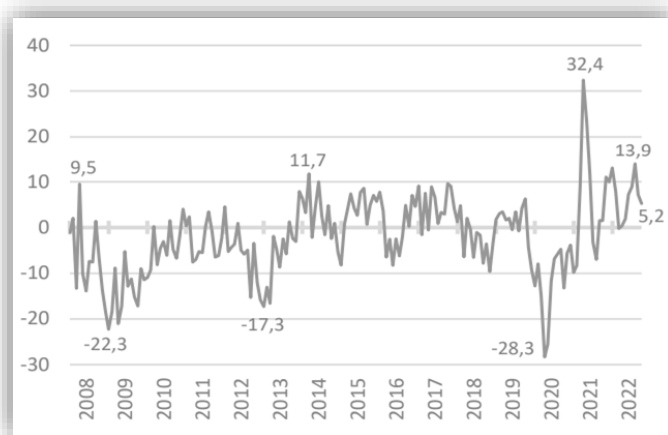


FIGURE 12 - ANDALUSIA INDUSTRIAL PRODUCTION INDEX. SOURCE: IECA¹³

In 2021 Andalusian public debt was up to 38 million euros, approximately 23% of its GDP and its per capita debt was 4,377€ euros per inhabitant. GDP values and imports-exports show a well-developed economy (Table 3).

TABLE 3 - GROSS DOMESTIC PRODUCT PRICES AND AGGREGATE DEMAND IN ANDALUSIA. SOURCE: JUNTA DE ANDALUSIA

	Final consumption expenditure	Gross capital creation	Regional demand	Exports	Imports	External demand	GDP
<i>Million euros</i>							
2006	121.533	40.943	162.476	46.496	66.022	-19.526	142.950
2007	131.382	42.905	174.287	49.254	70.332	-21.079	153.208
2008	137.964	40.433	178.397	51.464	73.188	-21.724	156.673
2009	135.205	32.184	167.389	45.907	64.114	-18.207	149.182
2010	137.770	30.153	167.923	50.735	69.031	-18.296	149.627
2011	137.198	26.922	164.120	56.447	72.594	-16.147	147.973
2012	133.145	23.070	156.215	58.618	71.273	-12.655	143.560
2013	130.455	21.170	151.625	58.999	68.820	-9.821	141.804
2014	132.127	21.564	153.691	60.115	70.432	-10.317	143.374
2015	135.100	23.736	158.836	60.371	68.850	-8.479	150.357
2016	138.596	23.563	162.159	63.910	71.607	-7.698	154.461
2017	144.677	25.370	170.048	70.168	77.491	-7.323	162.724
2018	148.996	28.467	177.463	72.965	82.161	-9.196	168.267
2019	150.440	30.706	181.146	74.313	82.429	-8.116	173.030
2020	138.721	27.710	166.431	56.425	66.900	-10.475	155.956
2021	152.297	29.177	181.474	67.532	78.251	-10.718	170.756
2019 III	37.891	7.685	45.577	18.218	20.545	-2.328	43.249
IV	38.093	7.923	46.015	18.683	21.037	-2.354	43.662
2020 I	36.746	7.329	44.076	16.702	19.079	-2.378	41.698
II	30.996	6.057	37.053	11.283	14.031	-2.748	34.305
III	35.184	7.219	42.403	13.991	16.668	-2.677	39.726
IV	35.794	7.105	42.899	14.450	17.122	-2.672	40.227
2021 I	36.996	6.718	43.714	14.210	17.360	-3.150	40.564
II	37.420	7.106	44.527	15.204	18.132	-2.927	41.599
III	38.193	7.227	45.420	18.266	20.559	-2.293	43.127
IV	39.687	8.126	47.813	19.852	22.199	-2.348	45.466
2022 I	40.551	8.005	48.556	20.638	23.450	-2.812	45.744
II	40.560	8.201	48.761	21.842	24.141	-2.299	46.461
III	41.478	8.078	49.555	23.294	25.605	-2.311	47.244

¹³ Boletín Mensual de Indicadores Económicos. Junta de Andalucía, Secretaría General de Economía, 2022.

Investments in Andalusia¹⁴ offer a series of advantages to multinational companies, which are based on (Figure 13):

- Strategic geographical location between Europe and Africa and a bridge between the Atlantic Ocean and the Mediterranean sea, being also a gateway to Latin America and the main route of maritime connection of the Mediterranean with Asia.
- Existence of five international airports, high-speed rail network, extensive network of roads and highways and 10 commercial ports in the region, including Algeciras, the main port of Mediterranean containers.
- Network of parks and technological centers specialised in RDI activities, accounting with 1.500 innovative companies located in these technological spaces, which generate more than 50.000 jobs and a turnover of more than 6.700M€/year per year.
- Combination of highly skilled workers with competitive labour costs.
- Free zones with tax advantages for the establishment of new companies and available for the exports.
- High intensity in subsidies, access to financing and other tax incentives.
- A good quality of life that makes an ideal destination for professionals.



FIGURE 13 – KEY FIGURES FOR INVESTMENT IN ANDALUSIA

The diversification of the Andalusian economy, with a large number of consolidated and emerging industrial sectors, offers numerous advantages and development opportunities for foreign companies and multinationals.

The relief is one of the main factors that configures the natural Andalusian environment. The mountainous alignments and their layout have a special impact on the configuration of the climate, the fluvial network, the soils and their erosion, the bioclimatic floors and will even have an influence on the way natural resources are used. Andalusia has a large number of natural spaces and ecosystems of great singularity and environmental value. Their importance and the need to make the conservation

¹⁴ For a sure win, invest in Andalusia. Junta de Andalucía, Regional Ministry of Economy, Knowledge, Enterprise and University, 2021.

of its values and its economic use compatible, have promoted the protection and management of the most representative landscapes and ecosystems of the Andalusian territory ¹⁵.

The link between mining and international trade is a constant from the very beginning of Andalusia history. However, the effective consolidation of a world-scale market was only be achieved in the XIX century, when the industrial revolution developed in the European countries acting as a trigger of the exploitation of the regional subsoil to obtain raw materials (especially metallic ones such as iron, copper, lead, etc), destined for those countries.

2.2.2. RIS 3 STRATEGY ANDALUSIA 2020: FINAL OBJECTIVES AND LINES OF ACTION¹⁶

In order for Andalusia to respond after 2020 on the RIS3 Strategy it is essential that the weaknesses suffered by the region are overcome, based on a strategy that, supported by the forces at its disposal, takes advantage of existing opportunities and combats the threats that can frustrate progress towards a more intelligent, sustainable and inclusive region. The Innovation Strategy of Andalusia 2020 is positioned as the fundamental tool to ensure that the region advances towards a new productive model based on innovation that generates quality employment and increases the productivity of the region, thus accelerating the process of rapprochement of Andalusia. to average EU levels in income per person and quality of life.

For the application of the Innovation Strategy of Andalusia, 8 specialisation priorities were selected, which come from the specialisation opportunities identified in the entrepreneurial discovery workshops and are the best option to transform the current economic model into a model based on knowledge and innovation (Figure 14).

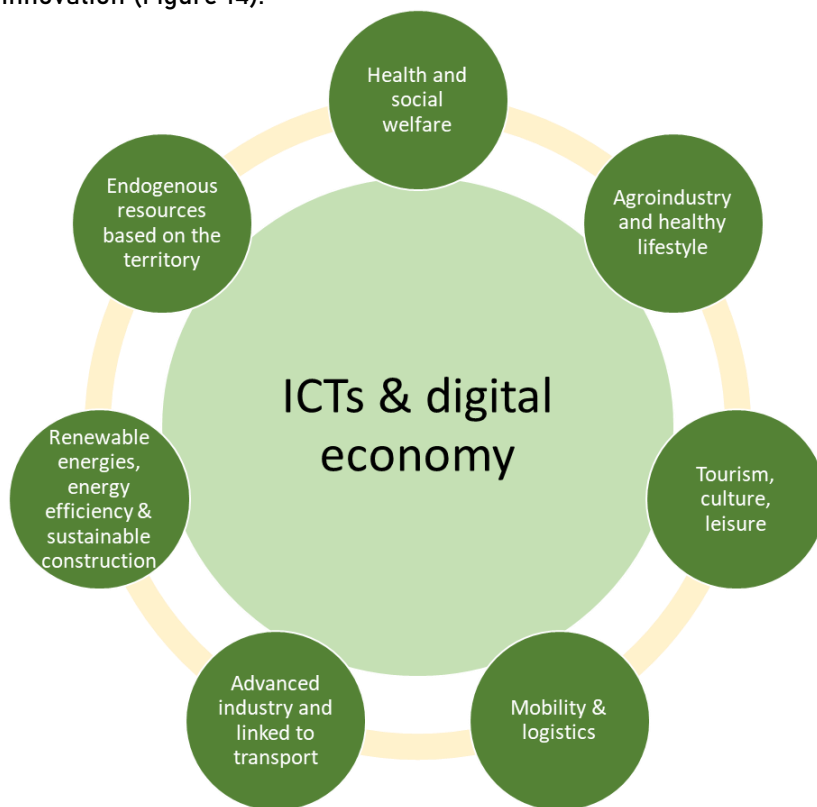


FIGURE 14 - RIS3 ANDALUSIA SPECIALISATION PRIORITIES

¹⁵ Las grandes unidades del relieve andaluz. Geografía de Andalucía, López Antonio. ISBN 84-344-3476-8.

¹⁶ ESTRATEGIA DE INNOVACIÓN DE ANDALUCÍA 2020. RIS3 ANDALUCÍA. Junta de Andalucía, 2015

Considering only the “Endogenous resources based on the territory” priority, Andalusia set the following lines of action, linked to I4-GREEN:

a) RESEARCH AND INNOVATION ON THE MANAGEMENT OF NATURAL RESOURCES AND CULTURAL HERITAGE: The region treasures a very valuable natural environment, with complex ecosystems and unique landscapes. These varied and complex conditions of the Andalusian ecosystems, derived from their geoposition, open up great prospects if the current productive and territorial model can be redirected towards a new model with greater use and conservation of territorial capital and with a greater participation of renewable processes. Andalusia is the European region with the largest number of spaces and the highest percentage of protected area and has in-depth knowledge in the management of these ecosystems, thanks to which it has developed its own management models that can be considered international benchmarks.

b) NEW PROCESSES AND PRODUCTS FOR THE USE OF AGRICULTURAL RESOURCES: The importance of a good use of the existing territorial resources in a model of balanced and sustainable use, must focus a good part of its efforts on introducing innovations in the current predominant model. The search for higher levels of adaptation and sufficiency in agricultural production presents an opportunity in relation to livestock residues: the real balances of surpluses in closed systems, the technologies to apply to agriculture with the minimum cost and with the maximum fertilising capacity, and the treatment strategies where to place the technology to make it economically viable.

c) INTEGRATE MINING IN THE TERRITORY: The important Andalusian geodiversity treasures a great variety of deposits of mineral raw materials and has been the support of the global relevance of this activity in practically all periods of its history. Metal mining is re-emerging in Andalusia driven by the increase in demand for metals in the world market and by better mining and territorial planning and by the application of innovative techniques. Thus, the new innovative extractive techniques have shown that it is possible to develop extractive activities while guaranteeing the protection of nature, so once again mining is a real engine for employment and development in our region. In this sense, the evolution of the technologies available for extraction and transformation is allowing the enhancement of resources that were previously not economically profitable, such as new materials, the use of tailings or mining tourism, industrial archaeology and the industry, which allow generating greater added value in Andalusia and minimizing the environmental liabilities of old farms, giving them new uses. One of the great opportunities offered by this new stage of mining is the recovery of areas degraded by mining, spills, etc.

d) INNOVATION FOR THE ADAPTATION OF TERRITORIES TO CLIMATE CHANGE: Climate change is the scenario that conditions all land management, especially in risk management. The adaptation to the new and rigorous conditions of the changing climate in Andalusia is a requirement for the maintenance of production capacity and well-being. The line of action will promote research in adapting to the new conditions of agricultural production, in maintaining climatic comfort conditions for residents and visitors, and in continuing the notable advances experienced in different areas in the field of mitigation of risks associated with climate change and desertification:

e) MAINTENANCE OF THE SUSTAINED FLOW OF ECOSYSTEM SERVICES. The services provided by the different ecosystems have been the subject of multiple research initiatives in Andalusia. The ultimate objective of this line of action is to help maintain the availability of ecoservices used by different sectors and social groups, and the ways and conditions in which society can use these ecoservices. For this, it is crucial to have a powerful information system that allows the identification of the necessary thresholds to respect the biophysical limit of functioning of the ecosystems that generate them.

2.2.3. ANDALUSIA SMEs: CHARACTERISATION OF THE MINING SECTOR

In relation to the mining sector in Andalusia, metal mining is gaining presence in the Andalusian socioeconomic context as an activity capable of generating wealth and employment. The evolution of available technologies and the rise in prices that have occurred in international markets are allowing access to and enhancement of important natural resources that have always been in the subsoil of the

Andalusian community and that constitute essential raw materials for development, for industry, for transport, for health and ultimately for people's quality of life and well-being.

Andalusia has the largest European reserve of non-ferrous minerals, emphasising aggregates, ornamental rock, industrial mining, mining energy and metallic mining with a total production of 41 million tons in 2021. There are currently 5 active metallic ore mines producing 15M tons of ore treated: Riotinto, Cobre Las Cruces, Aguas Teñidas Mine, Sotiel Mine, Magdalena Mine. There are also two additional ones in the process of opening: Mines of Alquife and Los Frailes. Mineral resources, known and already exploited since the ancient history, constitutes today an industry based in metal mining that in 2019 billed 3.200M€, an increase of 1.300M€ compared to the previous year¹⁷ (Figure 15).

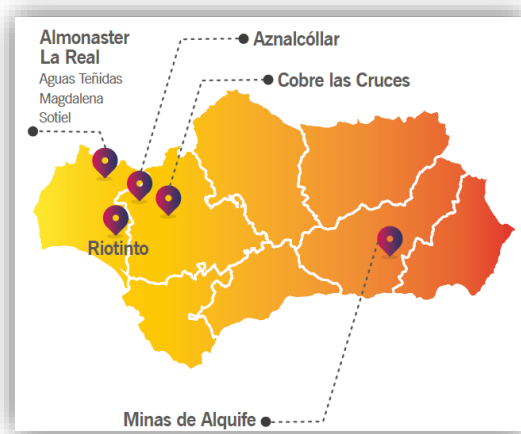


FIGURE 15 – MAIN SITES OF THE ANDALUSIAN MINING INDUSTRY. SOURCE: JUNTA DE ANDALUSIA

Andalusia concentrates 90% of the metal mining business all of Spain, with copper, zinc, silver and lead as main extracted materials. This places the community in an unbeatable position for the current energy transition, in which on all copper and zinc are called to be essential raw materials for the production of equipment and generators. In the mining activity as a whole, the Andalusian Community accounts for 38% of the sales, positioning itself as an outstanding leader in the Spanish context. And to such an extent is it triples the figures of the community that occupies the second position in the ranking. In its distribution, the province of Huelva stands out in first place, where almost half of the extractions are generated –Faja Pirítica Ibérica. The case of industrial rocks (limestone, clay and other materials used in construction) are present in a very distributed allocation throughout the Andalusian territory¹⁸. In 2011, Andalusia ranked first in the country in terms of the value of mining production with 22.4% of the national total and second in employment with 18.5% of national employment in the mining sector (Table 4).

TABLE 4 – MINING SECTOR IN ANDALUSIA: FIGURES AND IMPACT

Mining sector	2005	2010	Increase
Employment	5.039	5.796	15%
Energy consumption	49.582.059	64.059.290	29%
Material consumption	35.263.441	65.505.618	86%
Value-production	536.068.739	628.093.781	17%

¹⁷ Análisis panorámico de la industria minera andaluza. Junta de Andalucía, Consejería de Transformación Económica, Industria, Conocimiento y Universidades

¹⁸ «Energy and minerals: Natural resources of Andalusia. Junta de Andalucía, Ministry of Environment.

Sales abroad are the other factor in which Andalusia bases its leadership within the mining industry: mining of the region exported in 2018 for a value of 5.700M€, with non-ferrous metallic minerals, copper and basic iron, steel and ferroalloy products as main materials sold (Figure 16). The potential of critical mineral resources such as cobalt, barite, or antimony and rare earths, now under exploration, or strontium and spar fluoride, in exploitation, make this land an attractive territory for investments in these materials for high technological components.

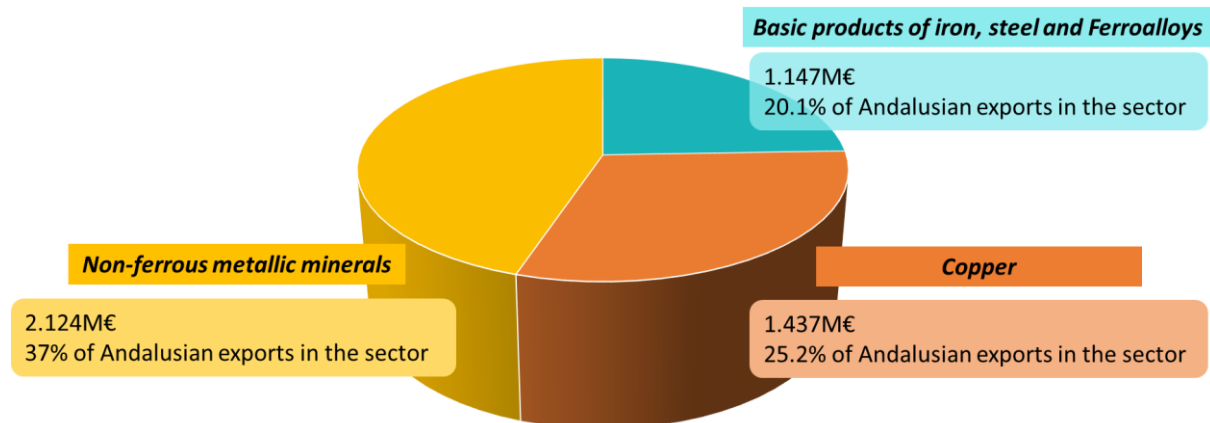


FIGURE 16 - ANDALUSIA'S PROSPECTION: MOST EXPORTED MINING PRODUCTS. SOURCE: SPANISH MINISTRY OF ECOLOGICAL TRANSITION

Finally, it is also worth mentioning the investments that some international companies are making for Andalusia as a preferred place to develop mining projects. The implementation of these projects would mean an aggregate turnover of more than 1,100M€ and the direct employment generated would be 2,200 people. To this data should be added that of indirect employment associated with the activity of the companies, which would raise the total figure to 5.000 people.

2.3. I4-GREEN REGION 3: EXTREMADURA (SPAIN)

2.3.1. EXTREMADURA CHARACTERISATION: ECONOMICS, COMPANIES AND INVESTMENTS

Located in southwestern Europe, the Autonomous Community of Extremadura has an area of 41,634 km², which represents 8.3% of the national territory, distributed in 388 municipalities, grouped in turn into 24 counties. It has a population of 1,051,738 inhabitants, meaning that it is the 13th Community of Spain in terms of population. With 25 inhabitants per km², it maintains a very low density compared to the population density of the country and also compared to the rest of Regions in Spain.



FIGURE 17- EXTREMADURA REGION IN SPAIN, NUTS2.

With an unemployment rate of 17.6% of the active population, it has a higher rate than the Spanish ratios, and that is why it is one of the Autonomous Communities with the highest unemployment rate, following Andalusia.

Extremadura GDP is 20,117M€, which places this Region as the 15th largest economy in Spain by volume of GDP. Regarding GDP per capita, Extremadura in 2021 accounted for 19.072€/person euros, compared to the 27,910€ of national average. Additionally, in 2021 Extremadura public debt was 5,046M€, 25.1% of its GDP and its per capita debt of €4,791 euros per inhabitant (Table 5) .

TABLE 5 - EXTREMADURA MAIN INDICATORS. SOURCE: EXPANSION¹⁹

National accounts		
<i>Indicator</i>	<i>Units</i>	<i>Year</i>
Annual GDP	20.117 M€	2021
GDP Per Capita	19.072 €	2021
Total debt (M€)	5.046	2021
Debt (%PIB)	25,10%	2021
Debt Per Cápita	4.791 €	2021
Déficit (M€)	41	2021
Déficit (%PIB)	0,21%	2021

Extremadura counts with an initiative to boost the investments in this region, under the Secretary of Economy and Trade, that has the mission to support promoters and entrepreneurs in all the stages of the investment and reinvestment process that they undertake in the region. The investments are directed to the new productive possibilities; projects leading to begin or expand an economic activity, preferably of industrial character and to the projects of acquisition of assets to improve and increase capacities or put them into operation (Table 6).

TABLE 6 - COMMERCE AND SOCIO-DEMOGRAPHY IN EXTREMADURA. SOURCE: EXPANSION

Commerce		
<i>Indicator</i>	<i>Units</i>	<i>Year</i>
Annual increase	218.790	2021
Exports	2.119,0 M€	2019
Exports %PIB	10,35%	2019
Imports	1.399,1 M€	2019
Imports % PIB	6,83%	2019
Commercial balance	719,9 M€	2019
Commercial balance % PIB	3,52%	2019
Commercial Retail Trade	1,0%	December 2022
Socio-Demography		
Population	1.051.738	2022

In addition, to set the context of the business climate, in 2017 Extremadura was the best region recognised because of the innovative strategy in terms of entrepreneurship, bringing 13 times more productivity compared to the rest of Spain, and the fifth Spanish region in “Doing Business” index (Figure 18).

¹⁹ Expansion, datos macro. Available at: https://datosmacro.expansion.com/?gclid=EAlalQobChMlg7ufxe7v_AIVjtB3Ch2FKQPdEAAAYASAAEglZ2PD_BwE



FIGURE 18 - PRODUCTIVITY COMPARISON IN EXTREMADURA-SPAIN. SOURCE: INVEST IN EXTREMADURA²⁰

Extremadura is the first region in Spain in terms of wooded area and the fourth in the country in terms of forest area, and a world biodiversity reference. Extremadura is the first region in the world that covers most of its needs with energy from the sun (photovoltaic and thermosolar): 65% of the total demand in 2015. It is the second national producing region of solar thermal energy and the third in photovoltaic. It counts with a third of all the dammed water in Spain, the region with the most inland freshwater coastline, with more than 30% of the territory protected. It's in one of best positions in air quality, having some of the skies with less light pollution. It is the leading region in Spain in the production of tomatoes, soybeans, raspberries, cherries, stone fruits, figs and plums and also the first in production of cork, charcoal or tobacco. Extremadura is the region with the most professional beekeeping in Europe, and the second with the largest number of hives in Spain, accounting with 13 protected geographical areas.

The relationships between the economy and the environment generate a series of specific activities that result, directly or indirectly, in jobs. The analyses carried out in 2017 by the Spanish Ministry of Education and Employment estimate the number of people affiliated in activities related to the green and circular economy at 117,928 people, which came to represent 30% of the regional affiliation that month. Comparing these data with the situation of this sector in 2011, membership has grown by 1% in this period, reaching 1,038 new members²¹ (Figure 19).

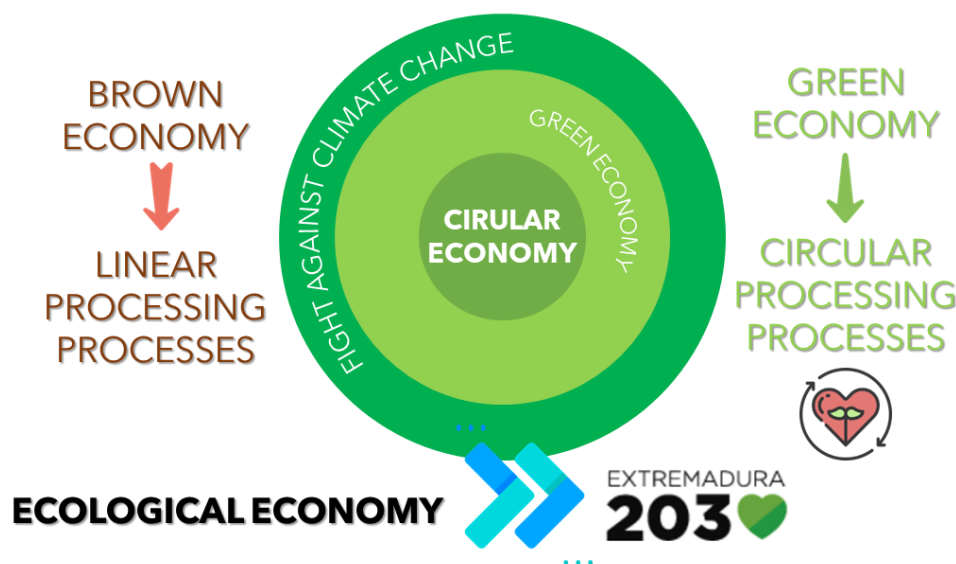


FIGURE 19 - EXTREMADURA OBJECTIVES 2030: GREEN ECONOMY. SOURCE: EXTREMADURA 2030.

²⁰ Memoria anual Consejo Económico de Extremadura, 2015.

²¹ Extremadura diagnosis: the strategy 2030. Available at: <https://extremadura2030.com/diagnostico-de-extremadura/>

2.3.2. RIS 3 STRATEGY EXTREMADURA: STRATEGIC OBJECTIVES 2027 AND LINES OF ACTION²²

The 4 strategic objectives of the RIS3 Extremadura 2027 are aimed at improving productivity and addressing bottlenecks in the Extremadura Science, Technology and Innovation System (SECTI), the industrial transition of the Extremadura economy, international collaboration for the export of products and services and the results of research, the application of technologies and innovation entrepreneurship, as well as deploying the entrepreneurial discovery process (PDE) (Figure 20).



FIGURE 20 - STRATEGIC OBJECTIVES RIS3 EXTREMADURA 2027

RIS3 Extremadura lines of action are linked to its strategic objectives, and may result interesting for I4-GREEN SMEs engagement:

a) Support instruments for RDI: Alignment of the R+D+i areas in which investment is made in the region with the needs of innovation, technological transformation and competitive development of the business fabric. Consolidation of the R+D+i system to respond to the needs smart specialization and competitive development of the region, and to create and develop alliances and strategic initiatives with institutional and scientific-technological agents of other regions, both at a national, European and international level.

b) Human capital for R&D. Increase in existing talent dedicated to R&D. increase in number of researchers and technical research professionals. Improve the capabilities to increase the investments in R&D, and its potential to define projects able to attract international competitive funds for the R&D (essentially from Horizon Europe).

c) Cooperation of innovative companies: Promotion of business associations and strong public public-private consortiums with companies in strategic and/or emerging economic areas for the region.

d) Public-private collaboration in Technology and innovation: Promotion of collaborative activities for the application of science and technology for companies

e) Human capital for business Innovation: Training of human capital in business applications and knowledge generated by the R+D+i projects financed in the region, and promotion of the necessary skills to value the results of RDI.

f) Fabric business reactivation: Recovery of the activity of companies in strategic sectors of the region in the post-COVID-19 stage, supporting the transformation of its structure and investment in strategic projects of reactivation.

²² Estrategia de investigación e innovación para la especialización inteligente de Extremadura. RIS3 Extremadura 2027, Junta de Extremadura.

g) Digital transformation and Ecological Transition: Motivation to companies to promote their digital transformation, as a way to increase their productivity and capacity competitive, as well as designing new products and addressing new market opportunities. Development of capacities in human capital and in companies of the region to efficiently take advantage of the opportunities generated by digital transformation policies and of ecological transition promoted by the European Commission, the Government of Spain, and Junta de Extremadura.

h) Gender equality and R+D+i communication: Promotion of the full and equal participation of women and Girls in Science and Technology.

i) Internationalization of RDI: Strengthening capacities to attract international funds for RDI.

j) Entrepreneurial discovery: Organization and promotion of hybridisation between companies in strategic sectors, for the use and application of knowledge and technologies (KETs) to the generation new areas of opportunity in the surrounding markets.

2.3.3. EXTREMADURA SMEs: CHARACTERISATION OF THE MINING SECTOR

Extremadura currently has a total of 15,665 companies that counts with an average turnover in the last 12 months of 827,352€, above the national average and also an average number of employees per company of 6 people, higher than the national numbers.

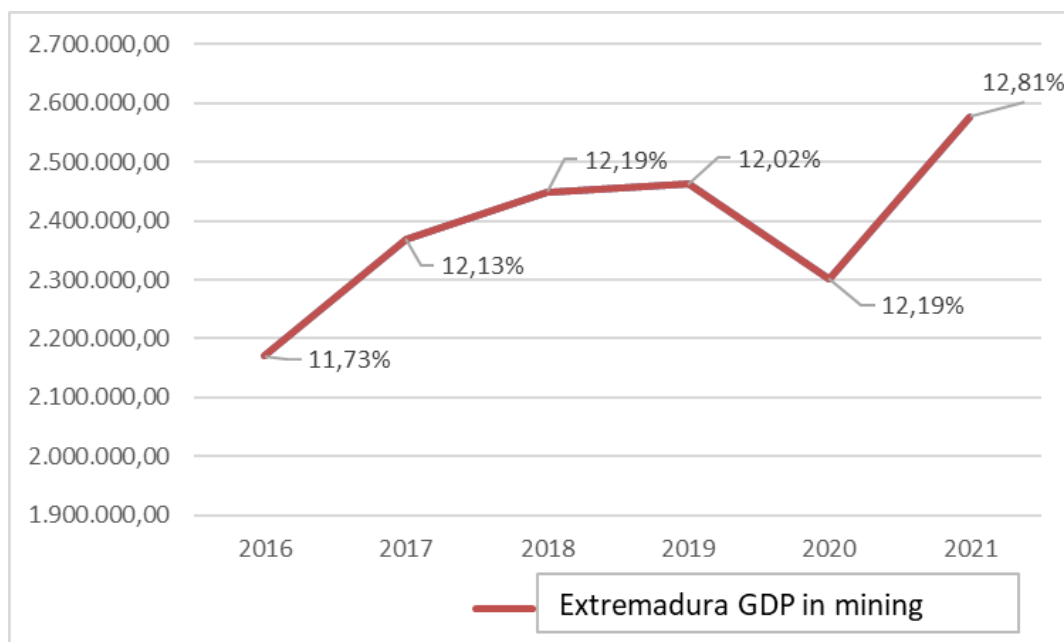


FIGURE 21 – GROWING TREND IN EXTREMADURA GDP IN THE MINING SECTOR

Extremadura is considered a metallogenic and mining region of great importance due to the richness and variety of its minerals. The mining activity in Extremadura began in the Roman Age, whose most important stage coincides with the mining development of precious metals such as gold and silver. There was also an important lead and zinc extraction activity at the end of the 19th century, coinciding with the national boom miner of the last third of that century. It is considered nowadays 4 large groups of minerals existing in the region: Metallic minerals, not metallic or industrial minerals, energetic and radioactive minerals; and minerals of gemmological interest²³. The following sections aim to briefly describe the metallic and non-metallic minerals because of their link to I4GREEN project (Figure 22).

²³ Yacimientos mineros y minerales en Extremadura. María José Serrano Suárez

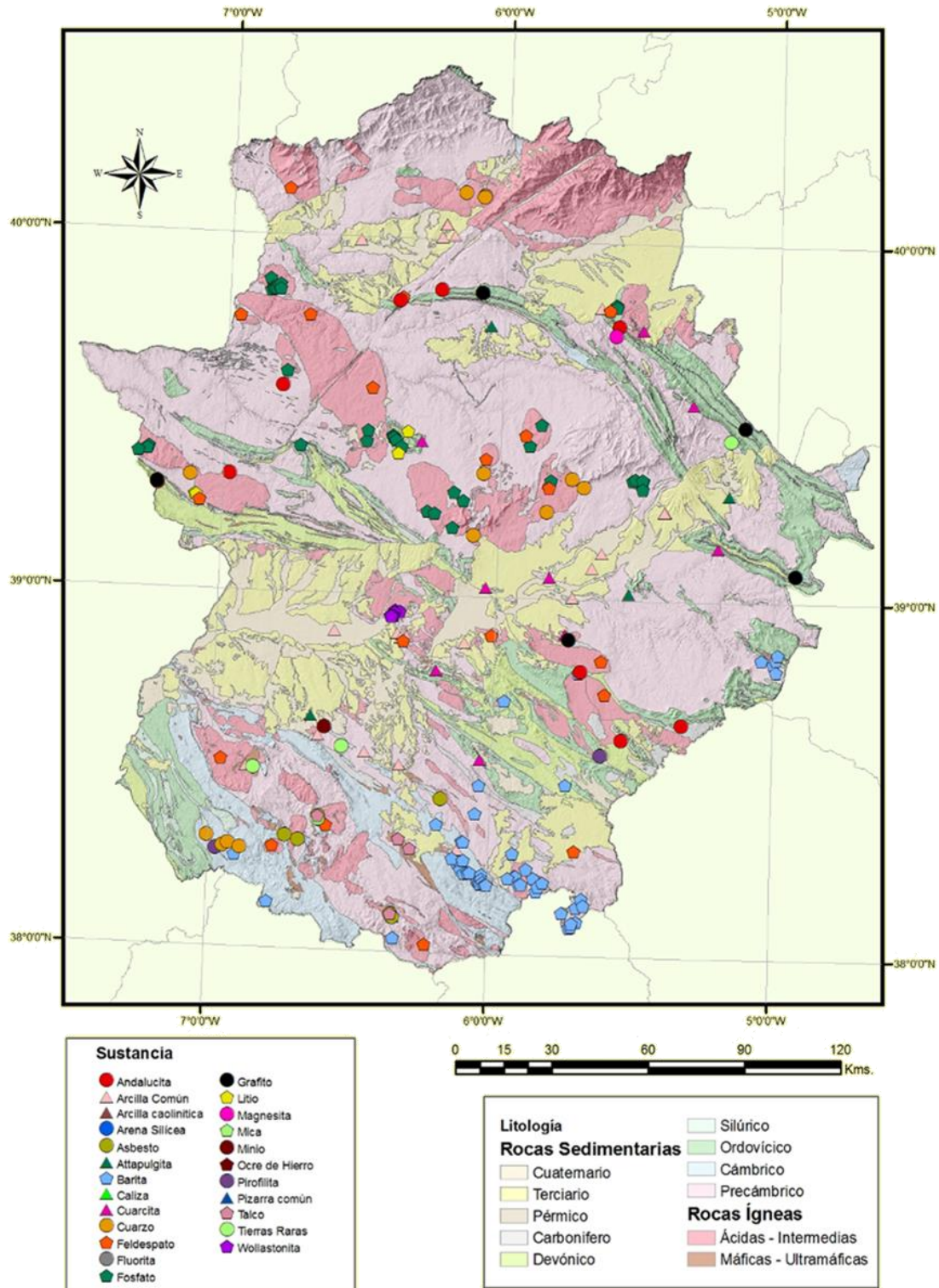


FIGURE 22 - INDUSTRIAL ROCKS AND MINERALS OCCURENCE IN EXTREMADURA. SOURCE: JUNTA DE EXTREMADURA²⁴

²⁴ <http://siggeo.juntaex.es/portalsiggeo/web/guest/minerales-industriales>

Metallic minerals:

- *Tungsten*: Together with Galicia, Extremadura is the autonomous community with the largest number of deposits and indications of tungsten and tin in the entire country. Amongst them, the "La Parrilla" deposit stands out, which made Extremadura a worldwide W producer.
- *Tin*: cassiterite is usually accompanied by quartz and very abundant in this community. The most notable deposits are "La Hoja", "Valdefl6rez, Mina de San Jos6", and "Mina Teba".
- *Iron*: The extraction of iron has stood out in contemporary times, although currently there is no active exploitation.
- *Copper-Nickel*: It is an important mining potential in Extremadura, mainly in the Aguablanca mine because of great economic and scientific interest.
- *Lead (silver)- Zinc- Copper*: very abundant in this region, with more than 250 indications.
- *Copper, Antimony, Mercury and Gold*
- *Manganese and chrome*.

Non-metallic or industrial minerals:

- *Phosphate deposits*: They are worldwide known because of its distinctive "holotype".
- *Lithium*: In Extremadura, most of the lithium mineralisations are associated with pegmatites, such as the "San Jos6" and "Tres Arroyos" mines.
- *Barite*.

Extremadura, in 2019, had 170 active mining operations, with a total gross production of 5.56 million tons. In total, the number of workers in the mining sector in Extremadura, in 2019 was 1.720. Regarding the joint business volume of the mining sector, it was 98.44 million euros (Table 7).

TABLE 7 - MINERALS IN EXTREMADURA: EXPLOITABILITY. SOURCE: JUNTA DE EXTREMADURA²⁵

Product	Number of sites	Marketable production (tons)	Production value (€)
Nickel	1		
Wolfram	1	35.000,00	395.201,00 €
Granite	66	445.434,26	23.031.640,20 €
Marble	1	2.000,00	220.000,00 €
Hornfels	1	1.785,00	125.800,00 €
Slates	1	2.555,00	922.932,00 €
Sand-gravel	47	2.414.498,00	5.074.421,00 €
Limestone-arid	13	659.827,00	2.805.078,00 €
Diabase-arid	2	220.929,00	1.166.645,00 €
Quartzite-arid	2	30.000,00	128.500,00 €
Greywacke-arid	7	527.382,00	3.710.705,00 €
Greywacke-arid	1	19.200,00	489.200,00 €
Gneis	2	24.360,00	170.520,00 €
Feldspar	1	50.500,00	606.000,00 €
Quartzite-industrial	1	7.320,00	256.200,00 €
Limestone-industrial	1	868.511,00	2.504.279,84 €
Clay	3	46.896,00	59.365,00 €
Slates-Kaolinitic	6	107.000,00	318.000,00 €
Slates-industrial	1	86.750,80	278.253,32 €

²⁵ <http://sigeo.juntaex.es/portalsigeo/web/guest/estadistica-minera>

The approximate marketable production in 2019 was 4.07 million tons in the mining sites and the sales value was estimated at approximately 98.4eM€, as reflected in table 8.

TABLE 8 - GDP IN EXTREMADURA FOR THE MINING SECTOR. SOURCE: EUROSTAT

Gross Domestic Product at market prices and Gross Value Added at basic prices by industry							
<i>Unit: thousands of euros</i>		2016	2017	2018	2019	2020	2021
NACE rev.2	NATIONAL	18.504.867,00	19.538.313,00	20.091.410,00	20.478.928,00	18.890.603,00	20.117.062,00
05-39	Mining and quarrying; [...] waste management and remediation activities	2.170.504,00	2.369.899,00	2.448.707,00	2.462.525,00	2.302.094,00	2.577.420,00
<i>Unit: percentage</i>		2016	2017	2018	2019	2020	2021
NACE rev.2	NATIONAL	100	100	100	100	100	100
05-39	Mining and quarrying; [...] waste management and remediation activities	11,73	12,13	12,19	12,02	12,19	12,81

The number of workers in the sector during 2019 was 1,720. The trends over the last few years are shown in the table 9.

TABLE 9 - EMPLOYMENT IN THE MINING SECTOR FOR EXTREMADURA. SOURCE: EUROSTAT

Compensation of employees by industry							
<i>Unit: thousands of euros</i>		2016	2017	2018	2019	2020	2021
NACE rev.2	NATIONAL	7.874.557,00	8.098.810,00	8.446.099,00	8.968.983,00	8.783.676,00	9.254.931,00
05-39	Mining and quarrying; [...] waste management and remediation activities	252.316,00	282.427,00	299.123,00	281.889,00	240.380,00	246.700,00
Total employment							
<i>Unit: thousands of persons</i>		2016	2017	2018	2019	2020	2021
NACE rev.2	NATIONAL	357,80	372,90	377,20	385,60	372,60	378,70
05-39	Mining and quarrying; [...] waste management and remediation activities	29,20	29,70	30,10	31,20	30,60	30,90

As depicted below, one of the lines of action of the mining administration in Extremadura is the enhancement of its rich mining heritage, with the aim of generating new cultural and tourist resources, not only for the revitalisation of nearby towns, but also in the increase in the exports offers and in the employment. The mining sites with significant patrimonial value, as well as the elaboration of a series of proposals for action in the green economy and rehabilitation for the enhancement of the mining heritage is being performed.

2.4. I4-GREEN REGION 4: CASTILLA Y LEÓN (SPAIN)

2.4.1. CASTILLA Y LEÓN CHARACTERISATION: ECONOMICS, COMPANIES AND INVESTMENTS

Castilla y León count with one total of 2,248 municipalities 22 (20% of the total municipalities of Spain), distributed over an area covering more than 94,000 km², mostly of rural character, and with a density population of 25.42 inhabitants/km², being, therefore, one of the largest regions in Europe with a high geographic dispersion. These characteristics determine the economic and social aspects and of its Regional identity.



FIGURE 23 - CASTILLA Y LEÓN REGION IN SPAIN, NUTS2.

Castilla y León has an unemployment rate of 8.8% of the active population, a lower rate than the Spanish average, and it is one of the Autonomous Communities with the lowest unemployment rates. Its GDP is 58,119M€, which places it as the 7th economy in Spain by volume of GDP. Regarding GDP per capita, in Castilla y León in 2021, it was accounted in 24,428€ euros, compared to 27,910€ of Spanish GDP per capita. It is ranked in the 8th position in the ranking of GDP per capita of the Autonomous Communities, which means that its population has a good standard of living in relation to the rest²⁶ (Table 10).

TABLE 10 - GDP IN CASTILLA Y LEÓN COMPARED TO NATIONAL VALUES

Area	Value in €/inhabitant
Spain	24,428
Castilla y León	24.397

In 2021 its public debt was 13,215 million euros, 22.7% of its GDP and its per capita debt of €5,560 euros per inhabitant. Ordering the Spanish regions, from lowest to highest debt, it can be observed that Castilla y León is in 8th position in the table of Autonomous Communities and in 10th position in terms of debt per inhabitant (Table 11).

²⁶ Expansion, datos macro. Available at: <https://datosmacro.expansion.com/>

TABLE 11 - CYL MAIN INDICATORS. SOURCE: EXPANSION

National accounts		
Indicator	Units	Year
Annual GDP	58.119 M€	2021
GDP Per Capita	24.428 €	2021
Total debt (M€)	13215	2021
Debt (%PIB)	0,227	2021
Debt Per Cápita	5.560 €	2021
Déficit (M€)	-62	2021
Déficit (%PIB)	-14%	2021

Regarding employment by economic sector, during the last 10 years the services sector is the one accounting with the highest number of employed persons, with 69.6% of the total employed in 2020. It is followed by industry, with a participation of 16.62% in 2020. After the construction, with 7.68%, and with a somewhat lower weight Agriculture appears, with 6.07%. Exports of goods from Castilla y León in 2020 have reached 13,442.48M€. The Region has followed the growth trend until 2019, without noting the impact of the pandemic in this indicator in the last two years. The imports, for their side, reached 10,020.8M€. In any case, the external balance continues being positive for Castilla y León (Table 12).

TABLE 12 - COMMERCE AND SOCIO-DEMOGRAPHY IN CYL. SOURCE: EXPANSION

Commerce		
Annual increase	499.370	2021
Exports	14.648,6 M€	2019
Exports %PIB	0,245	2019
Imports	12.272,7 M€	2019
Imports % PIB	0,2052	2019
Commercial balance	2.375,9 M€	2019
Commercial balance % PIB	0,0397	2019
Commercial Retail Trade	2,7%	Diciembre 2022
Socio-Demography		
Population	25	2022

Data for total R&D spending as a percentage of GDP in Castilla y León are above than the average for the whole of Spain, being in 2019 1.35%, compared to 1.25% nationally. This indicator has followed an upward trend that started in 2014.

In addition, Castilla y León is, due to its location, communications, sectoral diversification, educational system, foreign projection and quality of life, the ideal region for those companies that are seeking for a modern, dynamic and safe enclave to carry out their investment project, or start a new activity. The companies of Castilla y León have very different profiles in very diverse activities. Among the sectors with the greatest international projection, the automotive, agri-food, aerospace, pharmaceutical or cybersecurity sectors stand out²⁷.

²⁷ <https://invertirencastillayleon.com/>

2.4.2. RIS 3 STRATEGY CASTILLA Y LEÓN: OBJECTIVES AND LINES OF ACTION

The Research and Innovation Strategy for a Smart Specialisation of Castilla y León 2021- 2027 is conceived as an instrument to increase the competitiveness of the activities in which Castilla y León specialises, not only through its digital and ecological transition, but also by taking advantage of digitalisation, decarbonisation and the sustainability demanded at European and global levels as niches of opportunity, without losing the hallmark identity of Castilla y León²⁸.

The definition of the strategic objectives of the RIS3 until 2027 of Castilla y León is based on the socio-economic indicators, capacities, the main challenges and bottlenecks for the dissemination of innovation in Castilla y León, but also considering current trends in international technology markets. These specific objectives are the following ones:

- S01: Developing specialisation priorities, considering Castilla y León as a territory with quality of life, carbon-neutral and fully circular and the commitment of the region to smart manufacturing and cybersecurity.
- S02: Improve and strengthen Castilla y León’s research and innovation ecosystem for the advance specialisation.
- S03: Castilla y León’s Digital Agenda for taking advantage of the benefits of digitalisation.
- S04: Strengthening participatory governance for specialisation.

The lines of action in CyL are aimed at responding to the challenges and bottlenecks identified in the diagnosis of the region, as well as taking advantage of strengths and opportunities. All of this lead to solve existing weaknesses and threats that can be used by I4-GREEN engaged SMEs. The lines of action linked to I4-GREEN opportunities are (Figure 24):

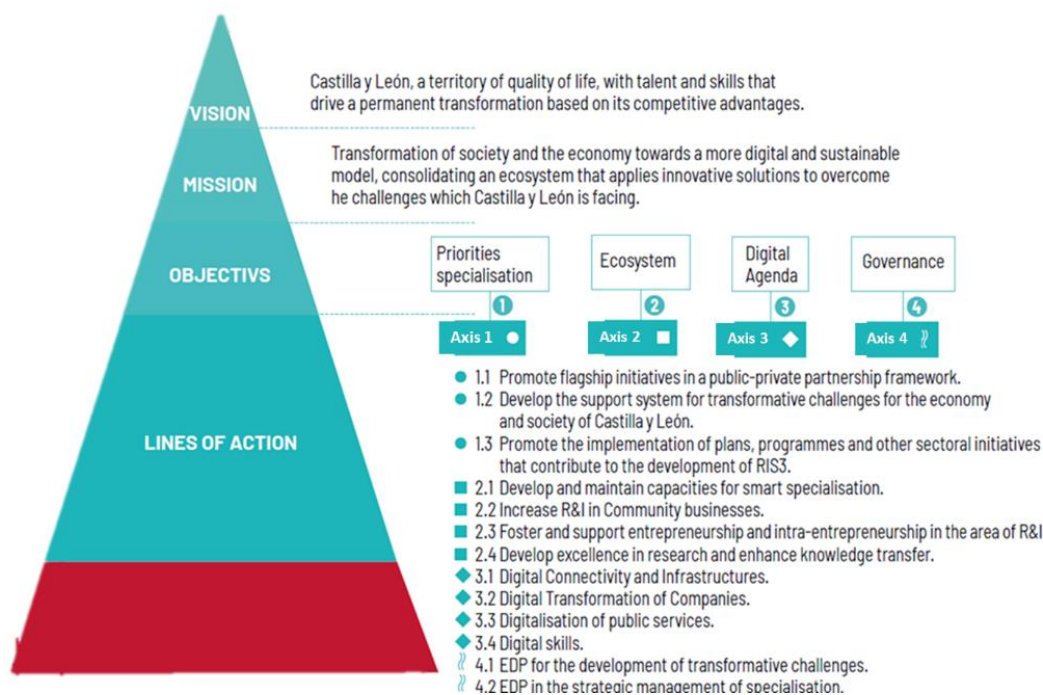


FIGURE 24 – STRATEGY LEVEL BLOCKS IN S3P CYL. SOURCE: JCYL¹⁶

²⁸ RESEARCH AND INNOVATION STRATEGY FOR SMART SPECIALISATION (RIS3) OF CASTILLA Y LEÓN 2021-2027. Junta de Castilla y León. Commissioner for Science and Technology

a) Promote flagship initiatives in a public-private partnership framework: making commitments and collaboration with the business sector of Castilla y León and the Administration, resulting on having an impact on the objectives of the RIS3.

b) Develop the system of support for transformative challenges for the economy and society of Cyl: identifying agents of the quadruple helix ecosystem of innovation, so they can play a major role in the development of these challenges, establishing contact and collaboration networks.

c) Promote the implementation of plans, programmes and other sectoral initiatives that contribute to the development of RIS3: maintenance of roadmaps for each specialisation priority for the alignment of the plans and programmes with the RIS3 priorities and identifying opportunities for the future.

d) Develop and maintain capacities for smart specialisation: focus on education and training and in the capacities to meet the R&I challenges.

e) Increase R&I in Community businesses: boost the competitiveness of Community businesses on the basis of innovation and the generation of economic activity from innovative products, processes or services

f) Foster and support entrepreneurship and intra-entrepreneurship in the area of I&I: help on the creation new lines of business and SMEs around the priorities of specialisation ensuring their consolidation and growth

g) Develop excellence in research and enhance knowledge transfer: supporting excellent R&D and the transfer of knowledge and technology to business and society

h) Digital transformation of companies: productive model's digital transformation (processes, services and products) with the aim of achieving economic growth and job creation, greater territorial cohesion and development of rural areas and digital leadership.

i) Digital skills: promotion of digital skills in education, encouraging technological vocations and raising awareness and training entrepreneurs and small businesses.

It is also important to highlight that one of the strategies in this region covers Castilla y León as carbon-neutral and fully circular community, so it's aimed to boost the sustainability of agricultural, forestry, livestock and mining activities, promoting circular economy and minimising the carbon footprint in the framework of the fight against climate change and the conservation of biodiversity. It is there considered in this area the importance of endogenous forestry and mining resources.

2.4.3. CASTILLA Y LEÓN SMEs: CHARACTERISATION OF THE MINING SECTOR²⁹

The large surface area of Castilla y León, together with its geological diversity, has led to the fact that, from the more remote times of its first settlers, have been extracted and exploited numerous mineral resources. Prehistoric human settlements, distributed along the Region, have left clear testimonies of the use of subsoil materials either as supply for buildings or as extraction of mineral raw materials for several uses. Precisely this long tradition in the work of these resources has formed a leading and innovative sector in business branches such mining or natural stone, the clearest example of which is the slate produced in León and whose qualities are among the highest in the world. Later, roman evidence in Castilla y León territory leave a clear idea of a metal as an almost exclusive protagonist: gold, mainly extracted in Las Médulas (León). Recent history shows that Castilla y León mainly developed their communities because of the richness in coal mines.

²⁹ Los minerales industriales en Castilla y León. Junta de Castilla y León, SIEMCALSA.

Castilla y León counts with a vast variety of natural resources, and in the following sections the minerals for industrial applications will be emphasised, but it is also important mentioning that other occurrences are also available (Figure 25).

PROVINCE	ENERGETIC	METALLIC	INDUSTRIAL	NATURAL STONE	ARIDS	TOTAL
ÁVILA				4	15	24
BURGOS	1		18	22	45	89
LEÓN	20		10	43	25	104
PALENCIA	2		9	8	20	40
SALAMANCA		2	6	13	25	51
SEGOVIA			22	16	30	70
SORIA			3	8	25	37
VALLADOLID			9	6	35	52
ZAMORA			5	10	25	43
TOTAL	23	2	86	130	245	510

FIGURE 25 - ESTIMATE OF ACTIVE MINING INDUSTRIES IN CASTILLA Y LEÓN. SOURCE: JCYL

Castilla y León currently accounts for some 400 industrial rock and mineral quarries, which provide more than 4,000 direct jobs, although there could be 500 more if extraction and first processing are considered, and a production of more than 15 million tons.

In Castilla y León there are currently around a hundred industrial mineral exploitations of a very varied nature, some of worldwide importance. Within the regional mining panorama, the industrial minerals sector occupies second place in terms of the total value of production, only surpassed by the energy mining in the past (Figure 26).

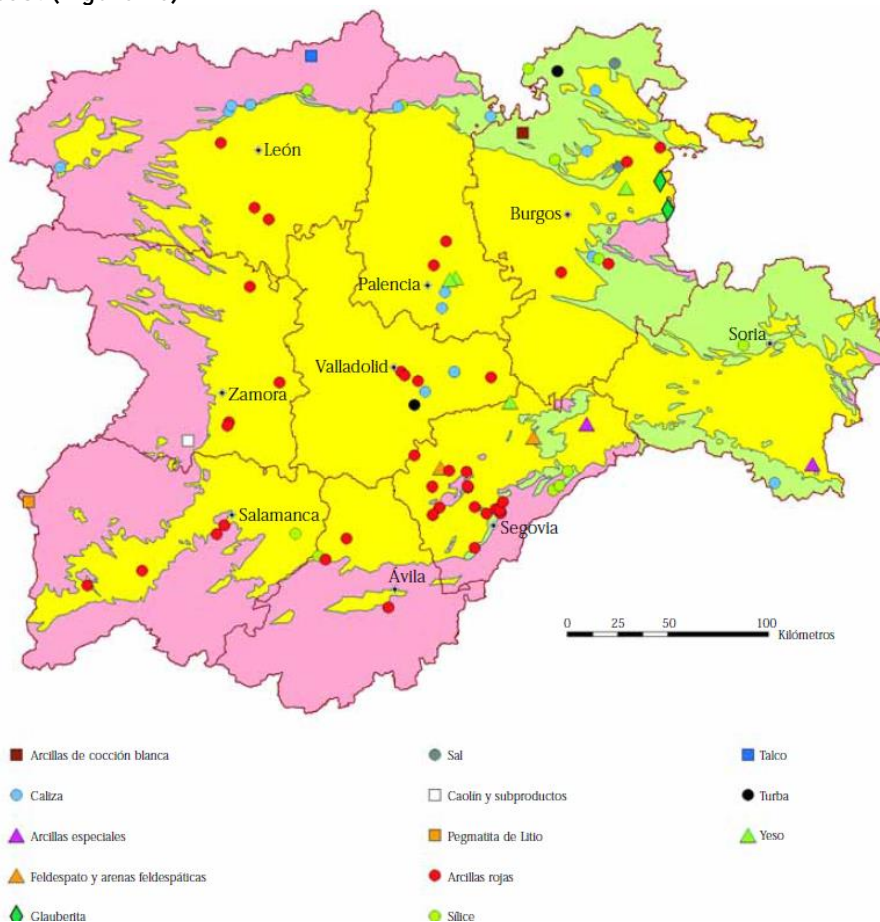


FIGURE 26 - INDUSTRIAL ROCKS AND MINERALS MINED IN CYL. SOURCE: JUNTA DE CASTILLA Y LEÓN

Industrial minerals that are being exploited currently in Castilla y León are the following ones:

- *Special clays*: The minerals included in this group are attapulgitite (or palygorskite), sepiolite and bentonite. This production represents around 90% of the national total for these minerals.
- *Kaolin*: the only active exploitation in Castilla y León benefits a deposit formed by kaolinization of a granite.
- *Mica*: In the kaolin exploitation of CyL, mica is obtained white (muscovite) as a by-product, which is sold for various applications. Mica has been further exploited in pegmatitic veins.
- *White firing clays*: ball clay deposit in the north of CyL has applications for the ceramic industry.
- *Red clays*: In Castilla y León they are used mainly in the manufacturing of structural ceramics, bringing together 35 companies with a joint production that represents 8% of the national rates.
- *Silica*: Exploitation of siliceous sands, sandstone quartzites, gravel pits and quartz veins, and jointly with feldspar (wind sands), kaolin or clay. The CyL productions are destined mainly to the manufacture of glass and foundry molds and, to a lesser extent, for mortars, filters, blasting, ceramics, ferrosilicon and silicon carbide.
- *Feldspar*: It is extracted for the ceramic industry. In CyL it is produced 55% of the national total of this type of feldspar.
- *Lithium*: Occurrence in Salamanca with highly exploitable applications.
- *Limestone*: In Castilla y León there are a total of 21 exploitations that destine their production, mainly, to the manufacture of cement and, in the background, to the sugar industry, fertilizers and feed, manufacture of lime, glass, etc.
- *Glauberite*: two mines located in the same geological unit extract the sodium sulfate by dissolving the glauberite in water and subsequent leaching of the mineral, and have a joint production about 60% of the national total.
- *Talc*: A company with a treatment plant in León, markets up to thirty varieties and has a production that represents around 85% of the national total.
- **Gypsum**
- **Salt**

MINERAL	SITES	WORKERS	PRODUCTION (t)	VALUE (€)
Arcillas cocción blanca	1	18	76.000	1.780.000
Arcillas especiales	2	43	28.000	3.324.000
Arcillas rojas	45	171	1.685.000	7.124.000
Arenas feldespáticas	Subproducto	Subproducto	311.000	1.959.000
Caliza	19	238	4.047.000	13.651.000
Caolín	1	35	3.000	160.000
Feldespato K	2	82	293.000	13.881.000
Glauberita	2	232	688.000	34.292.000
Mica (moscovita)	Subproducto	Subproducto	2.000	354.000
Pegmatita con litio	2	8	13.000	655.000
Sal	2	4	5.000	128.000
Silíce	11	133	1.990.000	17.132.000
Talco	1	82	90.000	10.350.000
Turba	3	8	9.000	133.000
Yeso	5	37	575.000	2.321.000
TOTAL	96	1.091	9.815.000	107.244.000

FIGURE 27 - MINERALS PRODUCTION IN CYL. SOURCE: JCYL

Simplifying, in Castilla y León they are extracted industrial minerals in a hundred exploitations, that produce around 10 million tons with a total value of about 100M€. The labors of extraction and treatment of the ore employ a thousand workers nowadays. The construction sector consumes around 40% of industrial mineral production in Castilla y León, specifically limestone for cement and gypsum. If red clays for structural ceramics are included (bricks, boards, etc.), the percentage would rise to 57%. Furthermore, they are notable for their relative importance in the national context lithium pegmatite productions (100%), attapulgitite (90%), talc (85%), sodium sulfate (58%), potassium feldspar (52%) and mica (44%) (Figure 27).

3. CONCLUSIONS

After the identification of the different RIS3 strategy of the regions selected, it is noted that common structural objectives and lines of action that the I4-GREEN implementation will support:

- *Support instruments, human capital and internationalisation for RDI and innovation*
- *Increase the qualification of regional human resources (talent)*
- *Cooperation of innovative companies*
- *Public-private collaboration in Technology and innovation*
- *Help in business reactivation and entrepreneurs*
- *Digital transformation & skills and Ecological Transition*
- *Gender equality.*
- *Research and innovation on the management of natural resources and cultural heritage*
- *Integrate mining in the territory*
- *Increase sustainability and territorial cohesion*
- *Reinforce the value of regional production chains*

In conclusion, after characterising economically, the SMEs environment, investment opportunities and once the mining sectors are depicted, the four regions selected for the SME's engagement in I4-GREEN (Alentejo, Andalusia, Extremadura, Castilla y León) it is highlighted that they count with a great value in resources, so they can easily afford exploitable routes for potential entities that could be part of the interregional innovation network created.

Moreover, given to the fact of the geologic and mineralogic occurrence (IPB), that crosses the Alentejo region and the Portuguese geographic boarder to Spain (Extremadura region), that is one of the largest polymetallic deposits and mining province of the world, this fact evidences a crucial geological link between the regions involved in the I4GREEN project. Resulting in strengthening and exploiting the full approach of project core technologies, pushing SME engagement and the promoting the growth of the interregional system between investors, tech partners, regional governments and other enablers that will improve sustainable green mining.