European Commission
Research Programme of the Research Fund for Coal and Steel
Technical Group: TGK1

Web INTEractive management tool for coal Regions in transition

WINTER

Deliverable 3.5

Transition management handbook

Coordinator:	Dr. Nikolaos Koukouzas
Authors	Dr. Konstantina Pyrgaki, Dr. Theodoros Zarogiannis, George Maraslidis, Pavlos Krassakis, Andreas Karavias, Evangelia Zygouri, Dr. Nikolaos Koukouzas – CERTH Aleksandra Szwaja, Marta Błachowicz, Beata Merenda, Dr. Barbara Rogosz, Dr. Jacek Szczepiński, Dr. Adam Bajcar- Poltegor Laura Cebula, Dr. Aukje van Loon, Kai van de Loo, Julia Haske, Jürgen Brüggemann - DMT-THGA
Grant Agreement number: 101057228-WINTER-RFCS-2021	

Document Control Page

Deliverable name:	Transition management handbook
Deliverable / Milestone number:	D3.5
Work-Package no and title:	WP3: Socioeconomic and management aspects of coal regions in transition
Work Package Leader:	DMT-THGA
Deliverable:	DMT-THGA
Authors:	Laura Cebula Dr. Aukje van Loon Kai van de Loo Jürgen Brüggemann Julia Haske Dr. Konstantina Pyrgaki Dr. Theodoros Zarogiannis George Maraslidis Pavlos Krassakis Evangelia Zygouri Andreas Karavias Dr. Nikolaos Koukouzas Aleksandra Szwaja Marta Błachowicz Beata Merenda Dr. Barbara Rogosz Dr. Jacek Szczepiński Dr. Adam Bajcar
Due date of deliverable:	31 May 2024
Actual delivery date:	31 May 2024
Language:	English
Dissemination Level[1] :	PU
Audience:	public
Status:	final

Dissemination level:

PU = Public

PP = Distribution restricted to other programme participants

RE = Distribution restricted to a group specified by the consortium

CO = Confidential, only allowed for members of the consortium

Table of Contents

EXECUTIVE SUMMARY

The transition from coal/lignite mining to post-mining offers decisive **opportunities** to integrate rehabilitation and repurposing plans, so that they are aligned with social, long-term spatial and economic development interests. Terminating the use of coal as an energy source assures a viable, responsible and sustainable post-mining management. As the first priority throughout a transition process is to **protect citizens and the environment by creating a safe and healthy environment**, rehabilitation and repurposing of former mining sites equally results in significant **challenges** for coal regions in transition. Compulsory sustainable post-mining management therefore needs to minimize negative consequences and maximize potential benefits. It aims towards constant enhancements in the environmental, economic and social capabilities of post-mining regions, and constitutes durable consequences, both opportunities as well as challenges.

This **transition management handbook** is generated within the context of WINTER's interrelated Work Packages 2 and 3: Work Package 2 (WP2) **'Environmental challenges of coal regions in transition and land rehabilitation solutions'** and Work Package 3 (WP 3) entitled **'Socioeconomic and management aspects of coal regions in transition'**. Thus, the aim of this handbook is to share knowledge and experiences that may be valuable to those regions that are now facing the transition. It thus serves the purpose to develop a best practice guide **including recommendations for strategies/plans, governance/stakeholder, welfare/employment and rehabilitation/repurposing of a just transition process** for policy makers (EU, national and regional levels), social partners (industry and employees), transition management institutions and communities. Taking into account both environmental and socioeconomic aspects, these are based on theoretical and empirical best practices and success stories, as well as on lessons learnt for designing and delivering more effective policies from the three coal regions in transition.

The handbook will therefore elaborate **a comprehensive replicable framework** which enables key actors in coal transition, including the affected regions, to contextualize the just transition framework and to implement strategies, policies and actions by utilizing the proposed recommendations. It aims to be a useful reference to those engaged in societal and political debates of the transition process in coal regions and is thus targeted towards national, regional and EU level authorities, as well as social partners (industry, managers and employees), transition management institutions, civil society and NGOs and the community in general. It is important to note however that, while coal regions differ regarding various characteristics (governance, economy, culture, demography, etc.) this handbook does not aim to adhere to a one-size-fits all approach and should be viewed as a learning journey for all stakeholders involved. Yet, by providing examples of current practices from three coal regions, covering one mature (Ruhr region) and two initial stages (Western Macedonia and Konin region), the risk of being too generic is minimised.

PROJECT OVERVIEW

SECTOR *(COAL /STEEL)*:	COAL
TECHNICAL GROUP:	TGK 1
GRANT AGREEMENT N°:	**101057228-WINTER-RFCS-2021**
TITLE:	**Web INTEractive management tool for coal Regions in transition**
ACRONYM	**WINTER**
BENEFICIARIES:	Centre for Research and Technology Hellas – CERTH Thessaloniki, Greece DMT-Gesellschaft für Lehre und Bildung mbH, Bochum, Germany Poltegor Instytut Gornictwa Odkrywkowego-Poltegor Institute of Opencast Mining – Poltegor, Wroclaw, Poland
START DATE:	01/07/2022
END DATE:	30/06/2024
PERIOD COVERED BY THIS REPORT:	01/07/2022 to 30/06/2024
MAIN RESULTS:	
ON SCHEDULE (*YES /NO)*:	Yes
MAIN PROBLEMS ENCOUNTERED:	None
CORRECTION – ACTIONS:	None
PUBLICATIONS, PATENTS:	None

1 Introduction

Coal mine closure and thus the transition from mining to post-mining offers decisive **opportunities** to integrate rehabilitation and repurposing plans, so that they are aligned with social, long-term spatial and economic development interests. Terminating coal use as an energy source assures a viable, responsible and sustainable post-mining management. Within this context "Just Transition" is defined as acknowledging "the need to mitigate climate change without disproportionally burdening segments of society dependent on the production of fossil fuels" (Furnaro et al. 2021:1). As the first priority throughout this transition process is to **protect citizens and the environment by creating a safe and healthy environment**, rehabilitation and repurposing of former mining sites equally results in significant **challenges** for coal regions in transition. Compulsory sustainable post-mining management therefore needs to minimize negative consequences and maximize potential benefits. It aims towards constant enhancements in the environmental, economic and social capabilities of post-mining regions, and constitutes durable consequences, both opportunities as well as challenges.

The EU RFCS-funded project WINTER develops a **Web iNTEractive platform for the management of coal Regions** in transition in order to provide guidance and to facilitate stakeholder engagement. Good practices are identified by exchanging information and knowledge concerning **transition opportunities and challenges** in each of the pilot regions, representing different transition process stages (initial process stage for Western Macedonia and the Konin area and mature process stage for the Ruhr area).

Main aim of the web interactive platform is **to enhance stakeholder involvement and interaction** by providing and sharing valuable information required to improve transition plans for these regions.

WINTER's research objectives are (1) supporting the just transition of the coal sector and regions, and (ii) minimising the environmental impacts of coal mines in transition. Although solid of experience of mine closure management exists, this knowledge can be fragmented and often resides in regions that have already undergone a transition away from mining. WINTER's aim is to cross-examine, in a holistic way, the particular case of the Ruhr area (Germany) as the "mirror" of the transition strategies of Western Macedonia and the Konin region, due to these two latter regions having the opportunity to gain experience from the former.

Thus, the aim of this handbook is to share knowledge and experiences that may be valuable to those regions that are now taking on transition.

Post-Mining Opportunities

Rehabilitation and repurposing can be viewed as a key element in forging a new future, as a cleaner environment and good living conditions can offer new business models and are a pre-requisite to attract highly skilled workers to regions. They provide important economic opportunities that support mitigating negative economic and social impacts during transition. Timely and efficient repurposing of land and infrastructure is viewed as a decisive factor in attracting new businesses and permanent new jobs in the region and is key to opening opportunities for renewed future regional responsibility.

Also, regions during or past transition processes often (re-)value the cultural heritage of industrial infrastructure and buildings, which is significant for successful transition. New facilities, such as recreation centres, museums, science and culture centres can be developed on the post-mining sites. A **good practice example** which is viewed as successful because it has highly valued, built-on and emphasised local coal heritage is the Zeche Zollverein (Germany), which is a UNESCO World Heritage Site.

The **transition management handbook** is generated within the context of WINTER's interrelated Work Packages 2 and 3: Work Package 2 (WP 2) **'Environmental challenges of coal regions**

in transition and land rehabilitation solutions' and Work Package 3 (WP 3) entitled **'Socioeconomic and management aspects of coal regions in transition'**.

WP 2 examines important challenges of environmental rehabilitation and repurposing of former mining assets to new sustainable functions. It aims at identification of the main environmental challenges regarding land reclamation in the selected coal regions (Western Macedonia, Ruhr area and Konin region), collection of existing experience of post-mining regional management and application of available land rehabilitation technologies in the best possible ways. Tracking spatiotemporal changes and building scenarios of the future uses of the post-mining areas will form a basis for sustainable planning and promoting public engagement and participation of the society.

The aim of WP 3 is to analyse the transition management processes in order to determine best and improper management strategies and implementation practices by identifying the actual processes, management strategies and practices that operate within these governance models and analyse their implications for post-coal governance. This includes success stories and their drivers to inform project recommendations. It also aims to investigate socioeconomic parameters of coal transition, by carrying out a systematic collection of data from the case study regions to assess the socioeconomic effects of the coal transition and to develop management strategies for the implementation and institutional structures in the three case studies.

Within this context of WP 2 and WP 3, this handbook firstly refers to literature on mine closure and post-mining management. Results are based on a detailed Google Scholar Database search which highlights that while literature on mine closure is well-developed, this does not account for literature on both *mine closure management* and *post-mining management.* By including relevant research and recommendations from, amongst others, the European Commission, the International Energy Association and the World Bank on post-mining challenges and opportunities, it becomes obvious that numerous issues are commonly identified.
This information is then further supplemented with the **management rules of sustainable economy** (Rogall/Gapp-Schmeling 2021). These are applied as recommendations within the context of mining regions in transition, as illustrated using the example of the coal-

Post-Mining Challenges

The potential for rehabilitation and repurposing depends on a number of regional and local factors, such as site location, sectoral demands and economic opportunities. Challenges and risks vary depending on the type of region (rural or urban), the type of mining (open cast mines or underground) and the predominant assets for which rehabilitation and repurposing is sought (land usage, building, infrastructure). Mine closure and transition process is a perpetual task which is highly regulated, mainly on the national level (e.g. Mining Act). Consequently, details differ from country to country (region to region). To a large extent, these challenges relate to the timespan of transition activities. The time horizon (which is not necessarily static) between the present an (expected) closure and related activities strongly impacts transition choices and options:

- Immediate or a time horizon of 0-5 years;
- Mid-time horizon of 10-20 decades:
- Undetermined time horizon

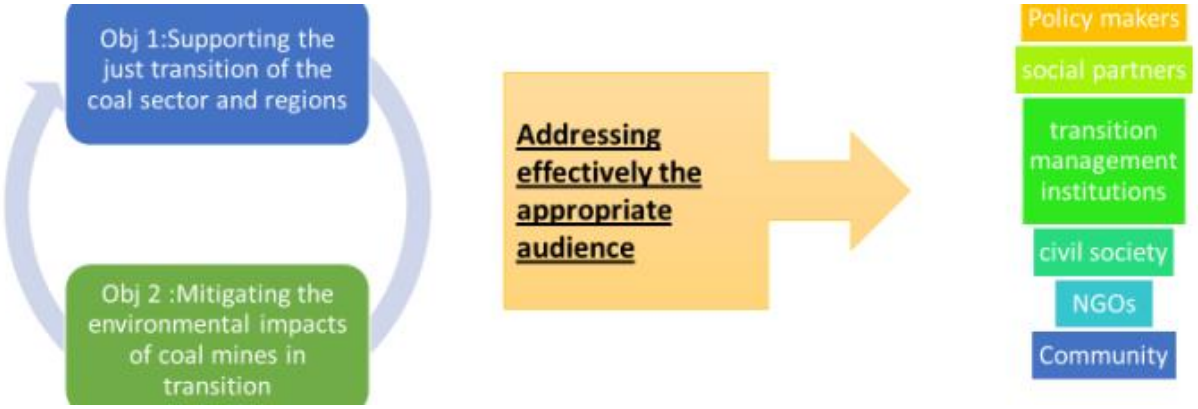
The longer the time horizon, the more time is available to adapt, the smoother the transition will be, and the larger the potential is for a coal region in transition. From a governance perspective, the most important aspects are:

- securing financing for mine closure;
- building up knowledge and applying tools to address regional knowledge and capacity gaps;
- establishing institutional and governance structures to coordinate approaches and speed up implementation;
- increase societal acceptance among all relevant stakeholders.

phase out in Germany (van de Loo 2023). This can be of particular significance with the Ruhr region representing a mature stage of post-mining, in contrast to the initial transition process of the Western Macedonia and Konin regions.
The transition management handbook thus serves the purpose to develop a best practice guide **including recommendations for strategies/plans, governance/stakeholder, welfare/employment and rehabilitation/repurposing of a just transition process** for policy makers (EU, national and regional levels), social partners (industry and employees), transition management institutions and communities. Taking into account both environmental and socioeconomic levels, these are based on theoretical and empirical best practices and success stories, as well as on lessons learnt regarding areas of difficulties and space for designing and delivering more effective policies from the three coal regions in transition.

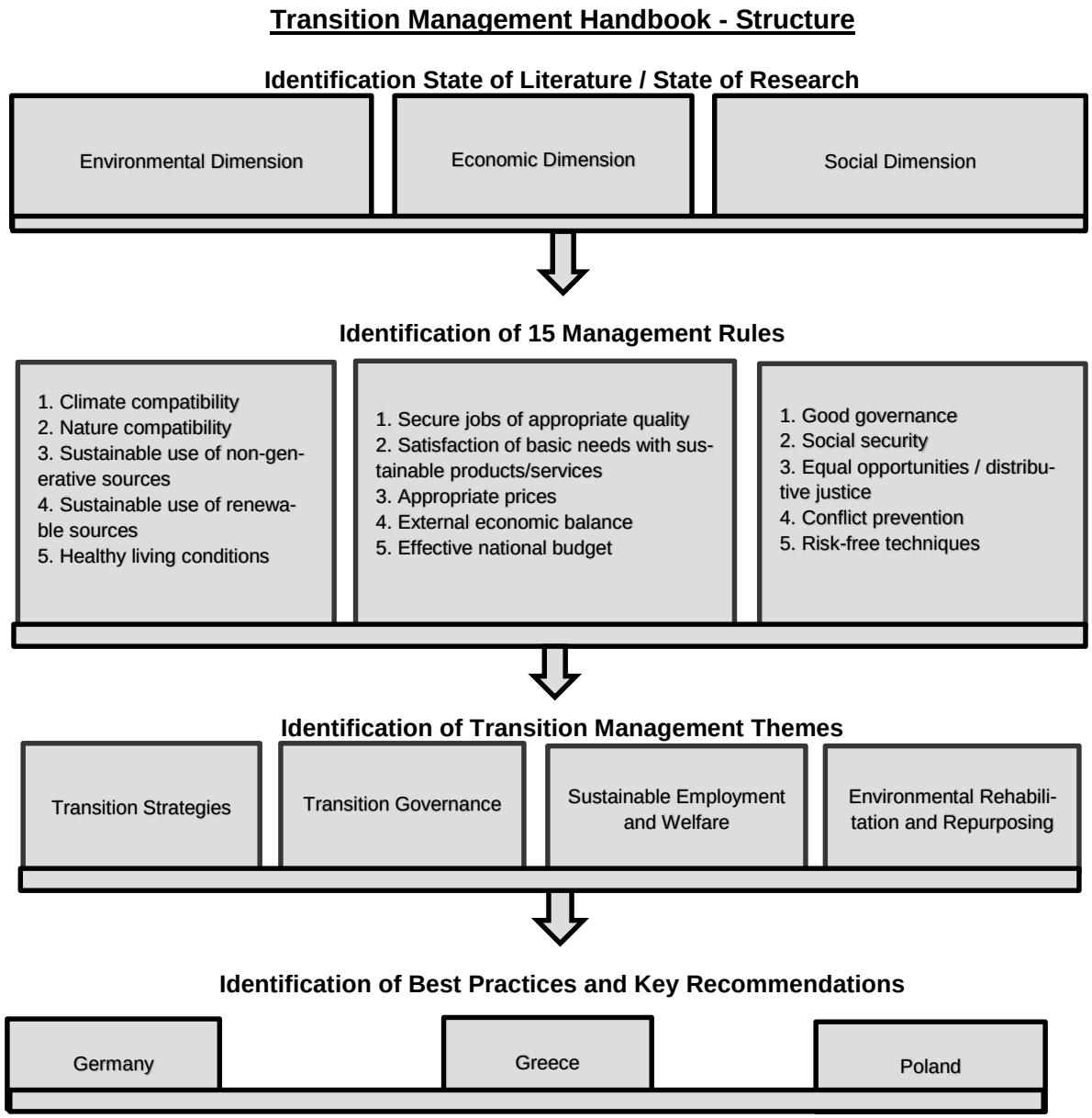
The handbook will therefore elaborate **a comprehensive replicable framework** which enables key actors in coal transition, including the affected regions, to contextualize the just transition framework and to implement strategies, policies and actions by utilizing the proposed recommendations. It aims to be a useful reference to those engaged in societal and political debates of the transition process in coal regions and is thus targeted towards national, regional and EU level authorities, as well as social partners (industry, managers and employees), transition management institutions, civil society and NGOs and the community in general (see WP 5). It is important to note however that, while coal regions differ regarding various characteristics (governance, economy, culture, demography, etc.) this handbook does not aim to adhere to a one-size-fits all approach and should be viewed as a learning journey for all stakeholders involved. Yet, by providing examples of current practices from three coal regions, covering one mature (Ruhr region) and two initial stages (Western Macedonia and Konin region), the risk of being too generic is minimised.

Figure 1: Conceptual diagram of RFCS Framework



Source: https://winter-project.eu/wp-content/uploads/2023/01/WINTER_D1.1_Comprehensive_Project_Overview.pdf

After this introductory section, the handbook is structured such that Chapter 2 illustrates a detailed Google Scholar database search and literature review in order to illustrate the limited available sources on management of transition process in general, and a transition management handbook in particular. Within the context of four transition management themes, 1) transition strategies; 2) transition governance; 3) transition sustainable employment and welfare, and; 4) transition environmental rehabilitation and repurposing, subsequent chapters illustrate a non-exhaustive reiteration of WINTER results in order to detect empirical best practices regarding areas of difficulties and space for designing and delivering more effective policies from the three coal regions in transition. Consequently, a summary of key recommendations is provided for coal regions transition to help bolster knowledge and capacity, enhance coordination to speed up implementation and increase societal acceptance in dealing with sustainable post-mining. This handbook thus comprises two areas: (i) a general description of the challenges and opportunities, (ii) as well as recommendations on how to deal with these.



2 State of Literature

An extensive literature review clarifies the limited research conducted and subsequent literature available on so-called *mine closure management* and *post-mining management*. Whereas the general phrase “mine closure” returned an overall 21,800 results, the phrase “mine closure planning” scored 1,320 results. Much less developed is the literature on “mine closure management” with 100 results, reducing the results of the term “mine closure transition” to only 12 results. While the general phrase “post-mining” with 41,500 results reveals more developed literature than the general term “mine closure”, results on “post-mining planning” only score 73 results. While “post-mining management” has 317 results, “post-mining transition” only scores 77 results. In addition, in each of these phrase searches, when including terms such as “stakeholders”, “sustainable development” and “European Union”, results are even more vastly reduced. Lastly, and within the context of this handbook, results regarding phrases such as “mine closure” AND “management handbook” (84 results), “post-mining transition” AND “handbook” (27 results, “post-mining transition” AND “management handbook” (0 results) are extremely scarce to non-existent.

Table 1: Google Scholar database search (no limit)

Phrase Search	Nr. of Results
"mine closure"	21,800
"mine closure planning"	1,320
"mine closure planning" AND "stakeholders"	791
"mine closure planning" AND "sustainable development"	702
"mine closure planning" AND "stakeholders" AND "sustainable development"	590
"mine closure planning" AND "stakeholders" AND "sustainable development" and "European Union"	91
"mine closure management"	100
"mine closure management" AND „stakeholders"	64
"mine closure management" AND "sustainable development"	68
"mine closure management" AND "stakeholders" AND "sustainable development"	55
"mine closure management" AND "stakeholders" AND "sustainable development" AND "European Union"	6
"mine closure transition"	12
"mine closure transition" AND "stakeholders"	11
"mine closure transition" AND "stakeholders" AND "sustainable development"	11
"mine closure transition" AND "stakeholders" AND "sustainable development" and "European Union"	-
"post-mining"	41,500
"post-mining planning"	73
"post-mining planning" AND "stakeholders"	44
"post-mining planning" AND "sustainable development"	52
"post-mining planning" AND "stakeholders" AND "sustainable development"	38
"post-mining planning" AND "stakeholders" AND "sustainable development" AND "European Union"	3
"post-mining management"	317
"post-mining management" AND "stakeholders"	102
"post-mining management" AND "sustainable development"	103
"post-mining management" AND "stakeholders" AND "sustainable development"	95
"post-mining management" AND "stakeholders" AND "sustainable development" AND "European Union"	26
"post-mining transition"	77
"post-mining transition" AND "stakeholders"	72
"post-mining transition" AND "sustainable development"	68
"post-mining transition" AND "stakeholders" AND "sustainable development"	61
"post-mining transition" AND "stakeholders" AND "sustainable development" AND "European Union"	11
"mine closure" AND "handbook"	3,930
"mine closure" AND "management handbook"	84
"mine closure" AND "management handbook" AND "European Union"	27
"post-mining transition" AND "handbook	27
"post-mining transition" AND "management handbook"	-
"post-mining transition" AND "management handbook" AND "European Union"	-

Source: Google Scholar database search conducted on 13.02.2024.

Subsequently, concerning this gap in research and the limited literature available, further reference points are selected from the following sources having dealt with *mine closure management* and the *post-mining management* transition process:[1]

[1] These are listed according to year of publication (recent first).

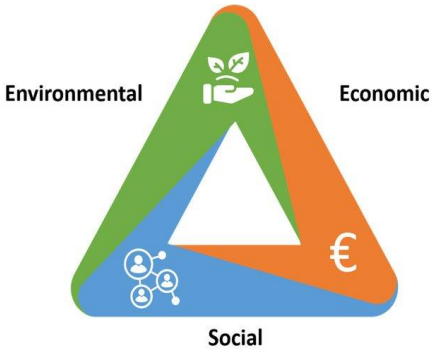
- Van de Loo, K. (2023) Grundlagen einer nachhaltigen Ökonomie der Transition von Bergbauregionen (dargestellt am Beispiel des Kohleausstiegs in Deutschland. Berichte zum Nachbergbau, Heft 4, THGA. Fundamentals of a sustainable economy for the transition of mining regions (illustrated using the example of the coal phase-out in Germany). https://fzn.thga.de/wp-content/uploads/sites/4/2024/01/Berichte-zum-Nachbergbau_Heft-4_vandeLoo_web_encoded-1.pdf
- **POTENTIALS: Best Practice Guidelines – Synergistic potentials of end-of-life coal mines and coal-fired power plants: update and re-adoption of territorial just transition plans.** December 2023 https://potentialsproject.uniovi.es/wp-content/uploads/2024/02/POTENTIALS_BEST-PRACTICE-GUIDELINES.pdf
- Wuppertal Institute (2022) **Just Transition Toolbox for coal regions.** https://webflow.henkelhiedl.com/wuppertal_institut/Just_Transition_Toolbox_for_coal_regions_EN.pdf
- International Energy Agency (2021) **Phasing Out Unabated Coal: Current status and three case studies.** https://iea.blob.core.windows.net/assets/861dc94d-a684-4875-80fb-a1faaf914125/PhasingOutUnabatedCoal-CurrentStatusandThreeCaseStudies.pdf
- EU Commission - EU Initiative for Coal Regions in Transition (2020):
    - **Toolkit Transitions strategies:** How to design effective strategies for coal regions in transition. https://energy.ec.europa.eu/document/download/b23e4e49-4b43-466f-9f08-359720acbde2_en?filename=transition_strategies_toolkit_-_platform_for_coal_regions_in_transition.pdf
    - **Toolkit Governance of transitions:** Design of governance structures and stakeholder engagement processes for coal regions in transition. https://energy.ec.europa.eu/document/download/93c3b4a0-12aa-4fda-a62f-eadd7cbc0be5_en?filename=governance_of_transitions_toolkit_-_platform_for_coal_regions_in_transition.pdf
    - **Toolkit Sustainable employment and welfare support:** How to accompany the labour market transition in coal regions in transition. https://energy.ec.europa.eu/system/files/2020-05/sustainable_employment_and_welfare_support_toolkit_-_platform_for_coal_regions_in_transition_0.pdf
    - **Toolkit Environmental rehabilitation and repurposing:** Guidance on the governance of environmental rehabilitation and repurposing in coal regions in transition. https://energy.ec.europa.eu/document/download/7b17af79-b4b2-482f-95c0-977b1c2fbb35_en?filename=environmental_rehabilitation_and_repurposing_toolkit_-_platform_for_coal_regions_in_transition.pdf
- World Bank (November 2018) **Managing Coal Mine Closure: Achieving a Just Transition for All.** https://documents1.worldbank.org/curated/en/484541544643269894/pdf/130659-REVISED-PUBLIC-Managing-Coal-Mine-Closure-Achieving-a-Just-Transition-for-All-November-2018-final.pdf
  9 lessons learned regarding coal mine closure.
- Edwards, D., Pahlen, G., Bertram, C. and Nathanail, P. (May 2005): **The RESCUE MANUAL: Best Practice Guidance for Sustainable Brownfield Regeneration.** Regeneration of European Sites in Cities and Urban Environments (RESCUE)**.**

The main issues and outcomes of these resources are used as reference points for this transition management handbook, and are elaborated in a comprised manner in the next section.

2.1 Management Rules of Sustainable Economy

In this publication, van de Loo (2023) sheds light on the fundamental requirements for post-mining from the perspective of the principles of "Sustainable Economy". To this end, focus on Rogall/Gapp-Schmeling's (2021) 15 management rules within a sustainable economy are outlined and applied to the opportunities and challenges of the transition of mining regions. First, however, their regulatory framework as well as their conceptual and instrumental foundations are clarified. Sustainable transition should encompass the following prime objectives: 1) a share of prosperity for society (social sustainability); 2) an endurance of positive economic development (economic sustainability), and; 3) the preservation of nature and heritage (environmental sustainability). Regarding the transition of mining regions, the extent to which the **social, economic and environmental** consequences associated with the coal phase-out in regions meet the requirements of a sustainable economy, and where improvements need to be made will be examined within the context of post-mining management.

Figure 2: Sustainability Triangle



Source: Sustainability Triangle (Rogall/Gapp-Schmeling 2021: 124).

With regard to the concrete implementation and operationalization of the 15 management rules, it is clear that: "in order to achieve the goals of sustainable management, a transformation process is required in which the management rules of sustainable management are adhered to. To this end, quality and action targets must be derived from the rules, and the degree to which these targets are achieved must be monitored using suitable indicators. (…) The degree to which the targets are achieved must be regularly reviewed in order to identify deficits and remedy them using suitable political and legal instruments. The effects of the instruments on the achievement of objectives must be evaluated" (Rogall/Gap-Schmeling 2021, 349).

Table 2: 15 Management Rules of Sustainable Economy

Environmental Dimension	Economic Dimension	Social Dimension
1. Climate compatibility	6. Secure jobs of appropriate quality	11. Good governance
2. Nature compatibility	7. Satisfaction of basic needs with sustainable products	12. Social security, no poverty
3. Sustainable use of non-regenerative sources	8. Appropriate prices (based on scarcity) performing an essential steering function	13. Equal opportunities, and distributive justice
4. Sustainable us of renewable sources	9. External economic balance with a high level of self-sufficiency	14. Conflict prevention
5. Healthy living conditions	10. Effective national budget and sufficient public goods	15. Risk-free techniques

Source: According to Rogall/Gap-Schmeling based on van de Loo 2023.

These management rules overlap with the UN Sustainable Development Goals, created in 2015, and are understood as guidelines and not as specific economic policy objectives. In this sense, this functions as a framework for recommendation where not all 15 rules can automatically be fulfilled, as some could be more prioritized than others on a transition timeline. Important nonetheless, particularly within the context of sustainability is that, although the weighing and application of these are reflected during the transition process, all rules are employed covering the whole spectrum of sustainable development, hence the environmental, the economic as well as the social-cultural dimension. The following is a brief explanation, including examples, of the environmental, economic and social management rules considered crucial for the implementation of a sustainable economy, according to van de Loo (2023, 29-31).

Environmental Dimension

1. *Climate compatibility:* (Structural Strengthening Act/CriT/Just Transition Initiative/Green Deal)
   The release of, in particular, greenhouse emissions should not exceed in relation to climate change.
2. *Nature compatibility:* (Rehabilitation/Repurposing/Renaturing)
   Timing and extent of human intervention or input to the environment should allow sufficient time for its stabilization.
3. *Sustainable use of non-generative sources:* (Shortage/price increases)
   When using non-renewable resources, the “compound saving rule” should be applied so that the resource is never completely exhausted, or is exhausted as late as possible.
4. *Sustainable use of renewable sources:* (Construction of wind turbines/solar power)
   The usage of renewable sources should not exceed the regeneration rate of the respective source, as the ecological real capital should be preserved.
5. *Healthy living conditions:* (Occupational health and safety/tightening of emissions limits/green infrastructure/revier parks)
   Political and economic decisions should consistently take into account the impact on human health and life, minimizing risk and damage to people and the environment.

Economic Dimension

6. *Secure jobs of appropriate quality:* (Regional unemployment rate/area renovation/real estate business/orientation towards renewable energies/environmental engineering services/investments in education/training/retraining/skilling)
   Employment in appropriate quality (decent work) should be secured and precarious employment relationships should be avoided.
7. *Satisfaction of basic needs with sustainable products and services:* (Dissemination/application of new knowledge with existing resources - university and research location (public education investments/ industry with traditional sectors (steel, chemicals, mechanical engineering)/new industries (environmental technology) and service sectors (logistics, health care, IT-services)
   Basic and collective needs should be provided for within a framework designed for markets to simulate innovation with a view towards a sustainable economy.
8. *Appropriate prices (based on scarcity) performing an essential steering tool:* (Coal phase-out within context of general price developments/influences CO2 EU-ETS pricing/fluctuations in raw material prices).
   Market prices should reflect the actual scarcity of resources and production factors and be efficient. If they are not, sustainability standards should be achieved through political and legal instruments.
9. *External economic balance with a high-level of self-sufficiency:* (Generation of high regional export surpluses/goods and businesses)
   A long-term external economic balance should be striven for, preventing distortions of competition and excessive economic dependencies.
10. *Effective national budget and sufficient public goods:* (Financial commitments from German government/coal states/EU (Just Transition Fund) regional-political programs secured through legal measures (Structural Strengthening Act) or public contracts.

The national budget should be balanced while adequately providing public goods such as infrastructure, education, social security, etc.

Social Dimension

11. *Good governance:* (Form of regional governance shaped by national/supranational (EU) decisions/active participation/integration of stakeholders (chambers/associations/trade unions/environmental organizations/citizens' initiatives) RAG-Stiftung/Initiative "Wandel als Chance"/RVR Bergbauflächenvereinbarung/Mining Area Agreement)
    Political and economic decisions should be aligned with the management rules of sustainability in order to permanently maintain the social institutions that are indispensable for the success of economic development and quality.
12. *Social security:* (State support for early retirement/company job changes as part of internal company restructuring/active employment impulses)
    Members of society receive social security benefits according to their needs or contributions made.
13. *Equal opportunities and distributive justice:* (Principle of equivalence of living conditions/sustainable spatial development/planning/economic efficiency)
    Equal opportunities and distributive justice should be ensured for current and future generations.
14. *Conflict prevention:* (Avoidance of structural economic disruption/preservation of social cohesion/securing sustainable value chains and employment/sustainable living conditions/creation of attractive regions with dynamic economy/good jobs and innovative energy/environmental remediation/early retirement rules with state adjustment aid/compensation for loss of income/training measures/personnel development)
    Stable national and international security should be provided.
15. *Risk-free techniques: (*Use of hydrogen technology/RWE and Open Grid Europe project/CO2 Compass Ruhr Area.)
    A precautionary principle should be applied to ensure the use of risk-free techniques. These are to be taken into account in relation to all three dimensions of sustainability.

For affected regions, coal phase-out means a loss of "geographically determined and economically and historically developed industrial core" (van de Loo 2023, 51). Hence, these regions are faced with various challenges and opportunities concerning all three dimensions of sustainability.

2.2 IEA Coal Phase-Out Recommendations

Based on the coal phase-out experiences of three case studies (Canada, UK and Germany), six recommendations are represented by the IEA:

1. **Allow sufficient time for consultation and implementation.** Phasing out coal may be a long and complex process. It may face political challenges and have numerous effects on communities, electricity prices, security of electricity supply and beyond. All these impacts need to be properly accessed and communicated to the public, together with the benefits involved.

2. **Provide support for affected workers and communities.** When coal plants and coal mines close, communities lose jobs and revenue. As a result, workers need compensation and reskilling, and both workers and capital need to be redeployed as part of comprehensive strategies.

3. **Ensure that security of electricity supply is a cornerstone of phase-out policies.** Security of electricity supply should be paramount. Plant closures should only proceed if security of electricity supply can be maintained by combining supply, demand and storage technologies with interconnections to reliable sources.

4. **In many regions, a key way of reducing coal generation is to establish a CO_2 price or a similar instrument**, such as a carbon tax, that encourages power plant operators to reduce the amount of CO_2 they emit. CO_2 prices can affect business competitiveness and

affordability of energy supplies, so these economic impacts need to be considered.

5. **Improve the climate for investment in clean electricity and the necessary infrastructure.** If there is to be a smooth transition away from coal-fired power generation, investment in energy efficiency, low-carbon generation and electricity transmission and distribution networks needs to accelerate. Mobilisation of investment in electricity networks is likely to be challenging. Long approval processes and frequent delays, often linked to public opposition concerns, can present major obstacles to development.

6. **Consider conversion of coal generation assets.** Converting coal-fired plants to low-carbon uses not only helps to phase out coal but also reduces the need for new transmission investments. Plants can be retrofitted to enable carbon capture, utilisation and storage (CCUS) or to use low-carbon fuels such as biomass or ammonia. They can also be converted to provide the ancillary services necessary to support electricity transmission from generators to consumers, such as frequency control. This can be a useful means to obtain an adequate return from existing assets and reduce emissions while keeping jobs and wealth in local communities (IEA 2021: 8).

2.3 World Bank: Managing Coal Mine Closure – Lessons Learned

The 2018 World Bank publication highlights the main concerns and challenges of coal mine closure, faced in particular by coal-dependent regions, and proposes 9 lessons learned on managing coal mine closure in diminishing the impacts of mine-affected societies. As domestic policy responses to coal mine closure regarding "job losses, and the subsequent socioeconomic impacts borne by families and communities in coal-dependent regions, are significant" (World Bank 2018: 9), these lessons are organized in three pillars: 1) Policies and strategy development; 2) People and communities, and 3) Land and environmental remediation. With the objective "to guide policy makers for more successful future mine closures" (World Bank 2018: 13), these lessons are drawn from coal mine closure experiences in China, the Netherlands, Poland, Romania, Russia, Ukraine, Poland, Romania, the United Kingdom and the United States.

Table 3: Lessons Learned on Post-Mining Management

Pillar 1: Policies and strategy development • Strong government commitment • Legal and regulatory review • Stakeholder engagement • Adequate budgets	**Lesson 1:** Managing the social and labour impacts is best achieved when multiple agencies participate. **Lesson 2:** Given the short-term high costs, meeting substantial budget needs is challenging. **Lesson 3:** Social conflicts can be avoided with stakeholder consultation starting at the planning phase and continuing throughout the process of closure.
Pillar 2: People and communities • Pre-unemployment planning • Pre-unemployment assistance • Post-unemployment assistance	**Lesson 4:** Focus on a systematic process in diminishing the social and labour impacts on mine-affected society before unemployment. **Lesson 5:** Pre-inform employers on unemployment planning/assistance. **Lesson 6:** Offer unemployment assistance such as temporary income support. **Lesson 7:** Introduce active labour market policies to encourage/enable re-employment
Pillar 3: Land and environmental remediation • Prevent negative impacts to soil, water and air resources • Restore quality of soils to pre-mining level	**Lesson 8:** Address environmental reclamation at the mine planning process. **Lesson 9:**

• Maintain/improve landscape and functional quality	Guarantee funding through financial assurance mechanisms.

Source: Based on World Bank 2018: 11.

This research points to the necessity of the important leadership role required of governments to early-stage planning, consistent dialogue with stakeholders, provision of pre- and post-unemployment planning and assistance, financing and technological solutions for environmental and land reclamation. “A window of opportunity exists to improve on past closure experiences and record new best practices for industry and society at large” (World Bank 2018: 49).

2.4 EU Initiative Coal Regions in Transition -Toolkits

With coal transition being part of an EU-wide framework, the EU Commission launched the “Coal Regions in Transition” (CRiT) initiative in December 2017, with the aim to promote structural change away from coal mining and its usage. This initiative is an open information and dialogue forum encompassing all relevant stakeholder and “represents a unique, bottom-up approach to a just transition, enabling regions to identify and respond to their unique contexts and opportunities”.[2] In the context of the European Green Deal, the Just Transition Mechanism (2021-2017) addresses the regional social and economic consequences which can be technically and financially alleviated by the Just Transition Fund, thereby supporting such aspects like productive investment in small and medium-sized enterprises, creation of new firms, research and innovation, environmental rehabilitation and repurposing, reskilling of workers, job-search assistance, as well as the transformation of existing carbon-intensive installations when these investments lead to substantial emission cuts and job protections.

To assist policy-makers and stakeholders in coal regions, of particular importance within the CRiT context are the guidelines for transition strategy development, officially referred to as “toolkits” which illustrate the strategies potentially to be applied by coal regions in transition for an economic, environmental and social sustainable coal phase-out. Through acknowledgment of the fact that no “one size fits all” strategy exists, focus is on key aspects of transition, strategies, governance, employment and welfare support, as well as environmental rehabilitation. Policy-makers and stakeholders receive support concerning;

- Transition strategy development, actor identification, strategy evaluation and adaption **(Transition strategies toolkit)** (European Commission 2020);
- Creation of effective governance models, promote civil society role, improve stakeholder engagement/social dialogue processes **(Governance toolkit)** (European Commission 202b);
- Managing labour market transition for long-term job creation **(Sustainable employment and welfare toolkit)** European Commission 2020c), and;
- Guiding environmental rehabilitation and repurposing of infrastructure emphasising the governance process **(Environmental rehabilitation and repurposing toolkit)** (European Commission 2020d).

In view of the enormous diversity of coal regions, this EU-wide provision of toolkits contains general recommendations for dealing with the ongoing and imminent transition away from coal.

2.5 Wuppertal Institute: Just Transition Toolbox

In collaboration with the CriT Initiative, the Wuppertal Institute developed the Just Transition Toolbox highlighting numerous experiences and learnings from coal regions on a global scale. It is centred around five primary themes; 1) strategy; 2) governance; 3) energy; 4) industry, and; 5) employment (Wuppertal Institute 2022: 10).

1. Strategies

Strategies or plans that guide choices and actions during the transition process

- Development of a regional transition strategy
- Identification of objectives/projects to support the transition strategy

[2] https://energy.ec.europa.eu/topics/oil-gas-and-coal/eu-coal-regions-transition_en

- Monitor, adapt and evaluate the transition strategy

2. Governance

Governance structures/mechanisms to plan, coordinate and manage the transition

- Design an effective governance model
- Facilitate stakeholder engagement
- Enhance participation of civil society

3. Energy

Supporting the shift from fossil to renewables

- Coal-related infrastructure repurposing options
- Renewable energy/technologies

4. Industry

Supporting decarbonisation of energy-intensive industries

- Create technology options to support decarbonisation
- Enhance infrastructure and production of hydrogen

5. Employment

Creation of sustainable employment and new business opportunities

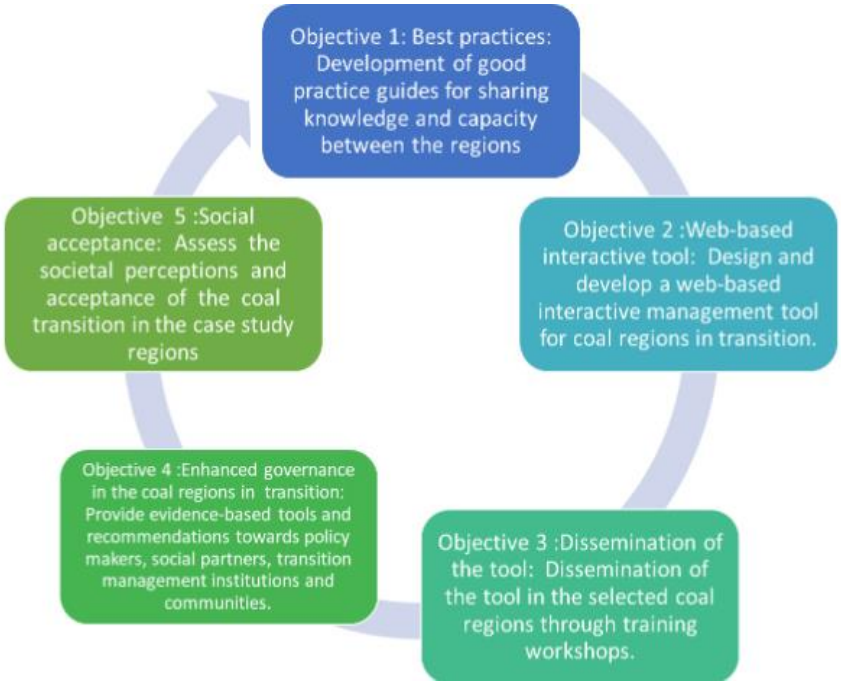
- Support for displaced workers
- reskilling and re-employment and training programmes
- Economic diversification/investments

It is “always better to have a managed transition than an unmanaged structural change process” (Wuppertal Institute 2002:6), as coal transition does not happen overnight, hence affected regions ought to commence a managed transition as early as possible.

2.6 Summary State of Literature

Based on the above-mentioned literature, within the concept of “Just Transition” consensus concerning the most significant dimensions when it comes to post-mining management are the environmental, economic and social dimensions. This is very much in line with WINTER’s overall objectives.

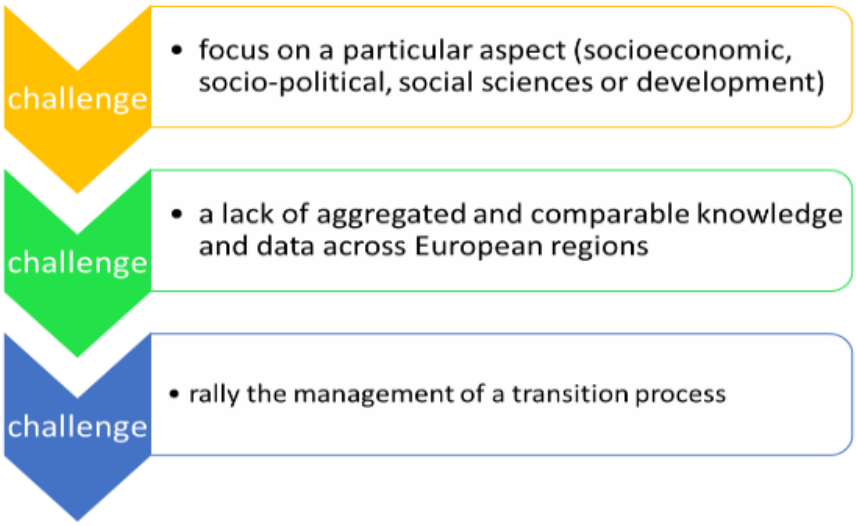
Figure 3: WINTER objective



Source: https://winter-project.eu/wp-content/uploads/2023/01/WINTER_D1.1_Comprehensive_Project_Overview.pdf

Based on the environmental, economic and social dimension of sustainable economy and the four themes of significance during the post-mining transition process, which is in line with the WINTER projects objectives, the handbook is centered around 1) transition strategies, 2) transition governance, 3) sustainable employment and welfare, and 4) environmental rehabilitation and repurposing. This comprehensive focus on including the integration approach of management of a transition process, thus post-mining management, contributes to WINTER's aim in applying a holistic approach to post-mining management (WINTER Del.1.1: 13).

Figure 4: Main challenges



Source: https://winter-project.eu/wp-content/uploads/2023/01/WINTER_D1.1_Comprehensive_Project_Overview.pdf

2.7 Further Resources on Just Transition Concept

- European Commission (2020) A Strong Social Europe for Just Transitions. https://eur-lex.europa.eu/resource.html?uri=cellar:e8c76c67-37a0-11ea-ba6e-01aa75ed71a1.0003.02/DOC_1&format=PDF
- International Institute for Sustainable Development (2020): Real People, Real Change Strategies for Just Energy Transitions. https://www.iisd.org/publications/report/real-people-real-change-strategies-just-energy-transitions?q=publications/real-people-real-change-strategies-just-energy-transitions
- International Labor Organization (2015) Guidelines for a just transition towards environmentally sustainable economies and societies for all. https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@ed_emp/@emp_ent/documents/publication/wcms_432859.pdf
- Robins, N., Brunsting, V. and Wood, D. (2018) Climate Change and the Just Transition: A Guide for Investor Action. Grantham Research Institute on Climate Change and the Environment. https://www.unpri.org/download?ac=9452
- World Resources Institute: Just Transition and equitable climate action resource center https://www.wri.org/just-transitions
- United Nations Framework Convention on Climate Change (2020) Just Transition of the Workforce, and the Creation of Decent Work and Quality Jobs. Technical Paper. https://unfccc.int/sites/default/files/resource/Just%20transition.pdf

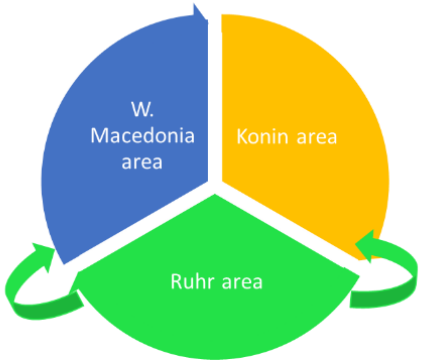
3 Transition Strategies

3.1 Best Practice Transition Strategies - Ruhr Area

In the WINTER project, the Ruhr area is perceived as the “mirror” of the transition strategies of the Konin and Western Macedonia regions because, due to their stage of processes, the latter regions have the opportunity to gain experience from the former. Although the Ruhr area cannot act as a type of blue-print for other coal-phase out regions, due to this vast experience in post-mining management and despite having specific regional characteristics, the Ruhr area provides potential transferable lessons to be learned for other regions within or initiating a phase-out ahead.

Figure 5: The Ruhr Area as "mirror region"

“mirror” of the transformation strategies



Source: https://winter-project.eu/wp-content/uploads/2023/01/WINTER_D1.1_Comprehensive_Project_Overview.pdf

In 2008, the German government decided to phase out hard coal mining by 2018. This decision enabled the coal mining regions in Germany, the Saar and the Ruhr region to prepare the post coal mining time within this period of 10 years. In the metropolitan Ruhr region, the challenge was and still exists to successful transform the former mining region. The cities and districts in the Ruhr region concluded **jointly to cooperate and to initiate an intercommunal decision matching and dialogue process.** The first step towards this was the development of strategic perspectives including:

- Concept Ruhr (2008-2018:

A 10-year phase out transition strategy involving regional development and master plans encompassing 15 mine sites for short- and long-term closures;

- Change as a Chance (2008-2014):

Joint implementation of medium- and long-term concepts signed by the regional association Ruhr RVR (an association of the eleven cities and four districts of the Ruhr region), the Ministry of Economics NRW, the coal mining company RAG and its subsidiary RAG Montan Immobilien (the Real Estate company). Encompassing more than 40 cities and communities in the Ruhr Area, this strategic perspective described the framework conditions, coordinated strategy, technological valorisation, thus stating fundamentals for joint local and regional actions;

- Coal-Brown Field Agreement (2009-2014):

A steering committee was established consisting of representatives of the municipalities, of the director of the regional association Ruhr, of the Ministry of Economics of North Rhine Westphalia, of the respective functional departments of the Ministries and of the District Councils as well as of the board of directors of the coal mining company and is steering the entire process on decision level. 20 hard coal mine sites were selected for accelerated development and provided a formal framework for activities such as:

  - Surface area: realisation of successful land usages;
  - Financial dimension: financing models and access to funding grants;
  - Time dimension: coordinated/integrated developments and acceleration of processes;
  - Organisation: reliable and target-oriented collaboration of the partners;

- Annual progress reports: knowledge transfer, transparency and common evaluation.

The Coal Brownfield Agreement is an interesting model for the transformation of mine and industrial sites. As a regional instrument and considering social, environmental and economic objectives, it can provide valuable advice for the transition of other coal phase-out regions.

3.2 Best Practice Transition Strategies – Western Macedonia

Western Macedonia in Greece is facing a major transition in order to be adapted to a diversified and sustainable economy. Best practices for adaptation in Western Macedonia, focusing on governance, social impact, land use, clean energy, smart agriculture, infrastructure, and technology, are presented below.

A transparent and inclusive governance structure is needed. This includes national, regional and local governments, civil society organizations, the trade association and academic players. The framework oversees the design, implementation, monitoring and evaluation of transformation activities and projects. Active engagement of all stakeholders ensures that the transition process is transparent addressing community needs and aspirations.

Strategies focus on assessing workforce needs and mitigating the adverse effects of the transition, such as job losses and social exclusion. Initiatives include skills development, employment support, and social protection measures. In this case, people's involvement assists them to feel that they are involved in the transition process and thus belonging to society something that leads to social cohesions as well as making sure that the benefits of the transition are well known and shared among people.

One of the most important steps comes down to positive identification of potential multiple land uses for the post-mining territories. This involves the modification and development of sites for renewable energy plants, tourism, agriculture and industries for environmental, economical and social aims. Efforts to attract new investments in these areas are vital for economic revitalization. Public-private partnerships and funding from national and regional grants, as well as the EU's Just Transition Mechanism, play a crucial role.

Development of photovoltaic parks, such as the projects by RWE and PPC Renewables, which include five photovoltaic projects with a total capacity of around 210 MWp. Initiatives like Hellenic Hydrogen's electrolysis unit and the Blue Med project focus on large-scale renewable electricity production and green hydrogen. Ensuring compliance with renewable energy regulations and alignment with regional energy transition plans enhances the feasibility and acceptance of clean energy projects.

In addition, implementing smart agricultural practices and technologies increases productivity and sustainability. Projects like intelligent livestock units and hydroponics are supported. These initiatives not only improve the economic viability of the region but also create jobs and attract external investments.

Establishing parks for the development of electric mobility infrastructure, including a potential battery plant, fosters industry growth and competitiveness. Development of sustainable tourism initiatives and fostering a regional innovation ecosystem support long-term economic growth and diversification.

In conclusion, Western Macedonia's transition strategies exemplify best practices in managing the shift from coal dependency to a sustainable and diversified economy. By focusing on governance, social impact, land use, clean energy, smart agriculture, and industry and technology, the region is set to achieve a just and equitable transition, ensuring long-term environmental, economic, and social benefits for its communities.

3.3 Best Practice Transition Strategies – Konin Region

In the Konin region of Eastern Wielkopolska, the transition from brown coal dependency is guided by a comprehensive suite of strategic documents at various governance levels. These strategies incorporate national, regional, and local initiatives, presenting a holistic approach to ensure a balanced, sustainable development that respects both socio-economic and environmental stakes.

Key Strategic Documents:

- **National Energy and Climate Plan (NECP) for 2021-2030:** Sets ambitious national targets for CO2 reduction, renewable energy integration, and energy efficiency, providing a strategic backdrop for regional actions.
- **Energy Policy of Poland until 2040 (PEP2040):** Aligns with EU climate goals, focusing on a just transition, zero-emission energy systems, and improved air quality. It outlines significant objectives such as increasing renewable energy usage, enhancing energy efficiency, and expanding offshore wind energy capacity.
- **Territorial Just Transition Plan for Eastern Wielkopolska:** Tailored to the specific needs of the region, this plan addresses the socio-economic impacts of transitioning from coal, aiming for climate neutrality by 2040. It focuses on energy efficiency, renewable energy (including green hydrogen), and fostering a circular economy.
- **Reclamation Plan and Entrepreneur's Plans:** Detail the post-mining land use and economic re-purposing strategies, emphasizing sustainable land management and innovative industrial transformation.

As the Konin region navigates its transition, it is underpinned by several strategic pillars that guide its efforts. These pillars not only reflect the ambitions laid out in the guiding documents but also embody the practical steps being taken on the ground to achieve a resilient, diversified, and sustainable regional economy. This structured approach ensures that the transition is managed effectively, leveraging local strengths and aligning with broader national and EU policies.

Strategic Pillars for Konin's Transition (Territorial Just Transition Plan for Eastern Wielkopolska):

- **Establishing a Zero-Emission, Dynamic, and Circular Economy:** This objective focuses on propelling Eastern Wielkopolska towards a sustainable future free from the reliance on coal and traditional energy sources. By capitalizing on the region's inherent capabilities, it aims to enhance both new and existing economic sectors, ensuring their alignment with the goals of achieving a climate-neutral and circular economy.

- **Creating Integrated High-Quality Spaces:** This pillar emphasizes the enhancement of living conditions by improving the quality and functionality of residential zones, thus ensuring a superior living environment for all residents. The focus is on the regeneration of areas impacted by industrial activities, with initiatives aimed at restoring previous functions or introducing new functionalities to these areas, ultimately aiming to minimize the environmental footprint left by mining.

- **Cultivating an Active Society:** Acknowledging the vital role of an engaged and proactive community in driving the region's transformation, this strategy addresses major challenges that undermine socio-economic growth, such as demographic shifts, social inequalities, and the negative impacts of economic transition. Efforts are directed towards empowering local residents, reducing social exclusion, and enhancing the availability of high-quality, affordable social services.

By the year 2030, Konin aspires to fully transition from its historical reliance on coal, marking a significant shift towards a more sustainable and resilient energy framework. This ambitious goal

is supported by substantial investments aimed at enhancing the region's renewable energy capabilities and establishing a pioneering green hydrogen economy. Such transformative actions reflect a strong commitment to innovation and sustainability in energy production.

The region's strategic initiatives are tightly aligned with both national policies and European Union directives, reflecting a deep integration of Konin's local ambitions with broader, strategic goals. These efforts are designed not only to meet the rigorous targets set forth by the National Energy and Climate Plan and the Energy Policy of Poland until 2040 but also to exceed them. By doing so, Konin seeks to lead by example in the national context, contributing significantly to Poland's overall climate commitments under the Paris Agreement and the European Green Deal.

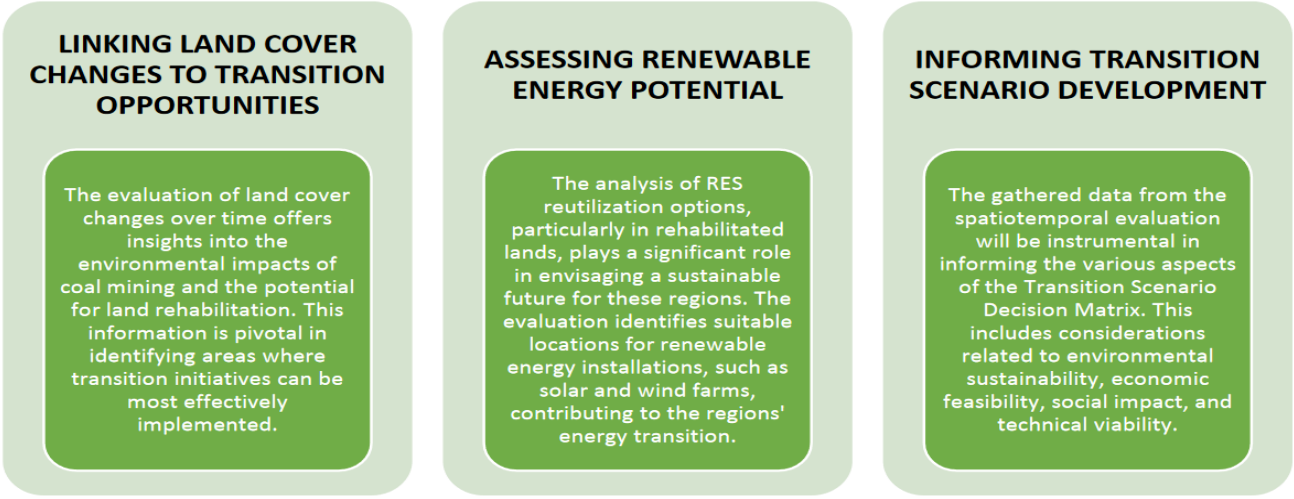
Furthermore, the strategic alignment with the EU's Just Transition Mechanism ensures that Konin's transition is not only environmentally sustainable but also socially equitable. This approach promises to foster economic growth and development while ensuring that the social fabric of the region is strengthened during this period of significant change. By integrating these elements, Konin's strategy aims to build a robust framework that will facilitate a successful transition to a zero-emission future, ensuring long-term environmental, economic, and social benefits for its communities.

3.4 Key Recommendations

While coal transition highlights certain common challenges and opportunities for all coal-affected regions, the actual framing of transition strategies should be region-specific, taking local economic, socioeconomic and environmental dimensions into account. Although there is thus no one-size-fits-all approach, by focussing on the development of a transition strategy, and not on the actual content of this, transitional strategies overall require;

- the engagement of all affected stakeholders and communities from early stages;
- combination of short-term goals and long-term objectives towards climate neutrality;
- encompassing a sound structure and effective approach of: 1) problem analysis and agenda-setting; 2) visions and objectives; 3) options and actions, and; 4) monitoring and adaptation.
- Comprehensive methodology for the:
    - **selection of transition strategies** (application of spatiotemporal evaluation and a decision matrix);
    - **strategy preparation** (Renewable Energy Source Utilization Scenario and Highest Feasibility Scenario);
    - **strategy evaluation** (SWOT-Analysis)

Figure 6: The role of spatiotemporal analysis in transition strategy formulation



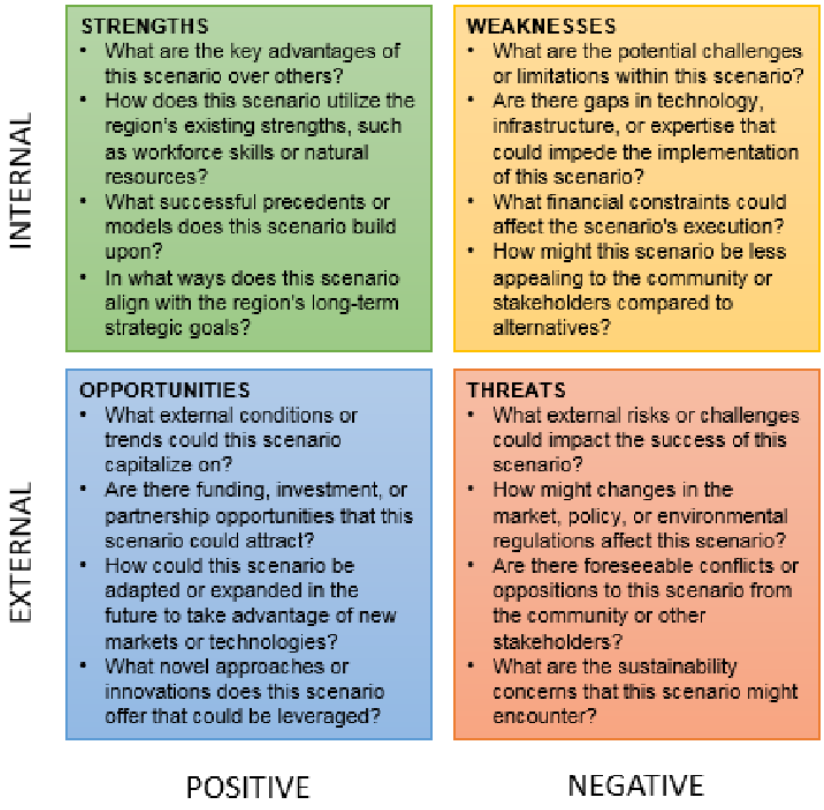
Source: https://winter-project.eu/wp-content/uploads/2024/01/WINTER_D2.3_part_2_transition-scenarios.pdf

Figure 7: Evaluation criteria description

CRITERIA	DESCRIPTION
Economic Viability	This criterion evaluates the financial aspects, including potential return on investment, job creation, and the ability to attract external investments.
Environmental Impact	Assesses the environmental implications, such as carbon sequestration capabilities, effects on local ecosystems and biodiversity, and the potential for water and soil conservation
Social Acceptance and Stakeholder Support	Measures the level of community support, the potential to address social issues, and the backing from key stakeholders, including government, NGOs, and the business community.
Technological Feasibility	Looks at the availability and readiness of technology, infrastructure requirements, and innovation potential.
Regulatory & Legal Considerations	Reviews compliance with regulations, potential legal challenges, and the availability of incentives or subsidies. Includes consideration of how well the scenario fits within the framework of national/regional/local transition plans.
Sustainability	Considers the long-term viability, resilience to external shocks, and contribution to the UN Sustainable Development Goals.

Source: https://winter-project.eu/wp-content/uploads/2024/01/WINTER_D2.3_part_2_transition-scenarios.pdf

Figure 8: Guiding questions for SWOT analysis of transition strategies



Source: https://winter-project.eu/wp-content/uploads/2024/01/WINTER_D2.3_part_2_transition-scenarios.pdf

Transition strategies constitute a crucial element in the analysis and planning of social, economic and environmental transformations. Their significance arises from several key aspects that are worth highlighting:

1) Understanding Complex Regional Challenges – Transitions strategies provide a framework for gaining a comprehensive understanding of the intricate challenges that regions confront. These challenges can encompass economic, social, and environmental dimensions. By envisioning different development pathways, stakeholders can gain insights into the potential outcomes and impacts of their decisions

2) Guiding Informed Decision-Making – Transition strategies serve as valuable tools for guiding informed decision-making. They enable policymakers and stakeholders to explore diverse scenarios, assess their implications, and identify strategies that lead to sustainable and resilient outcomes. This informed decision-making process is essential for addressing the wide-ranging challenges that regions face. The strategies developed are a key aspect of analysis, providing insight into the region's potential transformation trajectories. These strategies have to be carefully designed to take into account the specific challenges and opportunities of post-mining.

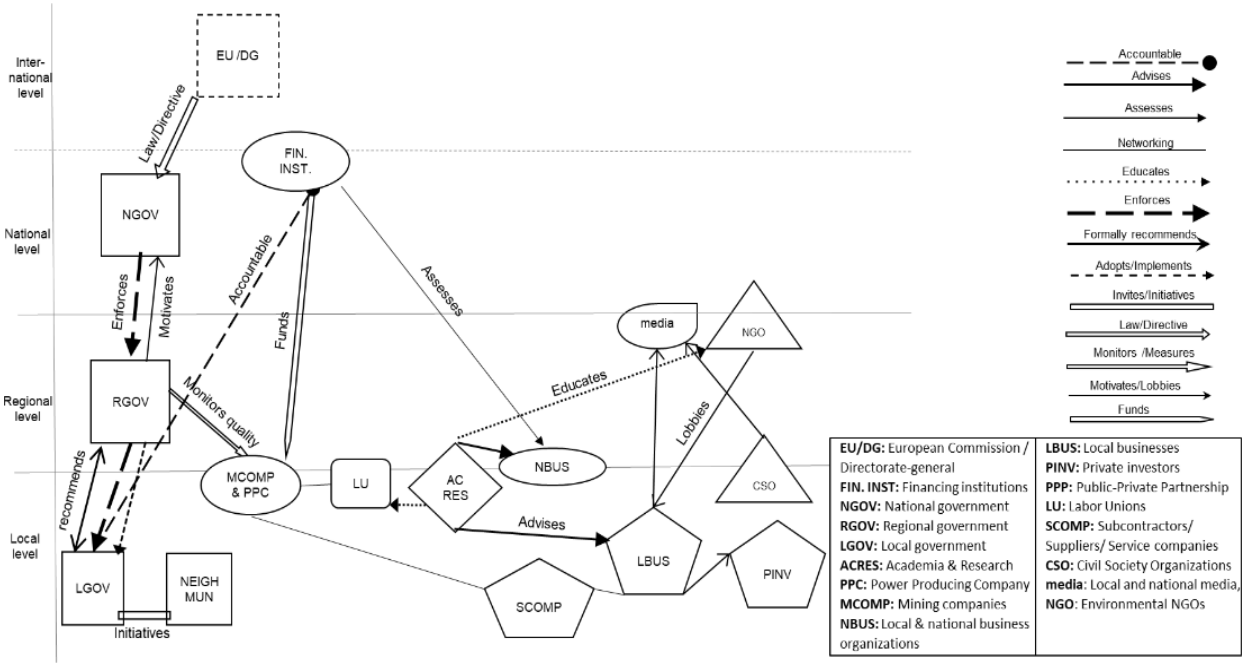
4 Transition Governance

In context with the coal transition, the European Commission terms a governance model as “the arrangement put in place by a national or regional authority to deliver its coal transition strategy in a way that is effective within the broader governance context prevailing in the region”. According to Roche (2020) the term governance summarizes the different ways in which actors and factors can interact in the pursuit of a collective goal, and the formal and informal means by which they can be influenced. In this context the Regional Governance describes a steering approach for complex, self-organizing networks under political leadership. At its core, this approach is based on the interest-driven cooperation of individual actors. The term Good Governance refers to the way in which decisions are made and implemented in a state. Good governance is not limited to the government, but applies to all those affected and involved. The German Federal Ministry for Economic Cooperation and Development expresses Good Governance as transparent, effective and accountable. It involves the whole population and considers the needs of minorities and the weak. Good governance therefore involves effective planning based on a multi-level and multi-actor perspective including the engagement of local stakeholders and the local economy, in order to include social justice and minimize the costs of social hardship.

4.1 Best Practice Transition Governance – Ruhr Area

The formal structure of the planning framework in Germany is derived not least from the history of the past century. Like the political and administrative systems, the structure is both hierarchical and dispersed. With regard to spatial planning, the federal government represents the highest level, yet it has no direct planning authority. The federal government has a coordinating framework competence while, at the lowest level, the municipality is the supposedly lowest-ranking link in the planning framework, but in contrast to the federal level, it has the most spatial planning powers. In Germany, municipal planning sovereignty is a constitutionally protected asset (Article 28 of the Basic Law).

Figure 9: Organigraph Germany

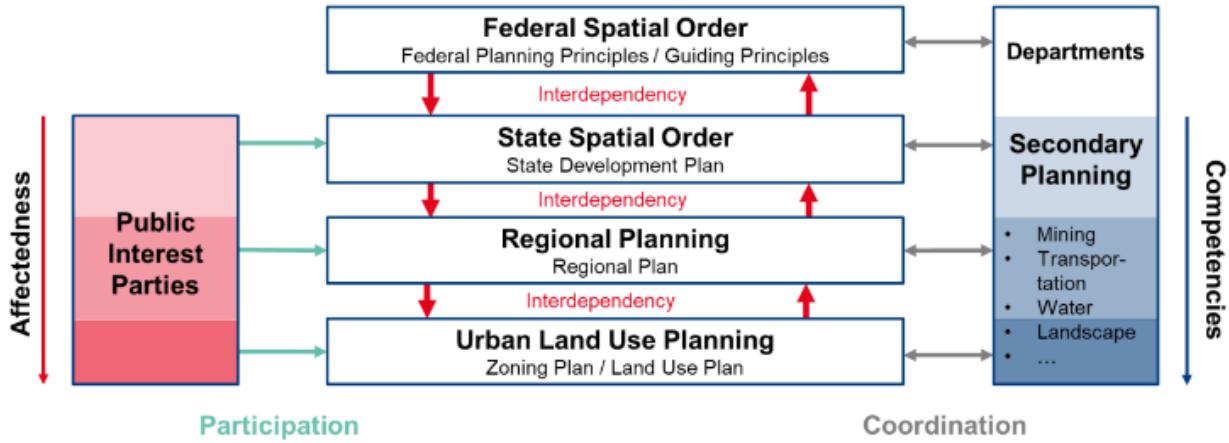


Source: https://winter-project.eu/wp-content/uploads/2023/04/WINTER_D3.1_Report_of_an_ideal-type_governance_and_management_structures_for_transition_regions.pdf

Between the federal level and the municipal level, federal states advance their own spatial planning in the form of state development plans. The principle of countervailing influence structures this interdependence and provides a framework for a state's spatial order, where the differently scaled areas and regions form distinctive interdependencies.

The development and subsequent use of former mining sites requires release from mining law through termination of the final operating plan. As long as the final operating plan is being executed and is the responsibility of the mining contractor, the approving mining authority is responsible for supervision. The final operating plan regulates the handling of pre-exploited soil, erected structures and shows the scope of revitalization measures to be done in accordance with the Federal Mining Act and in coordination with affected environmental law. Planning authorities may be involved as part of the final operating plan. Nevertheless, the application of the Building Code by the authorities and the corresponding further determination of post-mining land uses only takes place after completion of the final operating plan procedure.

Figure 10: Principle of countervailing influence



Source: https://winter-project.eu/wp-content/uploads/2023/04/WINTER_D3.1_Report_of_an_ideal-type_governance_and_management_structures_for_transition_regions.pdf

In Germany, when looking at the respective stakeholder systems, it becomes clear that these are mostly distributed on two transition levels, the local and regional scale. When applying the requirement to governance structures, it is not only a matter of fulfilling the requirements of good governance; the development of regionally significant areas is much more a matter of pursuing the public interest. In the development of post-mining landscapes, however, special attention must be paid to the ownership status of areas previously used for mining. The protection of property serves to maintain financial and in rem security and is thus a fundamental pillar of relative prosperity in the EU and many member states. In many scenarios, ownership of transition-related areas rests with private mining companies. Experience has shown that the right to dispose of these areas is rarely in public hands. Ownership is usually accompanied by economic interests of the owning companies. These may prevent the pursuit of the public interest in the development of such sites. The formation of regional forms of cooperation is able to enforce public interests and at the same time to satisfy economic ones. In Germany, the RAG and its affiliate RAG MI, an experienced mining company, are available as partners for the RVR and affected municipalities for the development of a post-mining landscape.

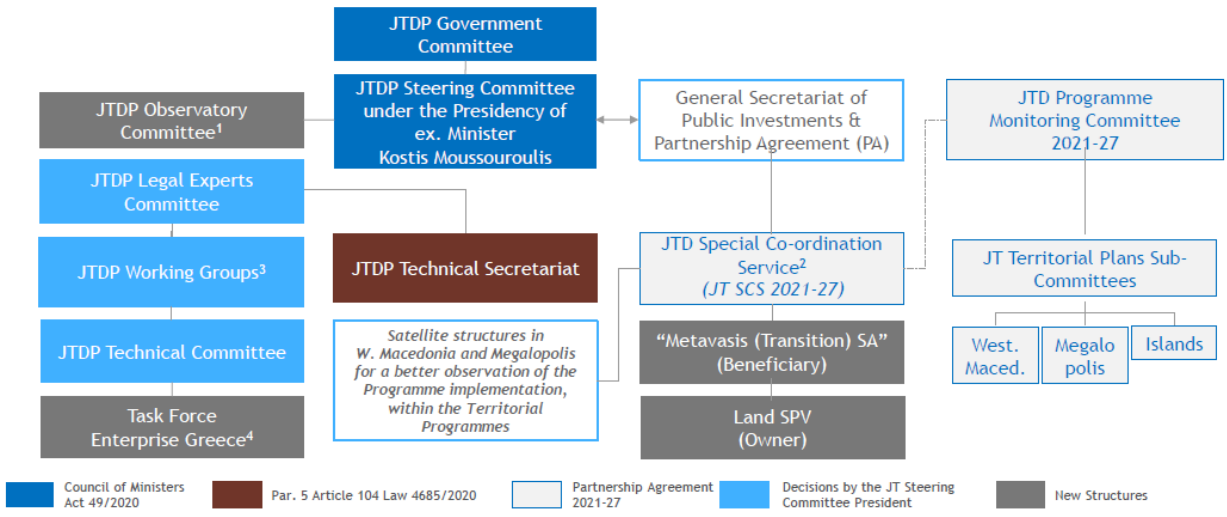
4.2 Best Practice Transition Governance – Western Macedonia

The de-lignification program of the domestic electricity generation foresees the parallel adoption of integrated programs to support the Greek lignite regions for the transition. In particular, the commitment of the Greek Government is the withdrawal of lignite power plants by the year 2028 in a coordinated and responsible manner. The goal of complete decarbonization of the country, by 2028, is reflected in the forecasts of the National Energy and Climate Plan (ESEK, Government Gazette B' 4893/31-12-2019), which ensures the stability of the electrical system and the energy security of the country.

The governance model for the transition of the lignite regions includes (Figure 11):
1. The Governmental Committee
2. The Steering Committee
3. The Technical Secretariat
4. The Special Coordination Service
5. The Observatory Committee
6. The Technical Committee and the Task Force Enterprise Greece
7. The Programme Monitoring Committee and regional sub-committees
8. “Metavasis SA”

In general, the governance structure is complex with many of these committees to have overlapping responsibilities (see deliverable 3.1).

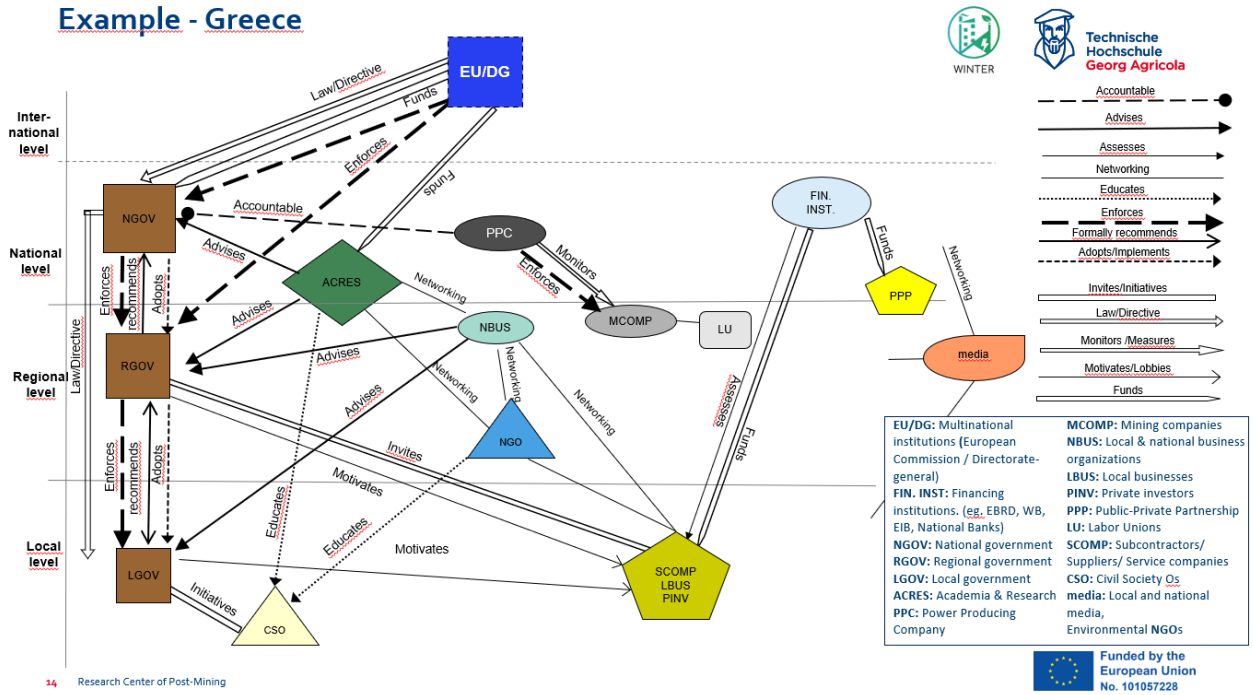
Figure 11: Governance model of the transition process in Greece



Source: https://www.sdam.gr/index.php/node/252

As it is shown in Figure 12 and based on the stakeholder group analysis, it becomes clear that the most influential stakeholders are mostly distributed between the national and regional scale. It is recommended to shift the main governance model towards the regional – local level for a more efficient and just transition.

Figure 12: Organigraph Greece



4.3 Best Practice Transition Governance – Konin Region

In Poland, the governance of spatial planning is inherently hierarchical yet crucially dependent on both vertical alignment and horizontal cooperation across various levels of government. The national, voivodeship, and local levels each play specific roles in the planning and execution of spatial development, which is essential in the context of transitioning away from coal dependency in regions like Konin.

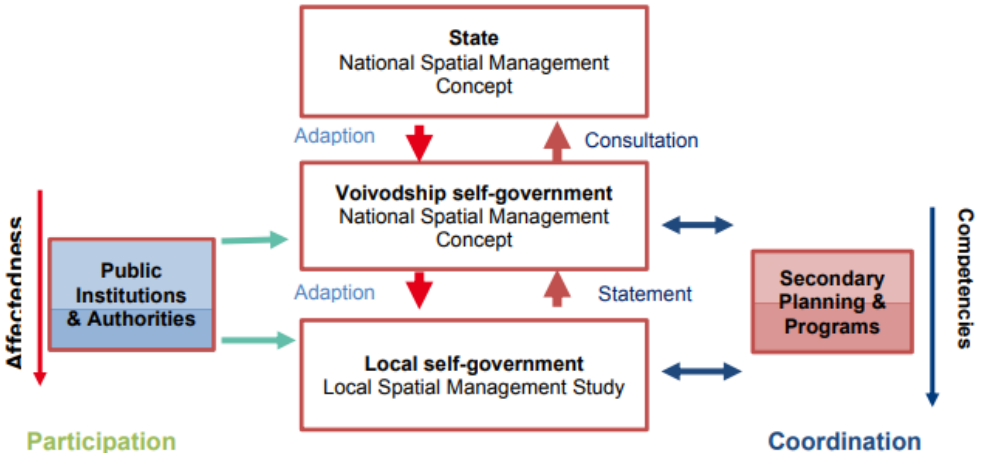
- **National Level:**
  At the highest level, the national government develops strategic documents that delineate socio-economic development goals, such as the National Spatial Management Concept. This framework is integral to coordinating state spatial policy and involves significant analytical work to address spatial development across Poland. Implemented through a central registry, these strategies influence regional and local planning by setting overarching goals and parameters.

- **Regional Level (Voivodeship):**
  The voivodeship, or regional government, adapts national directives to regional specifics by crafting a Voivodeship Development Strategy. This strategy encompasses objectives like economic stimulation, preservation of cultural and environmental assets, and maintaining spatial order. It necessitates the creation of a Voivodeship Spatial Development Plan, which binds local administration to its stipulations, thereby ensuring consistency in achieving these broader goals.

- **Local Level:**
  At the local level, municipalities develop and implement spatial management studies that serve as the groundwork for Local Spatial Development Plans. These plans are pivotal as they directly influence the day-to-day developments within communities, including Konin.

By adhering to both the Voivodeship Spatial Development Plan and the National Spatial Management Concept, local governance ensures alignment with regional and national priorities, thus facilitating a cohesive transition strategy.

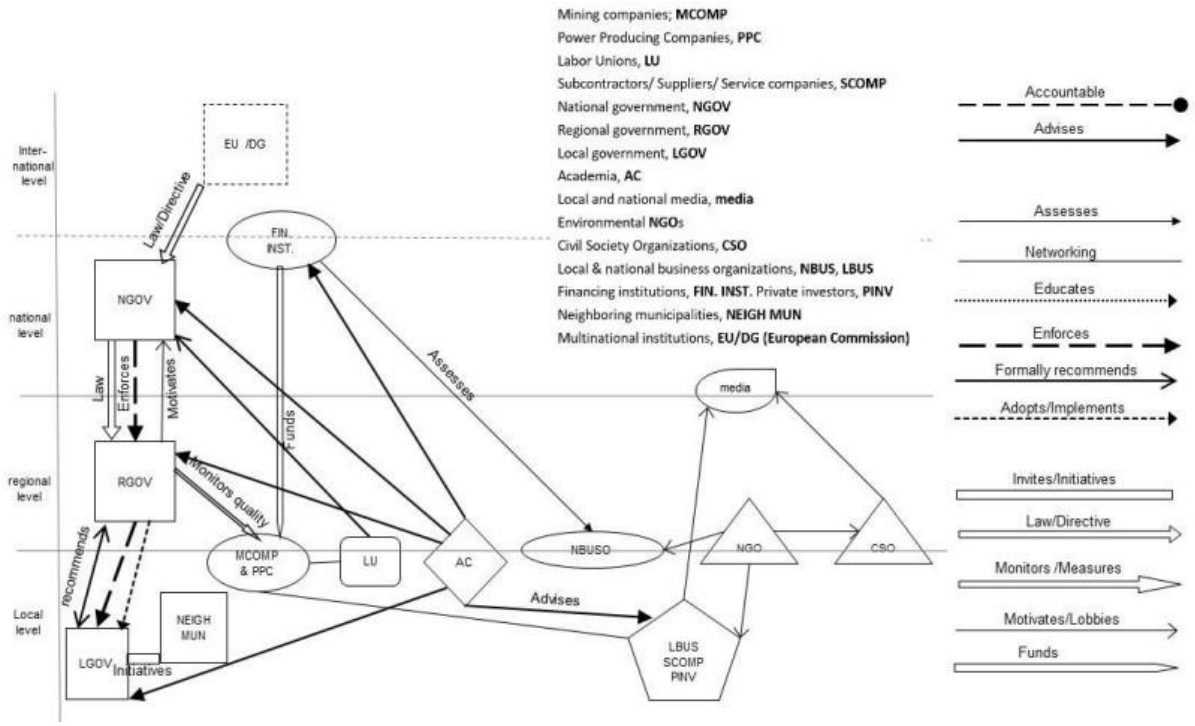
Figure 13: Planning Framework in Poland



Source: https://winter-project.eu/wp-content/uploads/2023/04/WINTER_D3.1_Report_of_an_ideal-type_governance_and_management_structures_for_transition_regions.pdf

The interplay between the European Union, national government, regional bodies, and local entities outlines the governance structure for Poland's energy transition. Local and regional governments are tasked with adopting and executing national and EU legislations, reflecting these in local development plans and engaging with civil society and stakeholders to ensure a balanced transition. Key stakeholders in the transition include public power corporations, educational institutions, local businesses, and NGOs, all coordinated by regional and local government bodies. This multi-stakeholder approach helps in addressing various facets of the transition, from environmental concerns to economic redevelopment.

Figure 14: Organigraph Poland



Source: https://winter-project.eu/wp-content/uploads/2023/04/WINTER_D3.1_Report_of_an_ideal-

4.4 Key Recommendations

While coal transition highlights certain common challenges and opportunities for all coal-affected regions, the actual framing of transition governance should be region-specific, taking local economic, socioeconomic and environmental dimensions into account. Although there is thus no one-size-fits-all approach, by focussing on the development of a transition governance, and not on the actual content of this, transitional strategies overall require;

- Participatory and inclusive processes: the engagement of all affected stakeholders and communities from early stages;
- Effective governance building on leadership, power, influence, institutional capacity and strategy;
- Appropriate governance including multi-level and multi-actor approaches;
- Social dialogue and collective bargaining result in more Just Transition processes.

Stakeholder analyses are crucial for regions in transition as it identifies the main participants as well as other interested parties directly and indirectly affected by the transition process. Such an identification answers questions as to which governmental institutions are involved and who else may be interested and/or important. For example, beyond mining and power producing companies direct stakeholders may also include businesses which may directly benefit from the transition by e.g. the opening of new investment opportunities in sustainable energy. Other interested parties include civil society organizations, particularly those working in or with affected communities, as well as individuals and groups from sectors that have been identified as particularly dynamic for the process and are seen as having further growth prospects.

Figure 15: Template for a stakeholder analysis

Stakeholder group	Stakeholder	Activities	Level of Interest	Level of Influence	Typology
Abbreviation	*Full name and abbreviation*	*Description of the Activities*	*0 – 5 (Very Low, Low, Medium, High, Very High)*	*0 – 5 (Very Low, Low, Medium, High, Very High)*	*Discursive, Bureaucratic, Technocratic, Financial*
Direct Stakeholders					
	…	…	…	…	…
Indirect Stakeholders					
	…	…	…	…	…
Government					
	…	…	…	…	…
Other Interest Parties					
	…	…	…	…	…

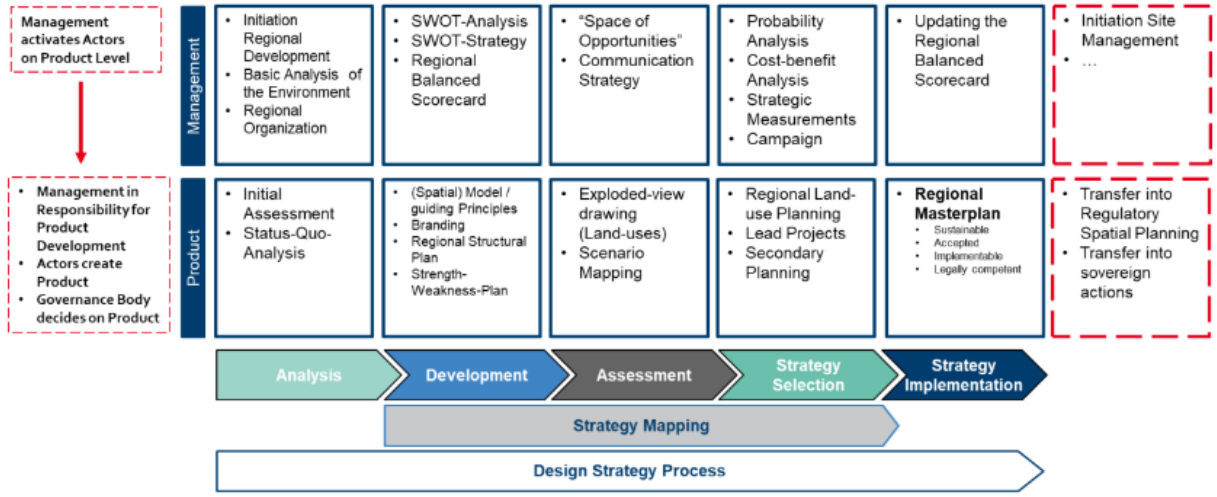
The “Governance of transitions toolkit” published on the Platform for coal regions (Roche 2020) recommends a specific mapping tool for understanding governance models: The organigraph method. It has been developed by the WHO Regional Office for Europe and expert academic partners for mapping governance structures and accountability mechanisms within governance systems (Tiliouine et al. 2018). It visualizes the relationships among actors and stakeholders with shapes and connectors on a single sheet and represent three elements:

- Implicated actors (shapes representing governmental and other public and nongovernmental actors);
- Relationships among actors (connectors), and;
- Their interactions in a multilevel system (the backdrop of local/national/international levels).

A stakeholder analysis includes the identification of processes that facilitate specific governance models, also across case studies. For this purpose, similar to an organigraph, a data collection protocol can be developed, which allows the comparison of the different configurations. It is structured in terms of 1) a characterization of institutional structures and stakeholders, and; 2) an empirically informed typology based on four practices of legitimation – discursive, bureaucratic, technocratic and financial. This dvisualizes the deliberations, involvement, exercise of power as well as relationships among stakeholders within the governmental system.

Having identified the distribution of respective stakeholder levels to be primarily on the regional transition level, establishment of transition management via the regional cooperation form seems ideal. Transition regions face the challenge of sustainable change within a globalized competitive environment and an increasingly complex and dynamic society. The strategic orientation of development within an appropriate form of regional cooperation is indispensable in order to shape upcoming processes in a resilient, sustainable and innovative manner. Assuming that in a regional context several sites are involved in a holistic regional development, the respective transition management of the sites has to adapt to a regional strategy. Transition management has the task to adapt consciously selected strategies for areas and regions to externalities and to communicate this regarding to the different interests of stakeholders (Brüggemann 2021: 45). To this end, transition management uses an open range of analytical methods in order to rationally identify and assess challenges and opportunities for a region. At the same time, transition management activates stakeholders, such as authorities and relevant companies, to stringently implement strategies through appropriate tools and plans.

Figure 16: Example of regional transition management structure



Source: modified from Brüggemann 2021:40 & Feldmann 2009: 57.

An example of a transition management process could be a regional masterplan, which spatializes the sustainable development goals of the region. This would provide a long-term orientation framework for the development of the region's sites and its project management. The development and the content itself, such as a regional master plan, is decided by a politically legitimized governance body.

5 Transition Sustainable Employment and Welfare

The transition of coal regions to sustainable economic models is an urgent necessity in the age of climate change. The transition from coal-based economies to diversified and sustainable structures requires a comprehensive strategy that takes into account not only environmental but also socio-economic aspects. In this context, socio-economic data plays a crucial role in the management of coal regions in transition. Collecting and analysing socio-economic data provides valuable insights into living conditions, employment patterns, education levels, healthcare and social structures in these regions. This information is essential to develop effective strategies to manage

economic restructuring and create new jobs. By understanding the current situation, targeted measures can be taken to counteract the social impact of the coal phase-out and ease the transition for residents.

Socio-economic data is invaluable in understanding the concerns and needs of citizens and offering targeted programmes of support. This can include developing new economic prospects, retraining the labour force, promoting entrepreneurship and expanding social infrastructure. The successful transformation of coal regions requires a holistic approach based on substantiated data and broad community participation. Socio-economic information enables transition management decision-makers to make informed decisions that take into account both economic viability and social responsibility. The data supports political opinion formation and allows forecasting. To summarise, socio-economic data is an indispensable tool in the management of coal regions in transition. It serves as a basis for developing customised strategies to mitigate social impacts, strengthen community resilience and ultimately create a sustainable future for all stakeholders. Socioeconomic data typically includes information such as:

- Income and employment: statistics on unemployment rates, types of employment, income distribution and poverty lines;
- Education: Data on educational attainment, school qualifications, educational institutions and training opportunities;
- Health: Information on health care, diseases, life expectancy and access to medical care;
- Housing: Statistics on housing situations, property prices, rental costs and housing availability;
- Population composition: Data on age structure, gender ratios, ethnic diversity and family structures.

It is particularly important to increase social acceptance of such transitions processes. Changes in coal regions are often met with resistance as they affect existential issues in the community. Identification of the main challenges and opportunities of respondents' knowledge and support regarding the main transition challenges is thus of importance. Three groups of stakeholders can be addressed; 1) The broad public and citizens of the discussed regions; 2) Stakeholders of the discussed regions; and; 3) Expert stakeholders that are directly and actively involved in the transition process. Through conducting public online surveys questions can be asked, particularly in a comparative perspective, to allow direct comparisons of opinions. These questions yield information on:

- Screening of the population
- Knowledge, perception and engagement for transition processes
- Trust in government and responsible institutions
- Expectations for the future

In order to gain a fuller picture of all stakeholders involved, public online survey results can be complemented by expert interviews.

5.1 Best Practice Sustainable Employment and Welfare – Ruhr Area

As unmanaged transition has negative short- and long-term consequences for employees and communities past experience thus can avoid similar errors. In the Ruhr Area, the increasing uncompetitiveness of coal between the 1950s and 1960s, perceived then as a temporary economic breakdown, initiated the government's emphasis, not on addressing structural change but primarily on supporting and subsidizing the coal sector and its employees. The initial protection and deliberate prolongation of the declining coal industry lifecycle has been criticized. While economic hardship for employees was mitigated and around 289 – 331 billion of Euro of subsidizing efforts between 1950 and 2008 were spent (Oei et al. 2020: 968) a "faster and more pro-active hard coal mining phase-out in Germany would have been much less expensive and paved the way for new industries" (Oei et al. 2020: 963). A major lesson learned, based on this experience from the Ruhr area, is to develop a transition strategy which effectively "refrains from subsidizing the coal industry (…) thus enabling economic reorientation" (Oei. et al. 2020: 974), hence a future-oriented strategy would have strengthened regional innovation efforts and the economy, at a much lower

cost for taxpayers and consumers.

The Ruhr Area nevertheless provides a best practice case example of a large and gradual restructuring transition process, as in a parallel manner to subsidizing measures, regional diversification and innovation efforts of the economic base and its sectors have been undertaken as part of a more proactive structural policy. This has encompassed a wide range of activities, including attracting other industries to the region, such as automotive and tourism, and making significant investments in R&D by establishing technology parks, supporting technology transfer and introducing measures to improve infrastructure, universities and research. From 1969 to 2015, employee numbers shrank from 180,000 to 9,500. To support workers, a social compensation plan was created to support workers in transitioning to new jobs. This included the following elements:

- Early retirement, with the precise nature of the package depending on the age of the workers and the type of job that they had been doing (e.g., underground or surface mining)
- Qualification or retraining initiatives (around 26,500 individuals pursued this option)
- On-the-job qualification initiatives
- Direct redeployment
- Temporary placements
- In-house redeployment
- Redundancy payments
- Around 3,000 workers in total moved to other sectors (for example, around 100 former miners are now working at the Dortmund Airport).
- Coal heritage projects: the Zollverein industrial complex in Essen, formerly the largest colliery in the world, was converted into a museum and a UNESCO World Heritage Site, which now receives 250,000 visitors a year (Oei et al. 2019).

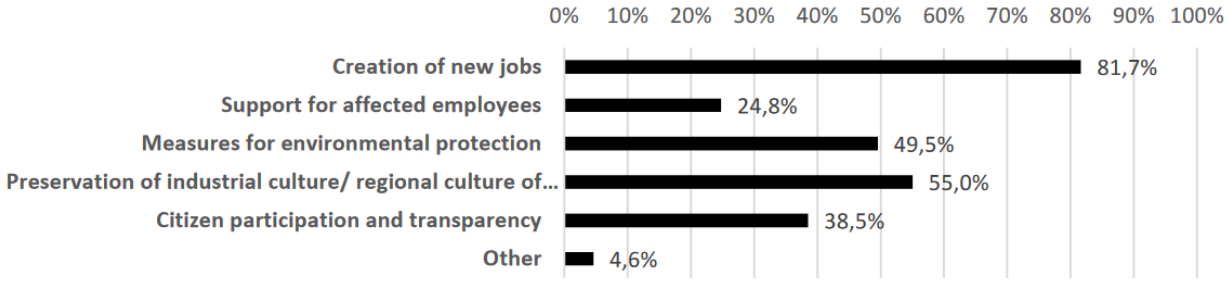
Figure 17: Ruhr University (1st public university in the Ruhr Area, est. 1962)

Source: Dahlbeck and Gärtner 2019: 39.

Stakeholder and civil society interests in participating in transition processes in coal regions are diverse, encompassing economic, environmental, and socially driven motives. Effective engagement and collaboration among these actors are crucial for ensuring a successful and sustainable transition that balances the interests of all parties involved. Although the involvement of civil society in managing transition is vital, this element is often overlooked. Examining stakeholders' and civil society's perception and acceptance, as well as community participation is therefore of great significance. Methodologically, public opinion surveys, also in a comparative manner, reveal significant results for transition management decisions. [3]

[3] The online public survey conducted for German respondents lasted from 17.11.2023 until 30.11. 2023. Out of a total of 123 online visitors, 108 persons participated. The percentage of people who completed the questionnaire was 87,8% and the way of participation was 99,1% via direct link. The majority of respondents

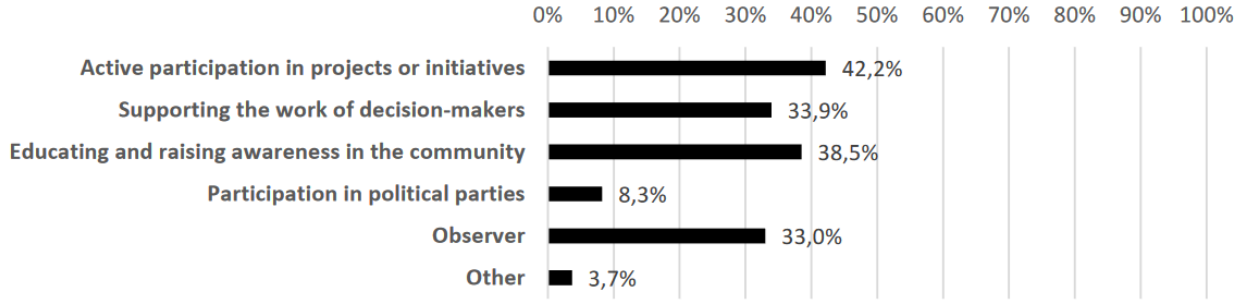
Figure 18: Q. Which of these points do you think are particularly important for the citizens of the Ruhr Area?



Source: https://winter-project.eu/wp-content/uploads/2024/01/D3.4-Report_social_acceptance.pdf

Particularly important for citizens of the Ruhr region, according to the survey participants' responses to this question (max. 3 answers; 254,1% total number of responses), is the creation of new jobs (81,7%), while preservation of industrial/regional culture of remembrance (55%) and measures for environmental protection is also of importance (49,5%). These three particularly important points are subsequently followed by citizen participation and transparency (38,5%) and support for affected employees (24,8%).

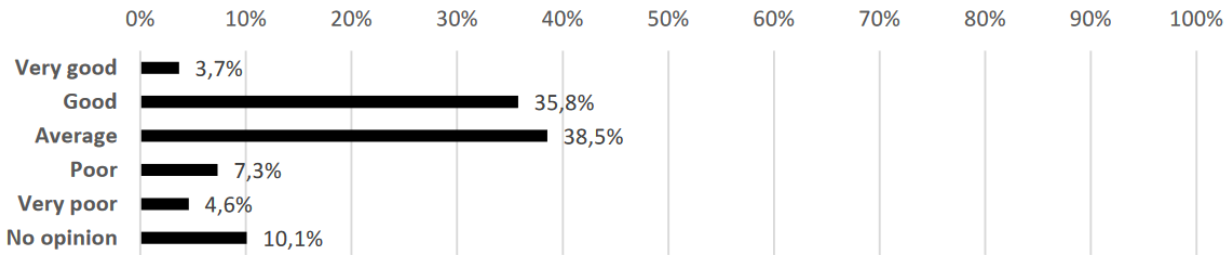
Figure 19: Q. What role do you personally see for yourself in shaping the transition away from coal in the Ruhr Area?



Source: https://winter-project.eu/wp-content/uploads/2024/01/D3.4-Report_social_acceptance.pdf

Concerning the personal role respondents, this question reveals active participation in projects or initiatives (42,2%) a ranked highest among respondent's view towards personal involvement in shaping the transition away from coal. This is followed by the answers educating and raising awareness in the community (38,5%), support the work of decision-makers (33,9%), while a minority of respondents prefer to act as an observer (33%).

Figure 20: Q: How do you rate the efforts of the (regional) government and the municipalities to manage the transition away from coal in the Ruhr Area?



Source: https://winter-project.eu/wp-content/uploads/2024/01/D3.4-Report_social_acceptance.pdf

(73,1%) completed the questionnaire in 2-5 minutes. For more information see: https://winter-project.eu/wp-content/uploads/2024/01/D3.4-Report_social_acceptance.pdf

Efforts of the respective (regional) government and municipalities in managing post-mining transition are overall rated positively by German respondents, as a relatively equal division of respondents choose very good/good (total 39,5%) or average (38,5%). In turn, a minority of respondents think this management is poor (7,3%) or very poor (4,6%). Notable is that roughly the same percentage of respondents had no opinion towards this question (10,1%).

5.2 Best Practice Sustainable Employment and Welfare – Western Macedonia

The Just Transition Plan for Western Macedonia is a comprehensive plan to shift the region's economy away from its reliance on lignite (coal) and toward sustainable employment and welfare. Due to the region's heavy reliance on coal for the production of electricity, the end of lignite operations calls for an economic and social transformation. Through a multifaceted approach that includes re-skilling initiatives, investments in renewable energy sectors, and the promotion of economic diversification, the plan seeks to alleviate the negative effects on the local labor and economy. Important measures include the creation of training facilities to provide laborers with knowledge and abilities needed for the green economy through entities such as local authorities, universities (University of Western Macedonia) and research organizations like CE.R.T.H.

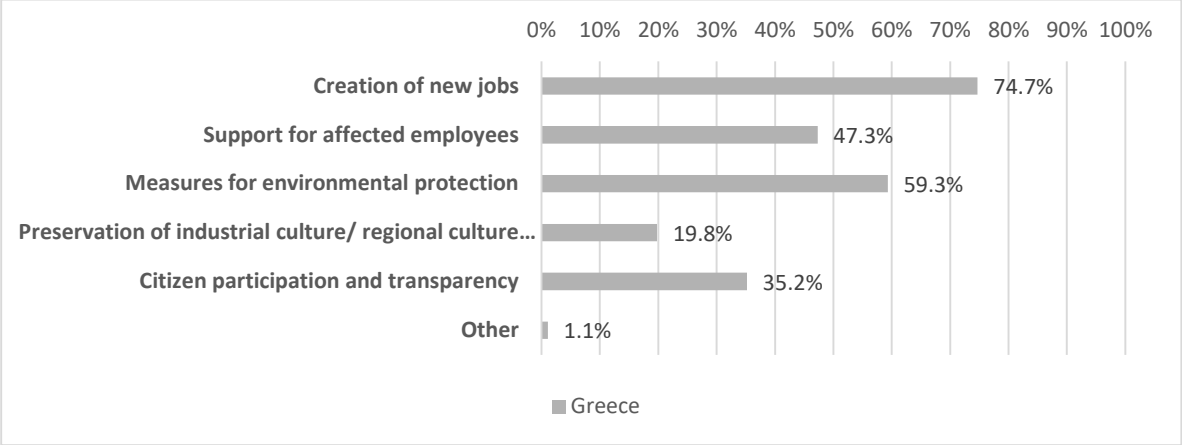
Figure 21: The new campus in the Active Urban Planning Zone (ZEP) of Kozani, University of Western Macedonia

The strategy also highlights how critical it is to support small and medium-sized businesses (SMEs) in their efforts to generate new jobs and to encourage entrepreneurial activity. Grants and financial incentives are given to promote business growth and innovation in industries like information technology, tourism, and sustainable agriculture. Furthermore, the implementation of infrastructure projects, such building renewable energy facilities and modernizing transportation systems, is expected to increase the region's economic resilience and create both temporary and permanent jobs.

Central to the welfare aspect of the Just Transition Plan is the commitment to social inclusion and community engagement[4]. This involves extensive consultations with local stakeholders, including workers, community leaders, and civil society organizations, to ensure that the transition process is equitable and reflective of the community's needs. Measures are in place to support vulnerable groups, including targeted social programs and access to healthcare and education, ensuring that the benefits of the transition are broadly shared. Overall, Western Macedonia's approach serves as a model for other regions undergoing similar transitions, highlighting the importance of proactive planning, investment in human capital, and community-centered policies to achieve a sustainable and just economic transformation.

[4]For the online survey conducted among the general population of Greece, the duration was 17 days from 17/11/23 to 4/12/23, and 91 people participated and completed the questionnaires out of a total of 117 visitors to the hyperlinks that were notified. The date of the first recorded participation is on 17/11 and the date of the last is on 02/12. The percentage of people who completed the questionnaire was 77.8% and the way of participation was 98.9% via direct link. The majority of respondents completed the questionnaire in 2-5 minutes while there were people who completed it in more than 10 minutes (5.5%).

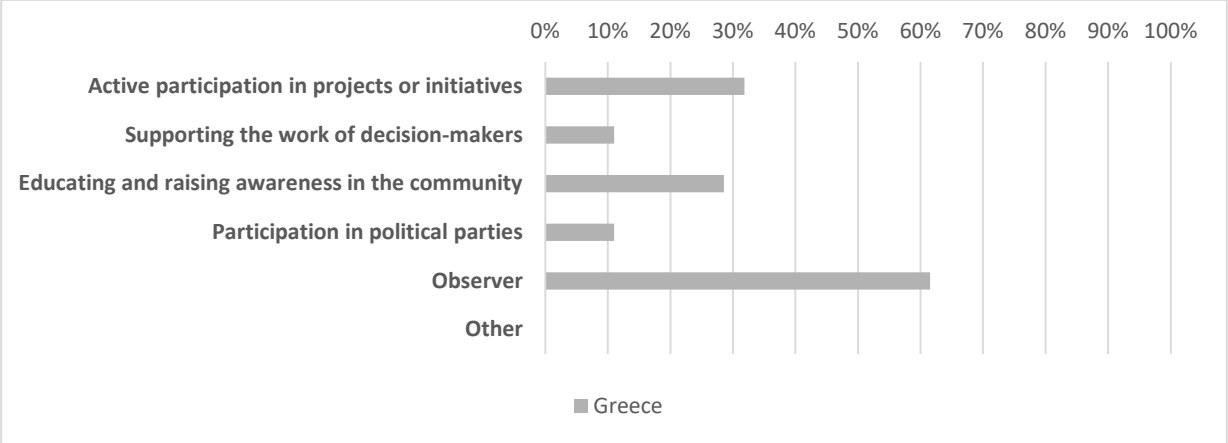
Figure 22: Q. Which of these points do you think are particularly important for the citizens of Western Macedonia?



Source: https://winter-project.eu/wp-content/uploads/2024/01/D3.4-Report_social_acceptance.pdf

The respondents' judgment on the most important points for the residents of Western Macedonia (Question 7; max. 3 answers; 237,4% total number of responses) includes the creation of new jobs (74.47%), the protection of the environment (59.3%), the empowerment of workers (47.3%), and public participation in decision-making bodies in transparent procedures (35.2%). Finally, a smaller percentage chose the preservation of industrial heritage (19.8%).

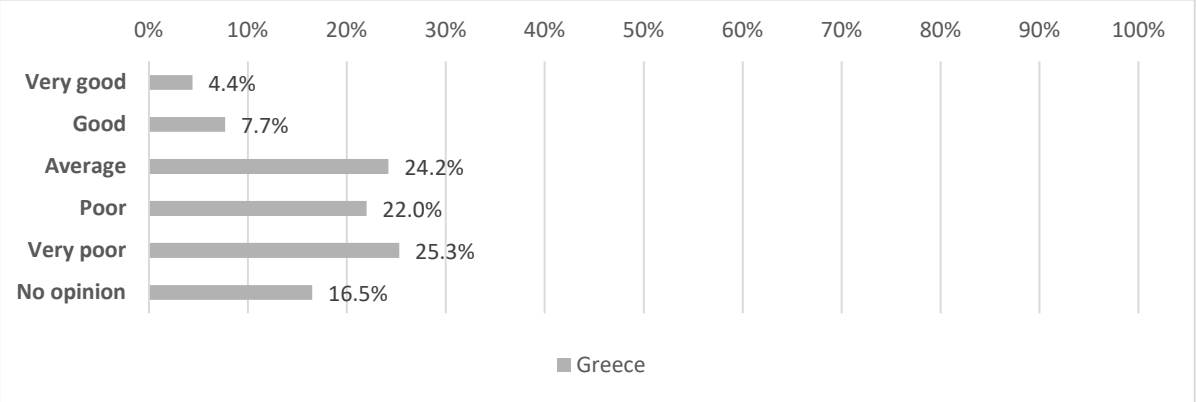
Figure 23: Q. What role do you personally see for yourself in shaping the transition away from coal in Western Macedonia?



Source: https://winter-project.eu/wp-content/uploads/2024/01/D3.4-Report_social_acceptance.pdf

In addition, for the role of respondents during the coal transition period (Question 12; max. 3 answers; 144% total number of responses), as illustrated below, the most popular option is observer with 61.5%, while the options of active participation (31.9%) and education (28.6%) are placed second and third.

Figure 24: Q. How do you rate the efforts of the (regional) government and the municipalities to manage the transition away from coal in your region?



Source: https://winter-project.eu/wp-content/uploads/2024/01/D3.4-Report_social_acceptance.pdf

Regarding the efforts of local governments to manage the transition away from coal (Question 6), the most popular responses that garnered the highest percentages were very poor (25.3%), average (24.2%), and poor (22%). In contrast, only a small percentage considered the response of local leaders to be very good (4.4%) or good (7.7%). This highlights overall the lack of trust to the governmental plan and its current implementation.

5.3 Best Practice Sustainable Employment and Welfare – Konin Region

The transition in the Konin region, located in Eastern Wielkopolska, exemplifies a holistic approach to achieving a just transition. This process is not merely about infrastructural changes but encompasses a broad movement towards enhancing living standards and amplifying community development opportunities. A significant element underpinning this transformation is the profound emphasis on social acceptance and community involvement, aligning economic growth with environmental sustainability. Recognizing the crucial role of grassroots initiatives, the Wielkopolska Regional Government has demonstrated a steadfast commitment to fostering a zero-emission economy. This commitment was solidified through the establishment of a dedicated Working Group for the Restructuring of the Economic Potential of the Konin Subregion in March 2018. The commitment to a just transition was formalized through an agreement signed by over 70 entities in April 2019, which highlighted mutual support for sustainable transformation and regional project funding. This foundational agreement not only solidified regional partnerships but also spurred the creation of thematic Working Groups. These groups play a pivotal role in addressing environmental, energy, infrastructure, and social challenges by developing strategic documents such as the Concept of the Just Transition of Eastern Wielkopolska, the Territorial Just Transition Plan, and the long-term Development Strategy of Eastern Wielkopolska.

The social consultation process in Eastern Wielkopolska is characterized by its transparency and inclusivity, allowing for a broad spectrum of stakeholder participation. This approach enables a comprehensive exchange of knowledge and ideas, enriching the planning and execution processes with a diverse range of perspectives. Through thematic working groups, stakeholders from various sectors including government bodies, businesses, academia, and NGOs collaborate to address regional transformation challenges and opportunities. This participatory process ensures that all voices are heard and integrated into the strategic planning, thus fostering a well-rounded and holistic approach to the region's transition.

The development of the Territorial Just Transition Plan (TJTP) for Eastern Wielkopolska has been a collaborative effort involving extensive consultations across multiple levels of governance and society. Launched in early 2021, the drafting process has engaged a wide array of stakeholders, ensuring that the plan not only aligns with European Union regulations but also resonates with the specific needs and aspirations of the local population. The TJTP draft has been subject to robust review and feedback through workshops, online platforms, and direct consultations, reflecting a comprehensive and transparent approach to regional development planning.

Looking ahead, the Konin region is set to continue leveraging strategic partnerships and EU funding opportunities to drive its transformation agenda. The ongoing development of education and training strategies, such as the Strategy for Vocational Education and Training in the context of the energy transition of Eastern Wielkopolska to 2040, highlights the region's proactive stance on building human capital to meet future economic demands. Moreover, the focus on entrepreneurship development and social inclusion programs will play a crucial role in ensuring that the transition benefits are widely shared among all community members, thereby enhancing the social and economic fabric of the region.

To further understand community perspectives, a detailed survey was conducted to assess public perception and engagement regarding the transition efforts in Konin. In the WINTER survey aimed at assessing public perception of the transition away from coal in the Konin region, a group of 18 respondents provided their insights.The demographic spread of the respondents indicated a significant interest in the Konin region's transition efforts, both locally and beyond, as 61.1% of the participants resided outside of the region. This broader interest may highlight the regional and possibly national implications of the transition process underway in Konin. The participants predominantly comprised women (66.7%), with the most represented age group being 21 to 40 years (72.2%). In terms of employment, the majority were employed (77.8%), underscoring an active workforce engagement in the survey.

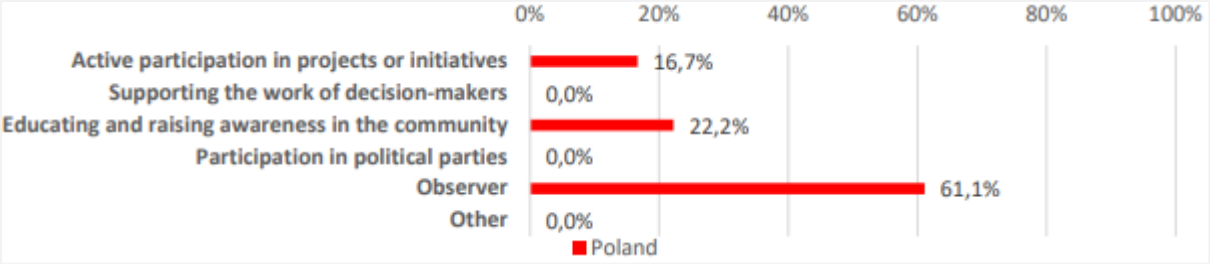
When asked about the issues of particular importance concerning the transition in the Konin region, a commanding 83.3% of the respondents identified the creation of new jobs as the top priority. This strong focus on employment highlights the community's concern over economic stability and opportunities post-coal. In contrast, aspects such as citizen engagement and transparency were considered less critical, with only 16.7% marking them as priorities.

Figure 25: Q: Which of these points do you think are particularly important for the citizens of Konin region?

Source: https://winter-project.eu/wp-content/uploads/2024/01/D3.4-Report_social_acceptance.pdf

Regarding their role in the transformation process, the majority (61.10%) viewed themselves more as observers rather than active participants. This perspective may reflect a perceived distance from the decision-making process or a lack of opportunities to engage more actively.

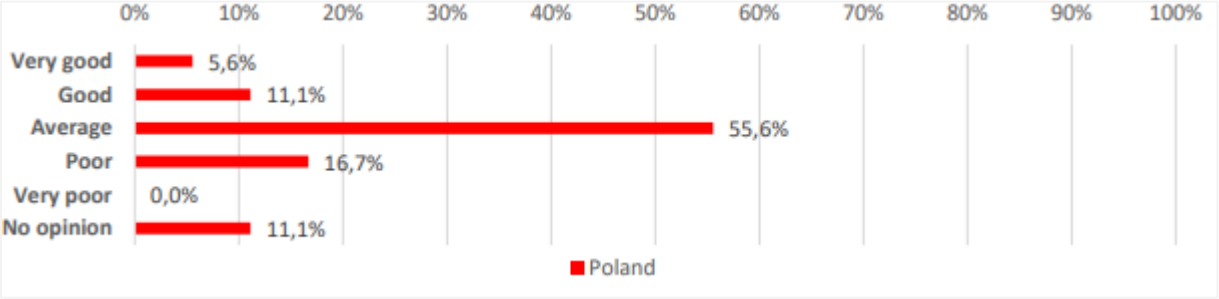
Figure 26: Q: What role do you personally see for yourself in shaping the transition away from coal in Konin region?



Source: https://winter-project.eu/wp-content/uploads/2024/01/D3.4-Report_social_acceptance.pdf

The assessment of the efforts by regional authorities and local governments in managing the coal transition revealed mixed feelings. While the majority (55.6%) rated these efforts as average, the feedback suggests room for improvement in how these transitions are managed and communicated to the public.

Figure 27: Q: How do you rate the efforts of the (regional) government and the municipalities to manage the transition away from coal in your region?



Source: https://winter-project.eu/wp-content/uploads/2024/01/D3.4-Report_social_acceptance.pdf

The survey results emphasize the need for a focused strategy on job creation and more robust efforts in public engagement and transparency. The data also call for regional authorities to enhance their communication strategies to better articulate the actions taken and to involve the community more actively in the ongoing transition processes.

5.4 Key Recommendations

Managing the impact of the transition away from coal has on regional employment is a significant issue and one that involves a large number of stakeholders. There are many points to consider, including short-term measures such as reskilling and redeploying the existing workforce, creating local employment opportunities, as well as longer-term concerns such as diversifying regional economies with the aim to stimulate employment in new sectors. Transition management is more likely to be effective, and more likely to be socially accepted, when those affected by the transition view this process as legitimate, transparent, purposeful and offers opportunities of involvement. Given these factors, the following key recommendations considering tailored support can be valuable:

- Differentiation is to be made between short-term measures concentrating on upskilling and redeployment of employees, and parallel long-term actions focusing on economic diversification and attracting investment to generate new jobs.
- Involvement of all stakeholders, including employees and those supporting them, as well as civil society, as early as possible.
- A forward-looking policy encompassing a coherent timeframe, and knowledge of transition phases, assists in competent planning and shaping coordinated and appropriate responses to new developments, e.g. through boosting a regions' competitiveness, expansion of infrastructure and research landscape.
- Encouragement of a participative and inclusive approach of involving civil society in order to inform and increase social acceptance towards the transition away from coal.

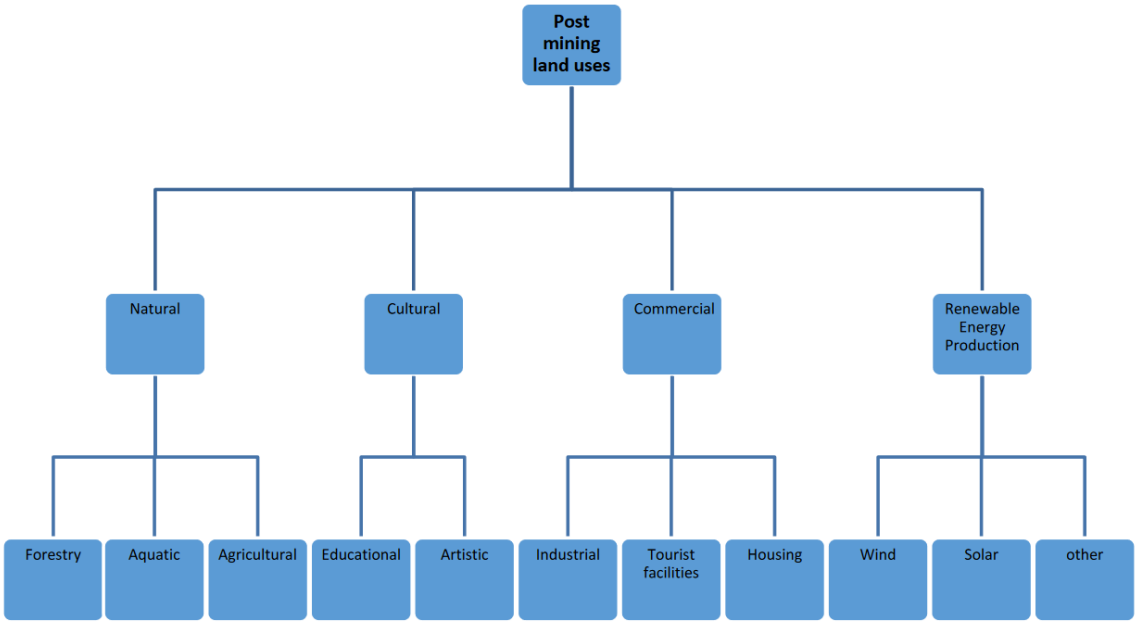
6 Transition Environmental Rehabilitation and Repurposing

The life cycle of each mining project consists of these main steps: 1) exploration & discovery; 2) feasibility & construction; 3) mining & extraction, and; 4) closure & site rehabilitation. (Michaux et al., 2020). Rehabilitation is the process of restoring the usable or natural value of land damaged by mining activities. It is regulated by specific legislation for each country. Repurposing of post-mining areas compensates for the adverse changes caused by mining activity, and, however in many cases, it is considered an opportunity to repurpose post-mining areas to more attractive land uses (Kasztelewicz, 2010). After mine closure, besides facing many challenges, they leave behind a legacy of environmental degradation. Locations formerly used for mining and related industrial activities require environmental rehabilitation. Hence, the repurposing of land and infrastructure is necessary to make them available for post-mining use. Timely and efficient rehabilitation and repurposing is viewed as a dominant decisive factor in attracting new businesses and permanent new jobs in the region. This is essential to opening up opportunities for future regional prosperity. The potential for environmental rehabilitation and repurposing is region-specific and depend on various local and regional factors, such as site location, sectoral demands and economic opportunities. Key challenges of the environmental rehabilitation and repurposing are, amongst others:

- Securing site safety;
- Water management and renewable energy;
- Heaps and rivers;
- Perpetual obligations

Regional legal aspects, environmental conditions and the decisions on future land use have the most significant impact on technologies needed to rehabilitate and repurpose mining areas. WINTER proposes a classification of post-mining land use. Since mining sites are often large-scale areas, the implementation of many land uses is only possible, but necessary to reach rehabilitation goals and create the best outcomes. A Best Alternative Technology (BAT) guide can be used to identify the best technologies available for each post mining land use, with corresponding rehabilitation sites that already implemented and successfully introduced transition away from coal.

Figure 28: Suggested classification of post-mining land use



6.1 Best Practice Environmental Rehabilitation and Repurposing – Ruhr Area

The beginning of the retreat of the mining industry triggered a crucial structural change in the region. Today, the overall economy is dominated by service industries, high-tech operations, logistics sites and research and educational institutions. In the course of this industrialisation, the population of the Ruhr Area increased very quickly. The infrastructure of the whole region is therefore very well developed. In the Ruhr metropolitan region, the challenge was and still exists to successfully transform the former mining region. The post-mining land use is a complex interplay, both, within the legal framework and within the variety of after-use options. For a successful management of transition, the valorisation as well as the sustainable utilisation of former mining sites is a central element (Melchers, 2016). For detailed information on all Ruhr Area best practices regarding environmental rehabilitation and repurposing, these are available on the WINTER Platform (https://winter-project.eu/winter-platform/). These encompass, amongst others, the following sites:

- IBA Emscher Park
- Lohberg
- Ewald
- Alpincenter Bottrop
- Mont Cenis
- Rhenish Lignite Mining Area

One best practice example elaborated more in detail here is MARK 51°7. This new innovative quarter that has been created on the site in the third generation: From 1860 to 1960, the site was a hard coal mine area called Dannenbaum. In the 14th century first mining activities took place on the described area, yet the colliery “Dannenbaum” was established not before 1736. Mining operations took place up to -696 m below sea level. After mine closure, a large Opel automotive plant used the site between 1960 and 2014 until the closure of the factory due to lacking economic viability. Only the administrative building of Opel outlasted the demolition process finished in 2015. In the early 20th century. Although the hard coal mine site had already been reclaimed due to the post-mining use of the car manufacturing, the contaminations of the past still had to be taken into account for the new use. More than 50 years of car production left behind 70 ha sealed area with high pollution. The initial situation consisted of 700,000 m² area heavily built-up and the memorial site of the Opel building. (Bussmann et al., 2019).

The former Opel plant site is currently being developed into an industrial, technology and knowledge campus under the name MARK 51°7. In addition to the development of a total of around 45 hectares of commercial, industrial and technology areas, extensive public green spaces are planned that will generate high quality. An innovation quarter for companies and institutions that invest in knowledge and technology shall be created. Almost a third of the area will be laid out as green spaces and parks. The work-life balance plays a major role in the concept and will be achieved through:

- Appealing, modern architecture in combination with historical witnesses;
- Attractive and generous green space design over 15 ha;
- High quality of stay for employees and residents through restaurants, cafés and much more (Bochum Perspektive GmbH 2022).

Figure 29: Main aspects of the project

Source: ©skt umbaukultur

In addition to the planned post-mining land use there are deliberations to implement a utilisation of mine water for heating and cooling of the established or future infrastructure of MARK 51°7 (Bussmann et al., 2019) The Bochum Perspektive GmbH, a subsidiary of Bochum Economic Development was founded in 2014 to reclaim and develop the site. Their service spectrum covered the implementation of redevelopment, reactivation and development, the completion of properties ready for construction, as well as green and traffic areas, and the laying of utility lines and the sewerage system. Beyond that the company creates a concept and a strategy for the settlement and carries out the marketing (Bochum Perspektive GmbH 2022). Important innovations of the future are based on targeted knowledge transfer between business and science. To achieve this, places and platforms for interdisciplinary networking must be created and new working worlds such as FabLabs, co-working spaces and start-up incubators must be integrated. The site is characterised in particular by the integration of the adjacent neighbourhoods and is already considered a reference project for inner-city land development.

MARK 51°7 site is being developed together with the city of Bochum as part of an integrative concept. The development is open to the broad public and citizens can easily inform themselves via a website. Beyond that the Bochum Perspektive GmbH provides a video-Podcast with different and actual topics concerning the development of the construction site (https://www.mark51-7.de/podcast). The companies on MARK 51°7 are globally positioned and technology leaders in their industries. Already today, 96% of the 70 ha commercial and industrial area has been marketed. This alone ensures that more than 10,000 people will work at MARK 51°7 in the coming years. The reclaimed location is characterised by:

- Excellent infrastructure near city center;
- Knowledge spillover;
- Local and national networks on an international level;
- Qualified workforce and talent pool;
- Universities and institutes;
- Leisure, art, and culture;
- Flexible area cutting.

Surveys predict more than 3,500 jobs to be generated on the area of MARK 51°7, not considering impulses towards associated local and regional economies. Nevertheless, expected impacts regarding long-term unemployment are considered to be marginal (Funke, 2019).

6.2 Best Practice Environmental Rehabilitation and Repurposing – Western Macedonia

The operation of the Lignite Centre of Western Macedonia (LCWM) mines by the PPC started in 1957. As of 2018, the mines extended over an area of 17,000 ha with annual excavations exceeding 170 Mm3 and lignite production being 27.2 Mt. A total of 1.74 Gt had been mined up to the end of 2020, with total excavations of 8.7 billion m3 and a stripping ratio (waste to lignite) of 4.16 m3/t. After the closure of the Amynteo - Lakkia and Kardia mines during 2020–2021, Mavropigi and South Field mines will be in operation until the overall phase-out. Currently, the environmental rehabilitation and repurposing plans are not completed taking into account that in 2019, the Greek Government as part of its National Energy and Climate Plan set the goal of a full lignite phase-out by 2028, with the majority of units being withdrawn by 2023, while only one plant will continue to operate—the Ptolemais V bloc and will burn lignite at the latest until 2028.
Among some of the best practices that were implemented during the operational phase of Western Macedonia lignite mines are mentioned below (for more detailed information see deliverable 2.2, https://winter-project.eu/deliverables).
Regarding the rehabilitation and reclamation activities, PPC has reforested many old mine areas in LCWM mainly with Robinia pseudacacia L., or black locust (Basnou, 2016). The plantations started more than 30 years ago covering more than 1,500 ha with average density 2,000 trees/ha. The choice of the black locust, despite the fact that is a non-native, highly criticised species has been characterised as an excellent one for restoring damaged soils and its fast-growing nature makes it popular for former lignite mine reclamation, reforestation and erosion control (Papadopoulou et al., 2018), therefore constitutes best practice in terms of land rehabilitation of former lignite mining areas.

Figure 30: Robinia pseudoacacia L. plantations used for slope stabilisation and erosion control in Amynteon mine

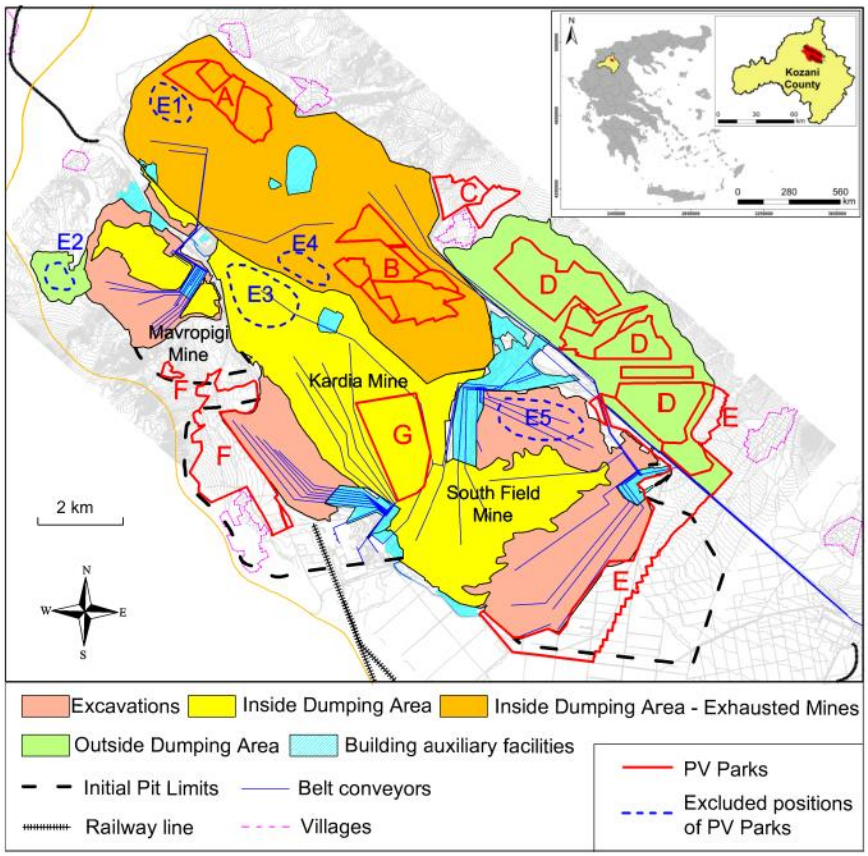
Source: *Papadopoulou et al., 2018.*

Apart from the cultivation of crops, a pilot greenhouse for hydroponic cultivations was created, using teleheating run. A model orchard (Figure 26) was also developed in the internal deposition area of the Main Field mine containing apple trees, pear trees, plum trees, cherry trees and other species, as well as a vineyard for the purpose of demonstrating to the local farmers of the region the possibility of developing agricultural activities with increased added value (PPC, 2009).

Figure 31: The orchard in the area of the Main Field mine (photograph taken on 26 October 2022)

Regarding the repurposing activities, three PV projects with a total capacity of 230 MW are under construction in Ptolemaida by Public Power Corporation Renewables (Fig. 16), with some parts already completed. Western Macedonia Solar Parks I (Fig. 27) & II will have 14.99 MW power each, with an estimated annual production of 21 GWh each. Solar Park I will be constructed on a surface of 312,745 km^2 on lignite dumps in the northern part of the Western Macedonia Lignite Centre, on the Paliampela site, while Solar Park II will be constructed on a surface of 300,000 km^2 on the Kardia mine dump, on Ksiropotamos site. The third project, Solar Arrow 1 will have 200 MW power (PPC Renewables, 2022).

Figure 32: General overview of the Ptolemaida region and locations investigated for PV parks



Source: Antoniadis et al., 2021.

Figure 33: Western Macedonia Solar Park (under development, photograph taken on 26 October 2022)

6.3 Best Practice Environmental Rehabilitation and Repurposing – Konin Region

In the Konin region, the transition from lignite mining to sustainable land use and environmental stewardship stands as a testament to innovative reclamation strategies. The region's efforts focus primarily on transforming former mining landscapes into valuable ecological and recreational assets. Central to this transformation has been the creation of several post-exploitation lakes, which have become integral to the region's landscape, enhancing its touristic appeal and providing varied recreational spaces for the community.

Creation of Post-Exploitation Lakes:
Water reclamation projects spearheaded by PAK KWB Konin S.A. have been pivotal in the Konin region. These projects involve the conversion of former mining pits into large water bodies that serve multiple purposes, from ecological habitats to recreational facilities. The creation of these lakes not only addresses environmental recovery but also adds significant aesthetic and functional value to the region. These lakes, characterized by their diverse depths and sizes, cater to a range of activities such as swimming, angling, and diving, thereby supporting local biodiversity and promoting eco-tourism.

Figure 34: Final pit lake of Nieslusz pit

Source: http://www.kwbkonin.pl/index.php/odkrywki-2/odkrywkanieslusz/

Examples of Lake Transformations:

- **Janiszew Lake:** Once a part of the Adamów Mine, this lake covers an area of 60 hectares with a depth of up to 9 meters. It has been fully transformed into a recreational space, complete with infrastructure for community engagement.
- **Koźmin Lakes:** These lakes demonstrate various stages of transformation, with the Koźmin Końcowy lake spanning 131 hectares and featuring depths between 31.8 to 45.8 meters, scheduled for completion by the end of 2023. These areas are being developed into vibrant community hubs with extensive recreational facilities.
- **Lubstów Lake:** Currently under development, this lake will span approximately 480 hectares, with depths reaching up to 63 meters. It illustrates the scale of transformation being

undertaken in the region, turning a vast mining pit into a potential major water-based recreational site.

Integration with Recreational Reclamation:
In Konin, the strategy extends far beyond the mere ecological restoration of former mining sites; it entails a comprehensive integration of recreational reclamation that synergizes water bodies with landscaped green spaces, interconnected walking paths, and diverse sports facilities. This approach is not just about rehabilitating land but is a transformative process that breathes new life into the community by enhancing the quality of life and promoting healthier, more active lifestyles. A prime example of this is the transformation of the Jóźwin IIA pit into a Recreation and Physical Activity Park. This project is turning an industrial relic into a thriving hub of community life, offering facilities for sports, leisure, and cultural activities, which collectively foster a strong sense of community and place. Such developments reflect a profound commitment to sustainable community planning, where recreational areas serve as both green lungs and social hubs, helping to forge stronger community bonds and a more engaged citizenry.

Figure 35: Angling station at the pit lake

Source: http://www.kwbkonin.pl/index.php/odkrywki-2/odkrywkajozwin/

The reclamation and repurposing efforts in Konin have catalyzed significant environmental and social benefits. By transforming defunct industrial zones into vibrant ecosystems, these initiatives have facilitated the emergence of new habitats for a diverse range of wildlife, contributing to biodiversity conservation and ecological balance. The creation of these lush, new green spaces not only enhances the aesthetic appeal of the region but also improves the microclimate, which benefits both the local environment and the people who live in it. Moreover, these spaces provide numerous opportunities for leisure, sports, and educational activities, thereby boosting the local economy through increased tourism and recreation-related spending. Educational programs based around these sites help the community understand the importance of ecological stewardship and sustainable land use practices, instilling a sense of environmental responsibility while also showcasing the tangible benefits of such endeavours. This holistic approach to land reclamation in Konin illustrates a successful model of how environmental rehabilitation can be seamlessly integrated with community development, yielding a sustainable, multipurpose landscape that serves the needs of both nature and society.

6.4 Key Recommendations

The transition away from coal to clean energy with low carbon emissions is a complex issue, and usually involves the complete reinvention of regions. Viable alternatives for transition and development of these regions need to be identified involving all stakeholders, who are willing to participate, providing support to implement best practice examples and transition models to fit with each region's particularities. For regions where coal is an element of local identification, this transition can be very difficult. In order to manage and mitigate risks from environmental rehabilitation and repurposing, the following recommendations are significant:

- The timeframe of (expected) mine closure significantly affects choices and options available to decision-makers. Comprehensive planning and secure financing eases time to adapt and enforces long-term environmental rehabilitation and repurposing processes;
- Enhanced coordination among institutional and governance structures speeds up the implementation processes;
- Continued informing of local communities increases social acceptance and participation;
- Rehabilitation and repurposing can offer communities a cleaner environment, good living conditions, renewable energy production (solar plants, wind energy) and new jobs through establishing facilities such as tourist and recreation centres, museums, science and cultural centres.

Table 4: General and specific rehabilitation and repurposing directions

General directions	Specific directions
Agricultural	farming: animals, poultry, fish
	crops: farm land, orchards, meadows, pastures, gardens for allotments
Forestry	protection
	commercial (e.g., for timber production)
	recreation: hiking trails, parks, hiking and biking paths, health paths, forest promotion complexes
Natural	forms of protection depending on the natural values: sodding, shrubbing, greening
Recreational	sports facilities, including those for winter sports, such as ski slopes, bobsleigh runs, hiking trails, parks, footpaths, health trails, playgrounds, amusement parks, extreme sports centres, skate parks
Aquatic	recreation: bathing sites, water sports
	commercial: retention basin, drinking water reservoirs
Commercial	housing, campuses, garages, tourist and hotel facilities
	industrial parks
	services: business incubators, warehouses, stores, wholesalers, parking lots, sports facilities, etc.
	landfills
Cultural	Educational facilities: thematic paths, laboratories, computer labs, concert and conference halls
	contemplative
	artistic: museums, expositions, exhibition and concert halls, galleries, theatres, stages, cinemas, etc.

Source: https://winter-project.eu/wp-content/uploads/2023/01/WINTER_D2.1_BAT_guide_for_land_rehabilitation_and_reclamation.pdf

7 Conclusions

This **transition management handbook** generated within the context of WINTER's interrelated Work Packages 2 and 3: Work Package 2 (WP 2) **'Environmental challenges of coal regions in transition and land rehabilitation solutions'** and Work Package 3 (WP 3) entitled **'Socioeconomic and management aspects of coal regions in transition'** aims to share knowledge and experiences of significance to those regions that are now taking on transition. It develops a best practice guide **including recommendations for strategies/plans, governance/stakeholder, welfare/employment and rehabilitation/repurposing of a just transition process** for policy makers (EU, national and regional levels), social partners (industry and employees), transition management institutions and communities.

Having elaborated **a comprehensive replicable framework** enables key actors in coal transition, including the affected regions, to contextualize the just transition framework and to implement strategies, policies and actions by utilizing the proposed key recommendations. It aims to be a useful reference to those engaged in societal and political debates of the transition process in coal regions and is thus targeted towards national, regional and EU level authorities, as well as social partners (industry, managers and employees), transition management institutions, civil society and NGOs and the community in general. By keeping in mind that, while coal regions differ regarding various characteristics (governance, economy, culture, demography, etc.), this handbook does not aim to adhere to a one-size-fits all approach and should therefore be viewed as a learning journey for all stakeholders involved. Yet, by providing examples of current practices from three coal regions, covering one mature (Ruhr region) and two initial stages (Western Macedonia and Konin region), the risk of being too generic is minimised.

As coal mine closure and thus the transition from mining to post-mining offers decisive **opportunities** to integrate rehabilitation and repurposing plans, so that they are aligned with social, long-term spatial and economic development interests, this handbook contributes to responsible and sustainable post-mining management by viewing the transition process as **protecting citizens and the environment by creating a safe and healthy environment**, rehabilitation and repurposing of former mining sites equally results in significant **challenges**. As compulsory sustainable post-mining management needs to minimize negative consequences and maximize potential benefits, this transition management handbook contributes to filling the gap in literature and in research by, both theoretically and empirically, highlighting regions' coal transition opportunities as well as challenges. Encompassing economic, environmental and social levels, these are based best practices and success stories, as well as on lessons learnt regarding areas of difficulties and space for designing and delivering more effective policies from the three coal regions in transition.

8 References

Antoniadis, A., Roumpos, C., Anagnostopoulos, P., & Paraskevis, N. (2022). Planning RES Projects in Exhausted Surface Lignite Mines—Challenges and Solutions. Materials Proceedings, 5(1), 93.

Basnou, C. 2016. Delivering Alien Invasive Species Inventories for Europe—Species Factsheet Robinia Pseudoacacia. European Commission under the Sixth Framework Programme through the DAISIE Project. Available online: http://www.europe-aliens.org/speciesFactsheet.do?speciesId=11942.

Bochum Perspektive GmbH (2022): MARK 51°7. Wissen schafft Wirtschaft, 2022.

Brüggemann, J. (2021): Städtebaulich-strategisches Projektmanagement für Stadtquartiere. In: FZN [Forschungszentrum Nachbergbau]; THGA [Technische Hochschule Georg Agricola] (Edit.): Berichte zum Nachbergbau (3), Bochum.

Bussmann, G.; Appelhans, K.; Hahn, F.; Jagert, F.; Bracke, R.; Torsten, S.; König; C. (2019): Reutilization of Mine Water for Heating and cooling in the Abandoned Colliery Dannenbaum in Bochum. Conference Paper, European Geothermal Congress 2019, Den Haag.

Dahlbeck, E. and Gärtner, E. (2019): Just Transitions for Regions and Generations: Experiences from structural change in the Ruhr area. WWF Germany, Berlin.

Edwards, D., Pahlen, G., Bertram, C. and Nathanail, P. (May 2005): The RESCUE MANUAL: Best Practice Guidance for Sustainable Brownfield Regeneration. Regeneration of European Sites in Cities and Urban Environments (RESCUE).

European Commission - EU Initiative for Coal Regions in Transition (2020a): Toolkit Transitions strategies: How to design effective strategies for coal regions in transition. https://energy.ec.europa.eu/document/download/b23e4e49-4b43-466f-9f08-359720acbde2_en?filename=transition_strategies_toolkit_-_platform_for_coal_regions_in_transition.pdf

European Commission - EU Initiative for Coal Regions in Transition (2020b): Toolkit Governance of transitions: Design of governance structures and stakeholder engagement processes for coal regions in transition. https://energy.ec.europa.eu/document/download/93c3b4a0-12aa-4fda-a62f-eadd7cbc0be5_en?filename=governance_of_transitions_toolkit_-_platform_for_coal_regions_in_transition.pdf

European Commission - EU Initiative for Coal Regions in Transition (2020c): Toolkit Sustainable employment and welfare support: How to accompany the labour market transition in coal regions in transition. https://energy.ec.europa.eu/system/files/2020-05/sustainable_employment_and_welfare_support_toolkit_-_platform_for_coal_regions_in_transition_0.pdf

European Commission - EU Initiative for Coal Regions in Transition (2020d): Toolkit Environmental rehabilitation and repurposing: Guidance on the governance of environmental rehabilitation and repurposing in coal regions in transition. https://energy.ec.europa.eu/document/download/7b17af79-b4b2-482f-95c0-977b1c2fbb35_en?filename=environmental_rehabilitation_and_repurposing_toolkit_-_platform_for_coal_regions_in_transition.pdf

Feldmann, P. (2009): Die strategische Entwicklung neuer Stadtquartiere – unter besonderer Berücksichtigung innenstadtnaher oder innenstädtischer brachgefallener Industrieareale. In: Schulte, Karl Werner; Bone-Winkel, S. (Edit.): Schriften zur Ökonomie (53). Regensburg, Immobilienmanagerverlag.

Funke, J. (2019): Strukturwandel Next Level: Bochums Opel-Gelände im nächsten Wandel. In:

Institut der deutschen Wirtschaft (Ed.): IW-Kurzbericht (2019), No. 74.

Furnaro, A., Herpich, P., Brauers, H., Oei, PY., Kemfert, C. and Look, W. (2021): German Just Transition: A Review of Public Policies to Assist German Coal Communities in Transition, Report 21-13, November 2021, Resources for the Future and Environmental Defense Fund.
International Energy Agency (2021) Phasing Out Unabated Coal: Current status and three case studies. https://iea.blob.core.windows.net/assets/861dc94d-a684-4875-80fb-a1faaf914125/PhasingOutUnabatedCoal-CurrentStatusandThreeCaseStudies.pdf

Kasztelewicz, Z., Reclamation of post-mining areas in Polish open pit mines. Monograph. Fundacja Nauka i Tradycje Górnicze z siedzibą Wydział Górnictwa i Geoinżynierii Akademii Górniczo-Hutniczej im. Stanisława Staszica w Krakowie, Kraków, 2010.

Melchers, C. (2016): Klassische Fragen der Sanierung einer Bergbaufläche. In Technische Hochschule Georg Agricola und Bezirksregierung Arnsberg (Ed.): NACHBergbauzeit in NRW-Beiträge 2011,2013,2015: Selbstverlag des Deutschen Bergbau-Museums Bochum, pp. 123–126.

Michaux, S. How to set up and Develop a Geometallurgical Program FINAL v6, 2020.

Oei, P-Y., Brauers, H. and Herpich, P. (2020): Lessons from Germany's hard coal mining phase-out: policies and transition from 1950 to 2018. Climate Policy, Vol. 20, No. 8963-979.

POTENTIALS: Best Practice Guidelines – Synergistic potentials of end-of-life coal mines and coal-fired power plants: update and re-adoption of territorial just transition plans. December 2023 https://potentialsproject.uniovi.es/wp-content/uploads/2024/02/POTENTIALS_BEST-PRACTICE-GUIDELINES.pdf

PPC Renewables (2022) Our Projects – Under construction. Available at https://www.ppcr.gr/en/projects/projects-under-construction (Accessed 03/10/2022)

Roche, M. Y. (2020): Toolkit Governance of transitions. Design of governance structures and stakeholder engagement processes for coal regions in transition. With assistance of Baker, P., Beutel, J., Bierwith, A., Kurwan, J., Pollock, R., Schepelmann, P., Schüle, R. Edited by European Commission.

Rogall, H. and Gapp-Schmeling, K. (2021): Nachhaltige Ökonomie. Band 1: Grundlagen des nachhaltigen Wirtschaftens. 3., stark überarbeitete Auflage. Sustainable economy. Volume 1: Fundamentals of sustainable management. 3rd, heavily revised edition. Metropolis Verlag.

Tiliouine, A., Kosinska, M. and Schröder-Bäck, P. (2018): Tool for mapping governance for health and well-being: the organigraph method. Edited by World Health Organisation. Denmark.

Van de Loo, K. (2023): Grundlagen einer nachhaltigen Ökonomie der Transition von Bergbauregionen (dargestellt am Beispiel des Kohleausstiegs in Deutschland. Berichte zum Nachbergbau, Heft 4, THGA. Fundamentals of a sustainable economy for the transition of mining regions (illustrated using the example of the coal phase-out in Germany).
https://fzn.thga.de/wp-content/uploads/sites/4/2024/01/Berichte-zum-Nachbergbau_Heft-4_vanDeLoo_web_encoded-1.pdf

World Bank (November 2018): Managing Coal Mine Closure: Achieving a Just Transition for All. https://documents1.worldbank.org/curated/en/484541544643269894/pdf/130659-REVISED-PUBLIC-Managing-Coal-Mine-Closure-Achieving-a-Just-Transition-for-All-November-2018-final.pdf

Wuppertal Institute (2022): Just Transition Toolbox for coal regions.

https://webflow.henkelhiedl.com/wuppertal_institut/Just_Transition_Toolbox_for_coal_regions_EN.pdf

9 List of Figures

10 List of Tables