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Bridging Policy Streams of Minerals and Land Use Planning: a Conceptualisation and Comparative Analysis of Instruments for Policy Integration in 11 European Member States

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1 ABSTRACT

Minerals play an important role for the European economy, hence the secure and sustainable supply of minerals is of political importance for the EU and its Member States (MS). Despite the fact that Europe has a potential for minerals development, access to minerals is, however, influenced by different stakeholder interests, often reflected in competing forms of land-use and institutional complexity of two policy streams of minerals and land use planning. Recent public sector responses in EU MS introduce new instruments such as safeguarding or protection of minerals deposits or valorisation schemes for minerals development, both aiming to bridge the two policy streams. However, there are significant challenges for governments and public administrations on all levels to achieve the effective integration of the two policy streams: Institutional and administrative fragmentation, unclear roles and duties, coordination deficiencies between levels of governance (departmentalism) or lack of willingness or ability to collaborate (Endl, 2017; Gugerell, 2019).

Thus, our research identifies different approaches to policy integration of minerals and land use planning policy based on a qualitative analysis of 12 case studies from 11 different EU MS. Against this background, the article conceptualises and analyses policy integration with regards to: 1) instruments for horizontal and vertical integration; 2) degree of integration - full versus partial integration (e.g. for horizontal integration: considering integration ex-ante/in the design versus ex-post/during implementation); 3) which aspects of horizontal or vertical policy integration are outlined (e.g. protection of deposits or design of land use plans); and 4) the capacity and willingness for policy integration by different actors.

The results indicate two central characteristics for policy integration: (i) the mix of different types of instruments for horizontal and vertical integration and (ii) capacity of the involved actors. Across the 12 case studies we identified a mix of regulatory, economic or informative instruments, national strategies/ policy guidelines across horizontal as well as vertical policy integration. However, we recognised a trend across all 11 countries: instruments that signify full integration of minerals and land use planning on both horizontal and vertical levels; the application of soft rather than coercive instruments; and a prevalence for instruments in the form of planning tools and/or maps with the objective of enhancing knowledge of potential land use, mitigate land use conflicts and/or integrating minerals into land use planning processes.

Our research shows that across 11 countries policy instruments are assembled to policy mixes for integrating minerals and land use planning policy combining regulatory, economic (fiscal) tools, (national) strategies and guidelines and information-based instruments. In the specific context of instruments for minerals planning (e.g. multi-criteria assessment, safeguarding) the results indicate that in order to support the integration of land-use and mineral policy, instruments should be adapted to the land-use planning system and a good fit with the actual processes on the lower level of implementation (local and regional). Moreover, the results illustrated that willingness and capacity of actors play a crucial role for policy integration and implementation. Against this backdrop, more centralised public administration can more readily support lower levels to manage policy challenges: they can support lower levels by providing expertise, capacity building activities and create platforms where the different policy sectors can meet. Conversely, in decentralised systems and systems where policy design and implementation are dispersed among different levels of government the willingness to collaborate between higher and lower levels of government is important to support later policy implementation.

Keywords: Policy instruments, Mineral policy, policy integration, Mineral resources, Land-use planning

2 INTRODUCTION

European economies are dependent on the secure and stable supply of raw materials and minerals. The access to raw materials for sectors such as the construction, chemicals, automotive, aerospace, machinery and equipment are estimated to be connected to the existence of 30 million job opportunities in Europe (European Commission, 2013). Import dependency and the need for minerals (including Critical Raw Materials, CRMs) for the transition to cleaner technology are necessitating a coherent and comprehensive minerals policy framework in the EU and EU Member States (MS) (Dooley, & Leddin, 2005; Tiess, 2010; Thomashausen et al. 2018, Fraser Institute, 2018).

A national policy framework can either enable or hamper the development of sustainable mineral production. Due to the cross- spatial, temporal, and sectoral nature of mineral- and raw material production, minerals policy constitutes a particularly "wicked" policy problem (Endl, 2017). Defined as intractable, ill-structured, fragmented and contested a wicked policy problem resists standard approaches to problem solving (Daviter, 2019). The governance of wicked problems constitutes an administrative challenge too complex to be tackled by prevalent sectoral silo thinking and specialisation (Daviter, 2019). Avoiding silo-thinking and engaging in coherent policy approaches, is particularly relevant in the context of land-use planning (LUP) and mineral policy for achieving access to and protecting minerals resources, managing the contested nature of exploitation and exploring new approaches for integrated policy design and implementation. Up until today, there are significant challenges for public administration on all levels to achieve the effective integration of the two policy streams: Institutional and administrative fragmentation, unclear roles and duties, coordination deficiencies between levels of governance (departmentalism) or lack of willingness or ability to collaborate (Endl, 2017; Gugerell, 2019). The paper gives an overview about concrete examples of EU Member State policy instruments for integrated minerals and LUP policy and their design and implementation experiences in order to address above-mentioned challenges.

3 BACKGROUND

3.1 Mineral resources in mineral and land use planning policy

Several EU MS have established more strategic policy approaches to secure minerals supply from primary sources. However, public disapproval, incoherence with other policy areas and lack of business incentives constitute barriers and challenges to ensuring effective policies and implementation (Everingham et al., 2013, Moffat & Zhang, 2014). Governing the secure and sustainable supply of minerals from primary production faces particularly "wicked" dynamics. Minerals policies need to address various factors such as multiple stakeholder interests, competing land-use interests, as well as conflicting agendas and objectives. Hence, studies focusing on governance of wicked policy problems often focus on the need for government coordination and/or collaborative governance to challenge existing patterns of sectoral responsibilities (Askim et al., 2009; Christensen & Laegreid, 2007, 2008; Flynn et al., 2011; Kavanagh & Richards, 2001; Bryson et al., 2006; Ferlie et al., 2011; Weber & Khademian, 2008).

The complexity of minerals policy-making warrants the consideration and application of different policy- and decision-making instruments; voluntary, regulatory and strategic, whilst recognising stakeholder and public interests (Clausen & McAllister, 2001). Nevertheless, studies on resource governance often tend to focus on the effectiveness of a single policy instrument rather than underlying factors of policy governance for managing the complex dynamics of primary mineral production (Söderholm, 2015; Endl, 2017). Hence, this paper explores the notion of a more integrated and comprehensive approach to minerals policy which addresses the instruments for horizontal and vertical policy integration; as well as degrees, aspects and capacity of such integration in the 14 EU MS case studies, thereby extending research on minerals- and land use policy integration beyond 'environmental trade-offs' to recognise inclusion of present (and future) socioeconomic and political needs in society.

Overall, LUP deals with assessments of potential land-use options serving the demands and needs of communities while managing natural resources of that option. These natural resources cover, for example, water(sheds) (Boschet and Rambonilaza, 2015), forests and agriculture (Ayambire et al., 2019; Gosnell et al., 2011), ecosystem services (Grêt-Regamey et al., 2017) or mineral resources (Bax et al., 2019; Lopes et al., 2018). Against this backdrop, LUP systems (i.e. instruments and processes) are expected to manage competing demands (e.g. nature protection, residential, agriculture (Gałaś, 2017; Mitchell et al., 2004;

Mitchell, 2016) and integrate them into the socio-spatial context (Gustafsson and Scurrah, 2019; Roth and Howie, 2015).

The current literature on land-use planning and mineral resources largely investigates valuation of mineral resources for LUP decision making (EUROMINES, 2011), modelling of decision support tools (e.g. for Strategic Environmental Assessments) considering different social, environmental and economic aspects (Lechner et al., 2017; Ustaoglu et al., 2018) and LUP instruments (e.g. Gustafsson and Scurrah, 2019). Altough research on linking or integrating mineral resources into LUP policies exists (Baker and Hendy, 2005; Roth and Howie, 2015; Wagner et al., 2006; Wrighton et al., 2014), there is no comprehensive overview that provides a more nuanced picture on different approaches in EU Member States. This article address this gap by looking into 11 EU MS and their setup of policy instruments covering a wide range of different aspects of minerals and LUP policy and outlining their success in integrating these two policy streams.

3.2 Forms of policy Integration - horizontal, vertical, diagonal

Policy integration can be understood as "the replacement of specific elements of existing policy 'mixes' or 'regimes' – the goals and objectives and calibrations of existing policy tools and goals – by a new policy mix, in the expectation of avoiding the counterproductive or sub-optimal policy outcomes that arise from treating interrelated policy regimes and components in isolation from one another"(Rayner and Howlett, 2009, p.99).

Policy integration can take place at different moments and/or periods of the policy cycle: either in the policy design and –development process, implementation, evaluation or in the re-design or update of a policy (Kivimaa and Mickwitz, 2006). Prior research advocates that the policy design and decision-making phase might be better suited for policy integration than later stages of the cycle, such as implementation (Jordan and Lenschow, 2010a; Uittenbroek et al., 2013). Two lines of arguments are supporting that consideration: a) early integration efforts are assisting the consideration of other actors/stakeholders' interests and policy objectives in the policy design and the development of implementation actions and measures; b) administrative procedures and routines of other administrative units might differ and thus sufficient time for coordination and administrative and pre-information is needed. However, the implementation phase and implementation actions and measures are the ones where the actual impact of integrated policies is created (Kohlhoff et al., 2016).

Horizontal policy integration is often understood as pertaining to organisational and institutional interactions across distinct sectors or, the extent to which a central authority has developed a comprehensive cross-sectoral strategy (Di Gregorio et al., 2017; Lafferty and Hovden, 2003). Horizontal policy integration can thus be seen in converging two (or more) policy streams to obtain a coherent approach, as policy streams with conflicting goals and objectives may undermine long-term alignment of overarching objectives across sectors (Nilsson, 2005). Horizontal policy integration is particularly addressed as paramount in 'naturally' cross-sectoral topics such as environmental- or climate policy (Di Gregorio et al., 2017; Jordan and Lenschow, 2010; Nilsson, 2005; Lafferty and Hovden, 2003) but also for minerals and raw materials policy (Endl, 2017; Clausen and Mcallister, 2001). Vertical policy integration, on the other hand, takes place among different levels and hierarchies across political administrative levels and/or territories (Endl, 2017). Hence, vertical policy integration involves actors from different levels of government such as, for example, national ministries, regional authorities and local governments, thereby increasing the need for capacity within and between such actors to achieve integration. Vertical policy integration can involve processes of devolving responsibility to local levels, and can foster coherency, consistency and learning between different levels of government (Nilsson, 2005). When the coordination efforts are crossing policy streams and administrative level, one speaks of diagonal policy integration: such cases can become apparent in strongly decentralised or federal systems, where setting the policy goals and their implementation is dispersed over different levels of government and policy sectors. Steurer and Clar (Steurer and Clar, 2015) are stressing, that, in such settings early agreements and commitment between the different administrative levels and the actors responsible for implementation are crucial in policy design and goal setting.

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3.3 Enabling factors of policy integration: tools, capacity and willingness

In order to be effective in terms of delivering policy goals, policy integration is subject to the availability of tools, and the capacity and willingness of public institutions to employ these tools. With regards to tools, we will mainly draw on EPI (Environmental Policy Integration) research done by Runhaar (2016), which has a long tradition and has produced a strong body of knowledge on policy integration. Runhaar (2016) distinguishes four types of integration tools:

(1) Regulatory tools (restricting/allowing certain options, actions and behaviour),

(2) Information tools (steer by providing information and guidance)

(3) Economic tools (e.g. change cost-to-benefit ratios)

(4) Organisational tools (organisational conditions such as capacity/willingness, procedures, etc.)

Regulatory tools are regulating choices: Runhaar (2016) also introduces regulatory tools relying on interactive governance modes (e.g. voluntary agreements, covenants). Voluntary agreements are criticised for their limited capacity to unfold implementation and integration pressure, due to too much flexibility and ambiguity (room for interpretation), lack of enforcement mechanisms, limited compensation measures (Glasbergen, 1998; Wu et al., 2018).

Information and voluntary tools are considered to drive behaviour through learning and grants of the addressed audience with a large freedom of discretion and freedom to act on the provided information. Voluntary usage of indicators (such as environmental indicators) is challenging in practice, due to language asymmetries (e.g. planners/policy makers) or insufficient involvement of planners (or other end-users) in the indicator development, which subsequently results in limited, fragmented or no application later on (Brown, 2003) or a mismatch between indicator scale and user-needs (Graymore et al., 2008).

Typical incentive structures are economic tools. Economic tools are supporting integration by either setting financial incentives, rewards or punishments. They are on the interface of top-down steering and voluntary behaviour: they might be put in place by higher levels of administration or government but depend on the voluntary behaviour (by contracting) of the involved actors and stakeholder. In EPI different studies have shown the effectiveness of market-based tools: their effectiveness depends on the financial reward and the enforcement power and possible trade-offs with other policy objectives and issues. EEA emphasises that economic tools should only be one part of a broader package and toolset that steers policy integration (EEA, 2005).

Organisational tools are stressing the importance of organisational structure and organisational practises, as well as the establishment of partnerships and networks that are supporting integration in different stages of the policy cycle. However, also those partnerships are assessed critically by stressing that they "seem to solve some problems but also create new ones". Partnerships and networks are long-term voluntary engagements that need trust building efforts and the willingness to share duties and responsibilities (Klijn and Koppenjan, 2016).

Capacity and willingness are key for effective policy integration (Fleurke and Hulst, 2006; Wu et al., 2018; Zuidema, 2016). Capacity (ability) refers to an organisation's or unit's capacity to perform certain tasks and objectives. Prud'homme (Prud'homme, 1995) explains that it cannot be assumed that (local) units are in command of all technical and managerial expertise and skills to perform certain tasks. This observation is important considering mining and mineral extraction is a very specific and technically sophisticated topic. Zuidema (Zuidema, 2016) is emphasising so called 'economies of scale' where larger (e.g. central government) units might have greater resources or the ability to attract and/or allocate resources to handle broad and complex policy issues. Ostrom (Ostrom, 2015) is noticing the importance of the central government to support local (and regional) authorities to handle and overcome possible challenges and hindrances.

4 METHODS

In our paper we screened a total of 16 case studies originally compiled via two MINLAND Horizon 2020 project reports for evidence of integrated minerals and LUP policy approaches (Luodes et al., 2019; Endl et al., 2019). Complementary information on case studies was retrieved from additional sources, such as summaries and minutes from MinLand Local Workshops and descriptive policy networks (Gugerell, 2019).

As a result the authors identified a total of 12 MINLAND cases that described 13 policy tools dealing with different aspects of minerals and LUP policy, and addressing different phases in the policy cycle. The identified policy instrument types are listed in the table below.

Policy tool	**Regulatory:** demanding compliance equally, steering predictability of governmental decisions (rule of law) and often followed by sanctions for non-compliance.
	Economic or fiscal: designed to encourage investments into exploration and access to raw materials, e.g. tax rebates for research activities (prospecting and exploration)
	National strategies/ policy guidelines: proposing a framework and/or identifying suggested criteria for consideration of minerals in e.g. land use planning
	Information-based: maps, data and tools to be utilised (on a voluntary or regulated basis) for the integration of minerals/land-use plans.

Table 1: Policy tool types differentiated for analysis.

Drawing insights from the literature review on policy integration and respective challenges dealt within minerals and LUP policy, the authors set up the following analytical framework where distinctions were made between 'low degree' and 'high degree' of integration efforts and potential:

	Degree of integration		
Vertical Policy Integration	**Low:** national voluntary or non-mandatory tools addressing minerals (often related to safeguarding objectives)	**Capacity for policy integration**	**Technical capacity** is referring to content-specific knowledge and skills, existence of other supportive policies (e.g. project subsidies, rewards, regulatory instruments)
	High: considers of minerals in land-use planning (input into land use planning originates from other levels of governance)		
Horizontal Policy Integration	**Low:** Land-use (or mineral) issues integrated into minerals (or land-use) planning documents, primarily in ex-post or in the implementation stage		**Managerial expertise** is referring to sufficient expertise regarding integrated policy approaches and/or expertise and skills for collaboration and working across departmental and governmental organisational borders
	High: considers minerals in preparation or design stage of land-use plans/ zoning documents or considers land-use planning in minerals planning documents.		

Table 2: Analysis framework for forms of policy integration, degree of integration and capacity.

The distinction between 'low' and 'high' degree of integration efforts was based on emprical findings from the cases, as well as evidence from the literature on minerals- and LUP policy integration. 'Low degree' in the vertical level hence refers to the existence of a tool with the intention to include e.g. minerals safeguarding into land use plans, whereas a 'high degree' is evidence of actual consideration (and inclusion) in the design and development phase of land-use planning. Similarly, with regards to horizontal integration again 'low degree' was used to describe practices of integrating mineral aspects into land-use (or vice versa) ex-post or in the implementation stage, rather than considering integration on a preparation or design phase, which was then deemed to display 'high degrees' of integration efforts and practices.

5 RESULTS

5.1 Policy instruments for minerals and land-use policy integration

12 MINLAND casess were assessed for horizontal and vertical mineral and land-use policy integration. Furthermore, following the framework of policy instrument type, instruments for vertical and horizontal policy integration were grouped according to: (i) strategies and regulatory instruments, or; (ii) informative policy instruments.

5.1.1 Vertical policy integration instruments

In Finland and Ireland mineral interests outlined in the national guidelines and planning frameworks directly fed into regional and local planning documents, thereby indicating high vertical integration. In Sweden, the regional level (municipalities) preside over the discretion to weigh the 'areas of national' interests (defined through horizontal/sectorial integration) with their regional land-use objectives, thereby signalling this as a low (and flexible) degree of vertical integration. See table 3 below for an overview.

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Country	Policy Tools	Aspect of Vertical Policy Integration	Degree of integration
Finland	National land use guidelines stipulate policy streams and strategic goals (including mining and deposits) in a centralised approach.	Top-down implementation in the regions – although regions can contribute to goals and objectives through setting their own priorities.	High
Ireland	Planning and Development Act complemented by a National Planning Framework (addresses objectives of minerals policy horizontally on a national level).	Top-down regulatory framework: general objectives are translated into regional and county level land-use plans.	High
Sweden	System of 'national interests' (horizontal/sectorial) definition of land-use interests and objectives.	Local levels responsible for land-use plans, system of 'national interests' can be weighed (partial vertical integration) on a local level and chief mining inspectorate or national levels can be involved if conflict arises.	Low

Table 3: Vertical policy integration in strategies and regulatory instruments.

The informative and voluntary tools by Austria, Portugal and Spain are all subject to challenges of vertical integration as they are designed on a national level but with the intention to support minerals policy (and safeguarding) integration in local and regional land-use plans of federal or decentralised systems. All cases discussed the need for coordination and communication between national and regional/local levels of government in achieving 'uptake' and integration of the tools on lower levels of government. A specific challenge that was brought up in the cases was the need to involve regional/local authorities already in the design-process of instruments as this would ensure 'ownership' and thus, willingness to integrate the tool or outcomes thereof in regional/local land-use plans. Two more MINLAND cases addressed the design and implementation of an informative policy tool (from a national to a regional level), similar to the cases outlined above. The tool from Greece was implemented in a centralised (top-down) manner, thereby, ensuring integration into spatial plans. In Norway the case study showed that the integration of the land-use management tool was successful in the county of Nordland (high integration).The pilot will now be extended to other municipalities and regions (no integration currently known). See table 4 for an overview.

Country	Policy tools	Aspect of Vertical Policy Integration	Degree of integration
Greece	National level policy tool for safeguarding the exploitation of primary aggregates – focus on framework applied for delineation of conflict free (land-use) aggregates extraction areas	Top-down implementation of national safeguarding policy (aggregates) in regional/local land use planning (spatial plans).	High
Norway	National land-use management tool with the objective of mediating potential land-use conflicts and safeguarding mineral resources of possible current and future value	Responsibility of planning lies with municipal council and regional authorities. Nordland case used as a pilot; the instrument contributed to increased awareness of mineral safeguarding on all levels of governance and is set to be implemented in all municipals and regions	High
Austria	Austrian Raw Materials Plan (ARMP). Soft-policy informative tool designed on a national level to avoid land-use conflicts and ensure mineral safeguarding	Local levels responsible for land-use plans – consultations between different levels occur in the form of checks and balances, review of the proposed plan on regional level and partly on national level if related to responsible department.	Low
Portugal	National voluntary instrument (land use planning methodology for mineral resources – LUP-MR)	Municipalities responsible for land-use planning, some have used the sub-categories of land proposed by the LUP-MR. National authorities approach municipalities not adopting the LUP-MR in an effort to increase understanding of the importance of minerals safeguarding	Low
Spain	National informative and voluntary instrument of mining-environmental planning map intended to be used as a starting point of defining mineral and mining strategies in regional land-use plans.	Challenges of vertical integration in a decentralised system where regional levels are responsible for land-use plans. Implementation met with challenges and is yet to be seen	Low

Table 4: Vertical policy integration in informative instruments.

5.1.2 Horizontal Policy Integration instruments

Regulation, strategies, informative instruments (land use planning or zoning) were most common instruments for horizontal policy integration during the implementation phase. Mineral issues integrated at a design stage (of land-use planning or a policy) were considered to signal a high degree of horizontal integration. Other instruments where minerals issues were considered (more ad-hoc) in the implementation stage were considered as evidence for low degree of integration. The information in table 5 outlines

strategies and regulatory policies that address horizontal integration of minerals resources in land-use policy (or vice versa) and the different aspects thereof.

Country	Policy Tools	Aspect of Horizontal Policy Integration	Degree of integration
Finland	Regional development strategies	Preparation phase of regional land use plans considers minerals exploitation via regional development strategies; consultation is conducted and regional strategy zoning updated/proposed.	High
Finland	Flexible zoning plans	Land use planning processes allows for re-evaluation of land use zoning according to development possibilities; e.g. re-evaluation can be conducted based on company plans for exploitation	High
Sweden	System of 'national interests'	National interests determined through sectorial integration – minerals and other land use interests determined through mechanisms of horizontal integration (respective authorities and actors involved).	High
Norway	Planning and Building Act (National)	Revised to include mineral resources as a specific topic (design) in the Norwegian land use legislation, mineral resources must be considered in the land use planning process.	High
Italy	Regional land-use and minerals strategy / municipality mining plan	Mapping geological heritage, flora and fauna with the intention of modifying the current planning instrument to consider e.g. touristic possibility of geological heritage.	High
Ireland	Planning and Development Act complemented by a National Planning Framework 2040	One policy objective of the national planning framework addresses 'rural development through the sustainable and economically viability of extractive industries, bio-economy and accelerating other sectors whilst protecting the natural landscape and cultural heritage. *The case still indicates that the integration of minerals policy in land-use planning appear modest.*	Low

Table 5: Horizontal policy integration in strategies and regulatory instruments.

Our results indicate that some countries cover instruments that weigh different land-use interests in the design phase of the policy on different levels of government: for example, whereas in Italy this was done on a regional level, in Sweden it was on a national level. Some cases also showed evidence that mineral resources have been integrated to a high (Norway), or low degree (Ireland). Finland also included an aspect of having flexible zoning plans that allowed for 'reformulated' strategies and land-use processes if new deposits were discovered (thereby integrating minerals into land-use plans in a flexible and on-demand basis). The cases, thus, indicated that horizontal integration of minerals and land-use planning represent different shapes and forms and can occur on different levels of government.

Similar to the section on vertical integration was the prevalence of informative policy instruments for horizontal integration. As outlined above, these instruments were characterised by a varying degree of vertical integration success in the different EU MS. Utilising a high degree of horizontal integration as pertaining to integration in the design of the policy instrument, the majority of informative instruments were considered to achieve a high degree as they often accounted for different land-use and societal interests already in their design phase. In one case, the informative instrument integrated aspects of already existing policy streams to achieve coherency and compliance, this was considered as low instead of a high degree of integration (Austria).

Country	Policy Tools	Aspect of Horizontal Policy Integration	Degree of integration
Greece	National Policy for Minerals Safeguarding (Quarrying Areas).	Designed for vertical integration into regional spatial plans this policy tool considers minimisation of environmental footprint, the national spatial strategy, socioeconomic factors and protection of archaeological and cultural heritage.	High
Spain	National mining-environmental mapping	Early phases of environmental land use assessment: territorial analysis factoring in environmental inventory, exploitable resources, cultural heritage, and visible impacts on landscape.	High
Portugal	Land use planning methodology for mineral resources (LUP-MR)	LUP-MR refers to the practice applied by the mining authority when contributing to Land Use Planning review processes of municipal land use plans. Full-integration of minerals safeguarding into land-use plan processes on a national level but modest implementation on sub-levels of government (vertical).	High
Austria	Austrian Raw Materials Strategy and Austrian Mineral Resources Plan	Coordinating parts and components of other policies such as Land-Use and Nature Protection into a Raw Materials Plan.	Low

Table 6: Horizontal policy integration in informative instruments.

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5.2 Capacity for policy integration

Technical and managerial capacities are necessary to support and perform coordination and policy integration. Technical capacity is referring to content-specific knowledge and skills, existence of other supportive policies (e.g. project subsidies, rewards, regulatory instruments). Managerial expertise is referring to sufficient expertise regarding integrated policy approaches and/or expertise and skills for collaboration and working across departmental and governmental organisational borders.

Our data on policy tools illustrate a differentiated perception regarding ability and capacities of involved actors, covering the entire scale from perceived low to high capacity. While respondents with geological and/or mining background consider LUP technical capacity in general rather low (e.g. Spain, Finland, Norway). On the other hand, MINLAND project meetings are illustrating a rather modest LUP knowledge (objectives, approaches, tools etc.) from many involved actors affiliated with geology or mining. This situation emphasises the importance of projects like MINLAND, to establish platforms for capacity building, knowledge sharing and as meeting space for involved parties.

Our results indicated that the availability of data for GIS and the necessary skills and knowledge for the integration of provided GIS data into LUP practise was prevalent in the planning departments and LUP authorities (see table 7 below) for most countries: GIS applications are standard applications in GIS practice, hence suitable interfaces and low-threshold download options with the necessary data provide a suitable base for LUP activities and support the integration of mineral resources in LUP practise (e.g. Austria).

Country	GIS tools and skills
Portugal	GIS tools assisting planners, all data in GIS systems
Austria	GIS processing tools are in full use, interface
Greece	Sufficient expertise and tools
Sweden	GIS data sharing
Italy	Specific data base is existing, assisting the mining and LUP
Finland	Each organisation relies on their GIS resources
Hungary	Data provided for GIS applications & National or Regional Development and Spatial Planning Information

Table 7: Technical skills for GIS and Information Systems for mineral resources and LUP, outlined in the MINLAND case studies

Among the abovementioned countries there are, however, differences regarding the general availability to mining experts and/or geologists in public administration and for immediate availability for LUP authorities: while in some cases geologists are available in public administration on regional or provincial level (e.g. Austria/Styria/Tyrol) in other cases they are not (e.g. Poland). Minerals, quarrying and mining is considered a delicate topic with very specific questions, which cannot be covered in house but experts are needed. The MINLAND cases show, that for authorities it is not always possible to have an expert on site, but it becomes clear that they either collaborate with experts or with geological surveys to tackle specific and complex questions they cannot cover by themselves (e.g. Ireland, Spain, Sweden).

6 CONCLUSION

Our paper indicates that in EU Member States a diversity of policy tools are assembled into policy mixes combining regulatory, economic (fiscal) tools, (national) strategies and guidelines and information-based instruments. One challenge of introducing new policy tools is their evalution in the context of the existing policy regime, and how the different tools work and fuction together. Existing research (e.g. Howlett and del Rio, 2015; Rayner et al., 2017) points out, that the mere adding or replacing of policy tools can result in a situation in which the policy tool and/or the entire policy mix cannot unfold its expected performance and/or can lead to underperformance and inefficiencies (e.g. resource expenditure).

The tools addressing vertical integration indicate the importance of coordination and communication between different levels of government. This is of high importance in decentralised and federal systems where involvement of lower levels of government early on in the design of tools were mentioned as key to ensure integration and implementation (e.g. Norway, Spain). It was apparent that a high degree of vertical integration was more prevalent in centralised systems where regulatory tools demanded integration of objectives or goals in lower levels of government planning. Interesting to note is the mandate of local

authorities to prioritise (Sweden) or identify own pathways toward realising national goals and objectives (Finland), which also gives flexibility of prioritising local interests and may increase legitimacy and ownership of policy and responsibility over connected challenges (Nilsson, 2005).

Our results on horizontal (sectorial) integration most commonly outline nationally developed policy tools with the intention of integrating mineral resources into land-use planning. However, there appears to be a deficit in vertical integration of such tools in systems where regional and local levels of governments have land-use planning mandates, as seen in the examples from Portugal and Austria. This suggests that although a high degree of integration can occur on a horizontal level, challenges remain to successfully achieve vertical integration in such systems. As seen from literature on policy integration, this again strengthens the notion that both dimensions of horizontal and vertical mechanisms are needed to achieve 'full policy integration' (Jacob and Volkery, 2004).

Capacity for policy integration plays a crucial role for effective policy implementation and delivery, which should be considered in both policy design and its translation into policy instruments. As regards the capacity of public authorities for policy integration, MINLAND cases indicate that for particular questions experts are needed to advise public authorities. Support, exchange and capacity building is considered particularly important for municipalities and regions which have no long tradition as an industry player and where public authorities and public administration were not engaged with mining earlier (e.g. cases Spain, Austria/Styria). Aligning with Zuidema (2016) and Ostrom (2015) we can see that the support of the central government or higher levels of government are needed to provide such resources and that smaller units (e.g. regions, municipalities) often do not have the capacities to utilise such resources (e.g. hired geologist). The cases of Sweden and Austria show that geological surveys provide support. For example, the Swedish Geological Survey provides particular support for the industry. Hence, it is important to note, that for advising public administration unbiased consultancy is required, apart from lobbying activities of industry, since LUP is expected to weigh, value and integrate various needs, expectations and policy streams.

7 REFERENCES

Askim, J., Christensen, T., Fimreite, A.L., Lægreid, P., 2009. How to Carry Out Joined-Up Government Reforms: Lessons from the 2001–2006 Norwegian Welfare Reform. Int. J. Public Adm. 32, 1006–1025. https://doi.org/10.1080/01900690903223888

Ayambire, R.A., Amponsah, O., Peprah, C., Takyi, S.A., 2019. A review of practices for sustaining urban and peri-urban agriculture: Implications for land use planning in rapidly urbanising Ghanaian cities. Land Use Policy 84, 260–277.

Bax, V., Francesconi, W., Delgado, A., 2019. Land-use conflicts between biodiversity conservation and extractive industries in the Peruvian Andes. J. Environ. Manage. 232, 1028–1036. https://doi.org/10.1016/j.jenvman.2018.12.016

Boschet, C., Rambonilaza, T., 2015. Integrating water resource management and land-use planning at the rural–urban interface: Insights from a political economy approach. Water Resour Econ 9, 45–59.

Brown, A.L., 2003. Increasing the utility of urban environmental quality information. Landscape and Urban Planning 65, 85–93. https://doi.org/10.1016/S0169-2046(02)00240-2

Bryson, John M., Barbara C. Crosby, and Melissa Middleton Stone. 2006. Th e Design and Implementation of Cross-Sector Collaborations: Propositions from the Literature. Special issue, Public Administration Review 66: 44–55.

Christensen, T. and Lægreid, P., 2007, "The whole-of-government approach to public sector reform", Public Administration Review, Vol. 67 No. 6, pp. 1059-1066.

Christensen, T. and Lægreid, P., 2008, "The challenge of coordination in central government organizations: the Norwegian case", Public Organization Review, Vol. 8 No. 2, pp. 97-116

Christmann, P., 2018. Towards a More Equitable Use of Mineral Resources. Nat. Resour. Res. 27, 159–177. https://doi.org/10.1007/s11053-017-9343-6

Clausen, S., Mcallister, M.L., 2001. An Integrated Approach to Mineral Policy. J. Environ. Plan. Manag. 44, 227–244. https://doi.org/10.1080/09640560120033722

Daviter, F., 2019. Policy analysis in the face of complexity: What kind of knowledge to tackle wicked problems? Public Policy Adm. 34, 62–83. https://doi.org/10.1177/0952076717733325

Di Gregorio, M., Nurrochmat, D.R., Paavola, J., Sari, I.M., Fatorelli, L., Pramova, E., Locatelli, B., Brockhaus, M., Kusumadewi, S.D., 2017. Climate policy integration in the land use sector: Mitigation, adaptation and sustainable development linkages. Environ. Sci. Policy 67, 35–43. https://doi.org/10.1016/j.envsci.2016.11.004

Dooley, G., Leddin, A., 2005. Perspectives on mineral policy in Ireland. Resour. Policy 30, 194–202. https://doi.org/10.1016/j.resourpol.2005.08.005

EEA, 2005. Market-based instruments for environmental policy in Europe. Copenhagen.

Endl, A., 2017. Addressing "Wicked Problems" through Governance for Sustainable Development—A Comparative Analysis of National Mineral Policy Approaches in the European Union. Sustainability 9, 1830. https://doi.org/10.3390/su9101830

Endl, A., Gottenhuber, S. L., Berger, G., Arvanitidis, N., Arvidsson, R., Cormont, A., van der Sluis, T., Galos, K., Carvalho, J. Raaness, A., Schiellerup, H., Tost, M., Luodes, N., Dinis, P., Joao, M. 2019. Final Manual for Good Practice on Mineral Resources in Sustainable Land-use Planning. Horizon 2020 Project Deliverable. MinLand (776679).

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European Commission, 2013. Strategic Implementation Plan for the European Innovation Partnerships on Raw Materials [Part I].

Everingham, J.-A., Pattenden, C., Klimenko, V., Parmenter, J., 2013. Regulation of Resource-Based Development: Governance Challenges and Responses in Mining Regions of Australia. Environ. Plan. C Gov. Policy 31, 585–602. https://doi.org/10.1068/c10184

Ferlie, E., Fitzgerald, L., McGIVERN, G., Dopson, S., Bennett, C., 2011. PUBLIC POLICY NETWORKS AND 'WICKED PROBLEMS': A NASCENT SOLUTION? Public Adm. 89, 307–324. https://doi.org/10.1111/j.1467-9299.2010.01896.x

Fleurke, F., Hulst, R., 2006. A Contingency Approach to Decentralization. Public Organization Review 6, 37–56.

Fraser Institute, 2018. Survey of Mining Companies 2018.

Glasbergen, P., 1998. Modern environmental agreements: A policy instrument becomes a management strategy. Journal of Environmental Planning and Management; 41, 693–709.

Gałaś, S., 2014. Environmental valorisation of mineral deposits, in: Ecology and Environmental Protection. Presented at the International Multidisciplinary Scientific GeoConference SGEM, Albena, Bulgaria, pp. 267–274.

Gosnell, H., Kline, J.D., Chrostek, G., Duncan, J., 2011. Is Oregon's land use planning program conserving forest and farm land? A review of the evidence. Land Use Policy 28, 185–192. https://doi.org/10.1016/j.landusepol.2010.05.012

Graymore, M.L.M., Sipe, N.G., Rickson, R.E., 2008. Regional sustainability: How useful are current tools of sustainability assessment at the regional scale? Ecological Economics 67, 362–372. https://doi.org/10.1016/j.ecolecon.2008.06.002

Grêt-Regamey, A., Altwegg, J., Sirén, E.A., van Strien, M.J., Weibel, B., 2017. Integrating ecosystem services into spatial planning—A spatial decision support tool. Landsc Urban Plan 165, 206–219.

Gustafsson, M.T., Scurrah, M., 2019. Strengthening subnational institutions for sustainable development in resource-rich states: Decentralized land-use planning in Peru. World Dev 119, 133–144. https://doi.org/10.1016/j.worlddev.2019.03.002

Gugerell, K.: Land Use Policies and Valuation of Land. Vienna, 2019. https://minland.eu/wp-content/uploads/MINLAND_D4.2.pdf

Howlett, M., del Rio, P., 2015. The parameters of policy portfolios: verticality and horizontality in design spaces and their consequences for policy mix formulation. Environ. Plan. C Polit. Sp. 33.

Jacob, K., Volkery, A., 2004. Institutions and Instruments for Government Self-Regulation: Environmental Policy Integration in a Cross-Country Perspective. J. Comp. Policy Anal. Res. Pract. 6, 291–309. https://doi.org/10.1080/1387698042000305211

Jordan, A., Lenschow, A., 2010. Environmental policy integration: a state of the art review. Environ. Policy Gov. 20, 147–158. https://doi.org/10.1002/eet.539

Kavanagh, D. and Richards, D. 2001, "Departmentalism and joined-up government: back to the future?",Parliamentary Affairs, Vol. 54 No. 1, pp. 1-18

Kivimaa, P., Mickwitz, P., 2006. The challenge of greening technologies — Environmental policy integration in Finnish technology policies 35, 729–744. https://doi.org/10.1016/j.respol.2006.03.006

Klijn, E.H., Koppenjan, J., 2016. Governance Networks in the Public Sector. Routledge, New York.

Kohlhoff, A., Runhaar, H.A.C., Gugushvili, T., Sonderegger, G., van der Leest, B., Driesschen, P.P.J., 2016. The influence of actor capacities on EIA system performance in low and middle income countries —Cases from Georgia and Ghana. Environmental Impact Assessment Review 57, 167–177.

Lafferty, W., Hovden, E., 2003. Environmental policy integration: towards an analytical framework. Environ. Polit. 12, 1–22.

Lopes, C., Lisboa, V., Carvalho, J., Mateus, A., Martins, L., 2018. Challenges to access and safeguard mineral resources for society: A case study of kaolin in Portugal. Land Use Policy. https://doi.org/10.1016/j.landusepol.2018.07.035

Moffat, K., Zhang, A., 2014. The paths to social licence to operate: An integrative model explaining community acceptance of mining. Resour. Policy 39, 61–70. https://doi.org/10.1016/j.resourpol.2013.11.003

Nilsson, M., 2005. Learning, Frames, and Environmental Policy Integration: The Case of Swedish Energy Policy. Environ. Plan. C Gov. Policy 23, 207–226. https://doi.org/10.1068/c0405j

O'Flynn, J., Buick, J. F., Blackman, D. and Halligan, J. (2011), "You win some, you lose some: experiments with joined-up government",International Journal of Public Administration, Vol. 34, pp. 213-220.

Prud'homme, R., 1995. The dangers of decentralization. The World Bank Research Observer 10, 201–220.

Rayner, J., Howlett, M., 2009. Introduction: Understanding integrated policy strategies and their evolution. Policy Soc. 28, 99–109. https://doi.org/10.1016/j.polsoc.2009.05.001

Rayner, J., Howlett, M., Wellstead, A., 2017. Policy Mixes and their Alignment over Time: Patching and stretching in the oil sands reclamation regime in Alberta, Canada 483, 472–483. https://doi.org/10.1002/eet.1773

Roth, B.J., Howie, R.A., 2015. Land-Use Planning and Natural Resource Rights: The Alberta Land Stewardship Act. J Energy Nat Resour Law 29, 471–498. https://doi.org/10.1080/02646811.2011.11435276

Runhaar, H., 2016. Tools for integrating environmental objectives into policy and practice: What works where? Environmental Impact Assessment Review 59, 1–9. https://doi.org/10.1016/j.eiar.2016.03.003

Söderholm, K., Söderholm, P., Helenius, H., Pettersson, M., Viklund, R., Masloboev, V., Mingaleva, T., Petrov, V., 2015. Environmental regulation and competitiveness in the mining industry: Permitting processes with special focus on Finland, Sweden and Russia. Resour. Policy 43, 130–142. https://doi.org/10.1016/j.resourpol.2014.11.008

Stead, D., Meijers, E., 2009. Spatial Planning and Policy Integration: Concepts, Facilitators and Inhibitors. Planning Theory & Practice 10, 317–332. https://doi.org/10.1080/14649350903229752

Steurer, R., Clar, C., 2015. Is decentralisation always good for climate change mitigation? How federalism has complicated the greening of building policies in Austria. Policy Sciences 48, 85–107. https://doi.org/10.1007/s11077-014-9206-5

Thomashausen, S., Maennling, N., Mebratu-Tsegaye, T., 2018. A comparative overview of legal frameworks governing water use and waste water discharge in the mining sector. Resour. Policy 55, 143–151. https://doi.org/10.1016/j.resourpol.2017.11.012

Tiess, G., 2010. Minerals policy in Europe: Some recent developments. Resour. Policy 35, 190–198. https://doi.org/10.1016/j.resourpol.2010.05.005

Uittenbroek, C.J., Janssen-Jansen, L.B., Runhaar, H.A.C., 2013. Mainstreaming climate adaptation into urban planning: Overcoming barriers, seizing opportunities and evaluating the results in two Dutch case studies. Regional Environmental Change 13, 399–411. https://doi.org/10.1007/s10113-012-0348-8

Wagner, H., Tiess, G., Solar, S., Nielsen, K., 2006. Minerals Planning Policy in Europe. RMZ - Materials and Geoenvironment 52, 607–620.

Weber, E.P., Khademian, A.M., 2008. Wicked Problems, Knowledge Challenges, and Collaborative Capacity Builders in Network Settings. Public Adm. Rev. 68, 334–349. https://doi.org/10.1111/j.1540-6210.2007.00866.x

Wrighton, C.E., Bee, E.J., Mankelow, J.M., 2014. The development and implementation of mineral safeguarding policies at national and local levels in the United Kingdom. Resources Policy 41, 160–170. https://doi.org/10.1016/j.resourpol.2014.05.006

Wu, J., Zuidema, C., Gugerell, K., 2018. Experimenting with decentralized energy governance in China: The case of New Energy Demonstration City Program. Journal of Cleaner Production 189, 830–838.

Zuidema, C., 2016. Decentralization in Environmental Governance: A post-contingency approach. Routledge.

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