

Aligning mine closure planning and regional development: an adaptive regional socio-economic transition framework from the Latrobe Valley, Australia

Yuliang Jiang ^{a,*}, Neeltje Slingerland ^b

^a School of Built Environment, The University of New South Wales, Australia

^b WSP, Canada

Abstract

Mine closure increasingly unfolds at a regional scale, where rehabilitation decisions are shaped by shared water systems, regional infrastructure, governance settings and social expectations. In regions where mines and powerplants are co-located, closure planning is further complicated by the interdependence of infrastructure and legacy management. Within the mine closure process, differences in how closure needs are prioritised and sequenced across stakeholders influence rehabilitation coordination. The Latrobe Valley in Australia provides a live context where these priorities are negotiated alongside active closures and emerging land use directions. Semi-structured interviews with 15 local stakeholders indicate that closure discussions commonly separate economic transition, technical site completion and livelihood considerations. Despite prolonged closure discourse and an abrupt mine and powerplant shutdown, transition efforts remain largely exploratory, as socio-economic pressures persist and a consolidated regional development pathway has yet to materialise. The findings highlight the need for a coordinated adaptive transition framework at the regional scale, with defined responsibilities and timelines, that extends beyond achieving geotechnically and geochemically safe and stable landscapes. It establishes alternative transition pathways ahead of final closure and progressively narrows these options as site and regional conditions become clearer over time. Operationally, this requires early transdisciplinary closure planning with expanded disciplinary representation, a shared definition of closure success oriented towards regional regeneration, alignment between rehabilitation sequencing and land use strategy, clarified governance roles and funding mechanisms, and staged implementation through regionally coordinated catalytic projects. This supports more coherent and responsive closure trajectories in regions undergoing structural change.

Keywords: Just Energy Transition, legacy management, mine closure planning, post-mining land use, regional coordination, socio-economic transition, stakeholder engagement

1 Introduction

As governments pursue decarbonisation targets, coal-dependent regions worldwide are undergoing major socio-economic and environmental change. This process is increasingly framed through Just Energy Transition principles, which emphasise protecting workers and communities, supporting participation in decision-making, and distributing costs and benefits more equitably. In these regions, one of the most visible outcomes is the phased closure of coal mines and coal-fired powerplants, a process that has accelerated in recent years (Barton, 2021). The decommissioning of these industrial sites leaves extensive brownfield areas where decades of extraction and energy production have reshaped both landscapes and regional economies (Liu et al. 2014).

* Corresponding author. Email address: yuliang.jiang@unsw.edu.au

Rehabilitation is critical to stabilising disturbed land, managing environmental risk, and preparing sites for post-mining land uses (PMLUs). It can also support regional transition, understood here as the long-term structural change of industrial regions as they move away from coal extraction and energy production toward more sustainable futures. Safe, stable and sustainable rehabilitation therefore provides the foundation for diversified economic activity and supports livelihood continuity for affected communities as this process unfolds. Former mine and powerplant sites can become more than compliance-oriented landscapes, supporting PMLUs that contribute to environmental recovery and broader regional development in post-coal economies (Loures & Vaz 2018; Shin & Pae 2022).

These challenges of rehabilitation and post-mining redevelopment are especially pronounced in regions with co-located coal mines and powerplants, where closure affects not only individual industrial sites but also the wider regional systems of employment, livelihoods, infrastructure and land use that have developed around them. In such settings, closure planning must address overlapping environmental, economic and spatial consequences, while balancing competing priorities such as risk reduction, closure financing, workforce transition and long-term land use planning.

Responding to this complexity requires coordinated stakeholder engagement and interdisciplinary collaboration. Although rehabilitation planning is strongly shaped by technical and regulatory requirements, the growing complexity of PMLUs also raises broader spatial and design questions. Studies of post-industrial landscape transformation show that design strategies can extend beyond technical remediation alone (Lee, 2019). Where closure has wider implications for nearby communities, employment systems, infrastructure and future land use, broader disciplinary input can help align rehabilitation planning with longer-term regional outcomes.

This study investigates stakeholder perspectives on closure planning and regional transition, focusing on how PMLU and associated redevelopment projects may contribute to socio-economic transition in coal regions undergoing structural change. These questions are examined through the case of the Latrobe Valley in Victoria, Australia. Located approximately 150 km east of Melbourne, it is the state's primary energy region and contains three co-located mine and powerplant complexes: Hazelwood, Yallourn and Loy Yang, with Loy Yang comprising two powerplants, Loy Yang A and B. Developed through the 20th century under the State Electricity Commission, the region is now entering a new phase of transition: Hazelwood closed in 2017, while Yallourn, Loy Yang A and Loy Yang B are scheduled to close in 2028, 2035 and 2047, respectively. These shifts make the Latrobe Valley a valuable setting for examining how rehabilitation intersects with broader regional socio-ecological and spatial change (Rutherford & Coutard 2013).

2 Method

Semi-structured interviews were employed to examine stakeholder perspectives on mine rehabilitation and regional transition in the Latrobe Valley. Ethical approval for the study (iRECS7201) was granted by the Human Research Ethics Advisory Panel at the University of New South Wales prior to participant recruitment. Stakeholder identification was initially guided by the groups outlined in the Latrobe Valley Regional Rehabilitation Strategy (DJPR & DELWP, 2020). Participants were recruited from industry, government, research, and community groups to capture a range of perspectives on closure planning, future land use and regional change.

Recruitment began with mine owners, local researchers and local historical societies whose contact information was publicly available. Through referrals from these initial contacts, additional interviewees were identified, including state government representatives and sub-consultants involved in mine rehabilitation and closure-related environmental issues such as water access and discharge, revegetation and biodiversity monitoring. Recruitment materials, including a flyer, invitation letter, and project information statement and consent form, were distributed through outreach managers.

The interviews involved 15 participants from a range of stakeholder groups in the Latrobe Valley: 4 industry professionals involved in mine rehabilitation and environmental management, one researcher from a local university, 2 government representatives responsible for regional planning and mine closure oversight, and

8 representatives of local community organisations. Qualitative interviews were conducted primarily as one-on-one discussions, with 3 paired interviews involving participants who shared relevant household, community, or professional perspectives. Two formats were used: sit-down interviews and ‘walk-and-talk’ interviews. The latter combined in situ discussion with the use of satellite maps and were conducted across both mine site and broader regional settings. Depending on the participant’s expertise, these sessions addressed either site-specific rehabilitation conditions or broader regional issues related to landscape change and transition. Interviews typically ran for approximately 45–90 minutes.

Interview questions were informed by literature on mine rehabilitation and regional transition. Previous studies emphasise the need to understand environmental challenges associated with abandoned mine sites (Cornelissen et al. 2019), as well as the evolving stages of rehabilitation and community perspectives during post-mining transition (Pavloudakis et al. 2020). These themes informed questions on environmental constraints, rehabilitation progress, future land use and regional transition.

The interview guide was then adapted to reflect participant backgrounds and expertise. For industry participants, questions focused on environmental challenges, rehabilitation progress, future site uses and engagement with government agencies and community groups regarding regulatory reporting and social licence maintenance. For government participants, they emphasised regional transition planning, strategic land use visioning, economic restructuring and stakeholder coordination. For researchers, questions focused on regional capacity, community wellbeing and long-term transition processes. For community participants, questions explored local history, industrial change, community identity and perceptions of landscape transformation.

3 Results

The interviews highlighted several key issues concerning both the technical demands of rehabilitation and its broader regional implications.

3.1 Environmental and technical challenges of rehabilitation

Stakeholders described mine rehabilitation as a long-term process shaped by interrelated challenges of landform stability, water management and ecological recovery. Across interviews, these issues were consistently discussed not as separate tasks, but as connected conditions that influence the timing and feasibility of future land uses.

Industry and government participants emphasised that achieving stable landforms is a fundamental prerequisite for mine closure. As one participant explained, operators must demonstrate through monitoring that rehabilitation has achieved its intended outcomes and that ‘the landform is stable’ before the site can transition to future land uses.

After initial landform stabilisation, water management remains a critical concern, particularly in relation to pit lake flooding. Participants noted that water is currently regarded as the most viable strategy for stabilising the large mine voids, with operators proposing to ‘use water to stabilise the voids’ as part of the final landform design. However, the scale of water required presents significant regional challenges. The 3 mines together may require up to 3 billion cubic metres (DJPR & DELWP, 2020), described in interviews as ‘4 and a half Sydney Harbours’, with filling potentially taking decades depending on current and future climatic conditions.

Stakeholders also raised concerns about ecological recovery beyond geotechnical and hydrological rehabilitation. One ecologist emphasised the importance of monitoring vegetation establishment and assessing how rehabilitation areas support biodiversity and habitat development, noting that ‘what we’re interested in is how those rehabilitation areas actually support biodiversity and habitat over time’. Government representatives similarly noted that planting strategies vary according to intended land use outcomes, with some areas directed towards grazing and others towards conservation. Planting strategies may also be used to support broader ecological connectivity. As one participant observed, ‘If you wanted to

achieve a wildlife corridor, you would design the vegetation accordingly.’ Overall, participants considered how PMLUs could align rehabilitation areas with surrounding land uses, although detailed discussion of more economically diversified or design-led redevelopment pathways was less prominent.

Across interviews, these environmental and technical processes were consistently understood as unfolding over long time frames. Participants noted that pit lake flooding alone may take ‘20–30 years’, while ecological recovery may take even longer. As one ecologist explained, ‘It takes a long time for those systems to start functioning in the way that natural systems do.’

3.2 Diverging stakeholder priorities in closure planning

Stakeholders broadly agreed on the technical challenges associated with mine rehabilitation. However, interviews revealed important differences in what closure was expected to achieve. While industry and regulatory perspectives focused primarily on meeting technical closure requirements, government, research, and community participants emphasised broader concerns related to future land use, regional transition and community wellbeing (Table 1). This pattern likely reflects the differing responsibilities, priorities and lived experiences of each stakeholder group, while also being shaped by the interview structure, as questions were tailored to participants’ professional roles or community perspectives.

Table 1 Summary of stakeholder priorities in closure planning

Stakeholder group	Key concerns in closure planning
Industry	Achieving technically safe and stable landforms that meet statutory closure requirements
Government	Supporting economic transition and attracting new industries to replace coal-related employment
Research	Building regional capacity and supporting community wellbeing during the transition process
Community	Ensuring post-mining landscapes contribute to regional renewal, including economic opportunities and public amenities that enhance quality of life

From a regulatory perspective, rehabilitation success is defined primarily through statutory closure requirements. As one participant explained, rehabilitation must demonstrate that the land is ‘safe, stable and sustainable’ before relinquishment can occur.

In contrast, several participants suggested that this requirement alone does not address the broader social, economic and spatial implications of closure. Community participants suggested that closure planning should also contribute to regional renewal, so that post-mining landscapes become ‘economically useful and visually attractive’. Differences also emerged with respect to the sequencing of future land use. Current rehabilitation frameworks tend to prioritise the completion of closure obligations before land can formally transition to new uses. In contrast, community organisations argued that future land uses should be planned alongside rehabilitation works, with one participant noting that, ‘Repurposing of this space should be done in parallel with rehabilitation.’

Government representatives also emphasised that mine closure must be understood within the broader challenge of regional socio-economic transition. Participants from Regional Development Victoria highlighted that replacing coal-related employment is not simply a matter of matching the number of jobs lost. Because coal mining and power generation historically provided relatively high-paying jobs with strong regional economic effects, replacing them may require substantially more jobs across other sectors. As one participant explained, ‘Rather than saying that’s 800 jobs gone and we need to find 800 jobs, you’re actually looking at needing around 2,400 jobs ... and that’s not even economic growth; it’s merely maintaining what we have.’ This suggests that the challenge is both numerical and structural: first, to generate a larger number of jobs overall to compensate for the loss of coal-related employment, given that such jobs were described

as paying up to 3 times as much as many other regional employment options; and second, to attract industries that not only offer comparable wages and regional economic benefits but also support long-term growth.

In the interview with a researcher, successful closure was similarly linked to building regional capacity, strengthening local organisations, and supporting workforce transition and community wellbeing over time. Community participants reinforced this point through lived experience, observing that closures have already affected employment and local economies, with ‘a lot of people ... having to move away to find work.’ This suggests that workforce attrition may occur where comparable local employment opportunities are limited, as workers may either seek similar jobs elsewhere or undertake reskilling for different sectors.

Taken together, these perspectives suggest that the central challenge is not whether closure planning extends beyond technical rehabilitation, but how competing expectations around socio-economic transition, land use, and regional futures can be aligned in practice. This reinforces the relevance of Just Energy Transition principles, as closure planning must address job losses, liveability and the development of a suite of compatible industries rather than assuming direct replacement of coal-related employment.

4 Discussion

4.1 Adaptive regional transition framework for post-mining development

The stakeholder interviews reveal two closely related issues in the transition of the Latrobe Valley. First, closure planning remains strongly shaped by statutory and technical requirements for safe, stable and sustainable rehabilitation, including geochemical, geophysical, hydrological and social measures such as workforce reskilling. While these priorities are necessary prerequisites for closure and future land use, they do not by themselves establish a coordinated regional development pathway. More ambitious redevelopment possibilities are often not anticipated within closure planning because they sit beyond the direct remit of mine operators and depend on wider policy direction, regulatory approval, funding, ownership arrangements and future land use planning. This creates a need for earlier multidisciplinary coordination between rehabilitation planning, regional development, statutory authorities, technical specialists, built environment professionals and community stakeholders. Broader questions about how mine sites might contribute to regional transition and economic renewal may be addressed too late, after key rehabilitation decisions have already narrowed future development possibilities.

Second, stakeholders differ in how they define the longer-term purpose of closure, especially in relation to socio-economic transition and land use planning. While regulatory and industry perspectives prioritised achieving safe and stable closure conditions, government representatives, the researcher, and community participants emphasised broader regional concerns, including economic transition, community wellbeing and landscape futures that support socio-economic regeneration. This distinction matters because rehabilitation may otherwise progress toward low-intensity end uses, such as grazing or conservation, that satisfy closure requirements but have limited capacity to replace coal-related employment, sustain household incomes, or support a more diversified regional economy.

These findings highlight a structural gap between the technical processes of mine rehabilitation and the broader socio-economic transition required for coal-dependent regions. They also reveal the need to better align stakeholder priorities regarding environmental safety, land use planning, and regional economic futures. Addressing this gap requires a coordinated approach that integrates environmental rehabilitation with long-term economic and spatial planning. In response, this study proposes a regional transition framework for post-mining development to support socio-economic transition prior to final closure.

Importantly, the framework is designed to operate beyond individual lease boundaries, recognising that mine and powerplant closures affect wider settlement, infrastructure, employment and land use systems. Although developed through the Latrobe Valley case, it may also inform other regions undergoing structural economic transition where mine rehabilitation must be coordinated with spatial and economic redevelopment.

4.1.1 *Early closure planning with expanded disciplinary representation*

Supporting regional economic transition requires more than engineering-led rehabilitation at individual mine sites. It also requires earlier and broader involvement from disciplines and professional expertise such as regional planning, economics (not to be confused with cost estimation and quantity surveying), social performance, stakeholder engagement, enterprise and supplier development, workforce training, legal and governance advice, architecture, landscape architecture and regional development. Working alongside engineers, these fields can help assess site constraints, align closure planning with community and workforce priorities, and identify future land use and economic opportunities.

As reflected in the interviews, closure planning already involves multiple actors with specialised roles in rehabilitation and transition. However, these perspectives are not always integrated through a shared process that links site rehabilitation with long-term regional development. As a result, broader transition planning may remain disconnected from technical rehabilitation or proceed only after closure conditions become clearer.

Early closure planning should therefore assess not only the mines' physical, environmental and socio-economic conditions. It should also consider how these extensive post-mining areas can realistically be shaped to support new regional economic futures, rather than being treated as passive land whose more transformative potential is deferred to later stages.

Given this uncertainty, an integrated closure and regional transition assessment should not yield a single fixed end state, but should inform an adaptive transition framework that identifies alternative regional development pathways under different rehabilitation, investment and land use scenarios. These pathways can then be progressively refined and narrowed as site and regional conditions become clearer over time. This allows more implementation-oriented regional transition planning to proceed alongside rehabilitation, rather than waiting until final closure conditions are fully resolved. It also extends beyond the broad strategic directions of Gippsland 2035: Latrobe Valley and Gippsland Transition Plan (LVA & DJPR, 2023) by considering how specific redevelopment projects, their anticipated regional benefits, and their sequencing can be advanced in parallel with rehabilitation. With broader disciplinary input, the framework can move beyond high-level vision-setting to include staged actions, delivery mechanisms and clearer responsibilities for implementation.

4.1.2 *Defining closure success for regional regeneration*

Participants suggested that, within the core responsibilities of mine operators, closure is still often framed through geotechnical stability and related technical criteria, with broader social, economic and land use objectives built around this foundation (DIIS, 2016). While such technical criteria are essential for environmental safety, they are insufficient on their own to support long-term regional regeneration, particularly given the cascading socio-economic impacts that can follow major industrial closures. Several stakeholders, therefore, distinguished between the importance of achieving safe and stable closure and shaping final landforms that can accommodate more substantial post-mining economic activity capable of stimulating regional economic growth.

A broader regional framework for evaluating post-closure outcomes is therefore needed, one that is regional in scope but grounded in the capacities and limitations of post-mining land. Such a framework would extend beyond the direct responsibilities of mine operators and help align site rehabilitation with wider regional transition strategies. Relevant indicators may include population retention, economic diversification and improvements to local livelihoods. Achieving these outcomes may involve the adaptive re-use of industrial infrastructure, the development of new buildings and public amenities and the creation of landscapes that support emerging economic activities.

From this perspective, closure success should be understood not only in terms of physical and chemical stabilisation, but also in terms of how post-closure processes can contribute to long-term regional regeneration, supporting the transition from an extractive industrial landscape towards more diversified economic and landscape futures (Zhao et al. 2024). This requires responsibility to be shared across stages

and actors beyond mine operators: operators establish the safe and stable foundation for closure, while subsequent owners and governing institutions must carry this forward through land use planning and regional development that, where appropriate, supports active regional growth, rather than limiting post-closure outcomes to safe but largely inaccessible or economically inactive land.

4.1.3 Alignment between rehabilitation sequencing and land use strategy

Current rehabilitation processes primarily prioritise physical and chemical safety and ecological stabilisation, while decisions about future land use are often deferred to later planning and policy stages. This separation can limit how rehabilitated landscapes respond to longer-term regional objectives.

As reflected in the stakeholder interviews, several participants argued that repurposing land and infrastructure should be considered in parallel with rehabilitation rather than only after closure obligations have been completed. A more integrated approach would align rehabilitation sequencing with intended land use directions from an early stage. Where feasible, this should begin from the outset, including mine design and operational planning, so that construction and operation can proceed with the end use in mind. At the same time, flexibility is needed to refine specific uses as site conditions, relinquishment requirements, land tenure arrangements, Traditional Owner interests and regional priorities become clearer. If rehabilitation is planned only for lower-intensity PMLUs, later transition to more intensive or higher-value uses may require substantial additional works and redesign.

This does not imply that all intended land uses can be delivered immediately, particularly where pit flooding and long-term stabilisation remain ongoing. Rather, it supports a staged approach in which interim uses and phased development can be introduced as site conditions evolve. International precedents illustrate the value of this approach. Although conventional PMLUs such as grazing or forestry may reduce safety and management risks, projects such as the Lusatian Lakeland in Germany show how former open cut mines can be transformed into lake landscapes that support marinas, waterfront housing, recreational infrastructure, and increased regional property values (Deshaies 2020). While the final form of redevelopment in Lusatia emerged over time, the region illustrates a more proactive sequencing model in which rehabilitation was progressively aligned with future land use directions and wider regional ambitions, rather than being treated solely as a precursor to later land use decisions.

4.1.4 Clarified governance roles and funding mechanisms

Establishing a diversified regional economy is likely to require significant upfront investment and governance arrangements that can coordinate public and private actors. The interviews highlighted the scale of the transition challenge, particularly the difficulty of replacing high-paying industrial employment previously provided by coal mining and power generation.

Under current Australian regulatory frameworks, mine operators are primarily responsible for rehabilitation costs associated with environmental stabilisation. However, once future land use directions are identified and development potential is better understood, subsequent responsibilities for planning, development and delivery may involve a broader set of actors, including government, private investors and other development partners. Duisburg-Nord Landscape Park illustrates this approach through the combined roles of Latz + Partner Landscape Architects as lead designers, IBA Emscher Park as the regional regeneration framework, public authorities and development agencies across municipal, state, federal and European levels as funding and enabling partners, and a dedicated operating entity responsible for long-term site management (Jiang et al. 2026).

Such arrangements would require clearer institutional roles and more coordinated regulatory pathways. Better alignment between rehabilitation and redevelopment could help avoid duplicated works, such as situations where recontoured landforms or revegetated areas are later modified again to accommodate new uses. In this way, coordinated planning may improve implementation efficiency and support earlier economic transition at the regional scale.

4.1.5 *Staged implementation through regionally coordinated catalytic projects*

Large-scale regional transformation cannot occur instantaneously. As demonstrated in several European post-industrial regions (Jiang et al. 2026), successful post-mining development typically unfolds through phased implementation and incremental change. In this respect, the proposed framework complements the Preliminary Land Use Vision (DELWP 2019) by moving beyond broad land use themes to consider how redevelopment projects can operationalise those themes and be phased to support regional transition before complete decommissioning, where site conditions, approvals and governance arrangements permit.

Once a strategic development direction has been identified, selected pilot initiatives may begin before the complete decommissioning of all mines, provided that site conditions, approvals and governance arrangements allow. These projects need not be confined to individual mine sites, but can be coordinated across the broader region to support emerging economic activities while rehabilitation remains ongoing. A similar approach is also emerging in Mpumalanga, South Africa, where a current Just Energy Transition diagnostic evaluation seeks to identify catalytic mine rehabilitation and post-mining redevelopment projects that can support regional economic inclusion, employment, livelihoods and community wellbeing (GIZ, 2026).

Early demonstration projects can also build confidence among residents, investors and policymakers. A recent domestic example is the redevelopment of part of the former Rhondda Colliery site into the Black Rock Motor Resort, which includes a driving circuit, driver training facilities, accommodation and tourism amenities. This illustrates how post-mining projects can contribute to regional transition through tourism, recreation and employment generation (NSW Government, 2024). A staged approach that allows targeted catalytic projects to proceed in parallel with rehabilitation, whether on former mine land or elsewhere in the region, can help accelerate the transition and lay the groundwork for longer-term socio-economic regeneration.

4.2 Challenges in implementing the regional transition framework

The proposed framework outlines key considerations for coordinating mine closure with regional socio-economic transition. However, several structural barriers may limit its implementation, particularly in the current Australian context. These include institutional fragmentation, unclear funding responsibilities for the design, construction and ongoing management of post-mining projects, and the long time frames associated with both mine rehabilitation and regional economic transition. Additional spatial and cultural constraints, including land use uncertainty, industrial heritage values and community attachment to former industrial landscapes, may further shape what forms of redevelopment are feasible.

4.2.1 *Institutional fragmentation*

Mine closure represents a major regional transition and involves a wide range of stakeholders preparing for changes that will fundamentally affect the region's future. Different actors are responsible for different aspects of the process: mine operators manage rehabilitation, state governments oversee regional development strategies, and local councils are responsible for land use planning.

This division of responsibility also creates uneven decision-making power. Mine operators have direct control over rehabilitation works and closure sequencing, while government agencies hold approval and planning authority. Future land use directions are therefore shaped through an iterative process in which operators assess technical feasibility and propose rehabilitation outcomes, while regulators and planning authorities assess these proposals against environmental, planning and public interest requirements. Local residents, workers and Traditional Owners may be consulted through formal processes, but consultation does not always translate into influence over future land use visions, rehabilitation sequencing, or whether local and place-based knowledge informs closure criteria. Their priorities may be acknowledged during planning yet later constrained by funding, approvals, land tenure or governance arrangements. As a result, engagement may remain procedural rather than substantive, limiting the extent to which regional transition reflects community priorities and place-based knowledge.

While coordination across these actors creates opportunities for collaboration, the involvement of multiple organisations can also slow agreement on integrated plans, particularly where timely responses are needed to address economic decline and potential population loss following mine closure. The multilayered governance structure can therefore extend the time needed for stakeholders to reach agreement. For this reason, early strategic planning is particularly important in regions undergoing long-term socio-economic transition, which is especially relevant for the Latrobe Valley.

4.2.2 *Post-mining project funding and investment uncertainty*

Regional socio-economic transition also requires substantial upfront investment, particularly for more intensive or diversified PMLUs that support new economic activities and regional development. However, current funding arrangements create uncertainty for such projects.

In Australia, rehabilitation costs are primarily tied to environmental safety obligations and are typically borne by mine operators. Private investment in development projects, by contrast, depends on clear land use strategies and predictable economic returns. Government funding is often allocated on a project-by-project basis, which may limit the ability to support long-term, coordinated regional transformation. International examples such as Anglo American's Project Alchemy, AngloGold Ashanti's Obuasi programs and First Quantum Minerals' Kansanshi initiatives suggest that mining companies can support transition beyond statutory rehabilitation obligations through corporate social investment, community trusts, foundations and local development programs. However, such mechanisms do not remove the need for clearer funding models for substantial built environment redevelopment projects, particularly where these involve new infrastructure, public amenities, long-term management or private investment on post-mining land. One possible mechanism would be to preserve the principal of existing rehabilitation funds for core closure obligations, while using interest to support proactive regional transition planning and early development for suitable post-mining sites. Within this process, built environment consultancies could be engaged through public tender processes to help prepare sites for higher-value land use, where appropriate, and attract suitable developers or future landowners.

Addressing these challenges may therefore require stronger institutional leadership and clearer funding mechanisms to coordinate planning, investment and implementation across multiple stakeholders.

4.2.3 *Long transition time frames*

Mine rehabilitation and regional economic transition typically unfold over several decades. Such long time frames create additional challenges, including policy continuity, changing economic conditions and uncertainty regarding long-term investment.

These factors may complicate project implementation, funding stability and sustained public support. As a result, long-term policy commitment and institutional continuity are essential to sustain regional transition beyond individual political cycles and to build confidence among local communities and external investors.

5 Conclusion

This study examined stakeholder perspectives on mine closure and regional transition in the Latrobe Valley based on 15 interviews with technical professionals, government representatives, a researcher, and local residents. The findings reveal a persistent gap between technically led closure processes and broader regional transition planning. While rehabilitation is primarily framed around safe and stable closure, stakeholders expressed uncertainty about how mine sites might contribute to future land use, economic renewal and wider regional development. In response, the study proposes an adaptive regional transition framework structured through 5 progressive steps:

- early transdisciplinary closure planning with expanded disciplinary representation
- a shared definition of closure success oriented toward regional regeneration

- alignment between rehabilitation sequencing and land use strategy
- clarified governance roles and funding mechanisms
- staged implementation through regionally coordinated catalytic projects.

Together, these steps position mine rehabilitation as an environmental obligation and a strategic process to support alternative land uses and catalytic development opportunities beyond individual mine sites.

These opportunities, however, are unlikely to be realised without deliberate coordination. Their implementation will require stronger institutional alignment, long-term policy commitment, sustained funding arrangements, and collaboration among government, industry, researchers, and regional stakeholders. International precedents such as Lusatia Lakeland and IBA Emscher Park show that beneficial PMLUs are more likely to emerge within cohesive regional frameworks that organise planning, coordinate delivery, and align governance and funding across multiple sites over extended time frames. By positioning the Latrobe Valley within this wider field of post-mining transition practice, the proposed framework can inform other coal-dependent regions undergoing structural change, where environmental rehabilitation must be coordinated with long-term economic and spatial transformation.

Acknowledgement

The authors gratefully acknowledge the stakeholders who generously contributed their time to participate in interviews and facilitate site visits to the mines and broader region. The authors also thank the anonymous reviewers for their constructive feedback, which helped strengthen the manuscript.

References

- Barton, B 2021, 'Fossil fuel mineral wealth and climate change law: expectations of coal mine development in a time of decarbonisation', *Journal of Energy & Natural Resources Law*, vol. 39, pp. 469–488, <https://doi.org/10.1080/02646811.2020.1866275>
- Cornelissen, H, Watson, I, Adam, E & Malefetse, T 2019, 'Challenges and strategies of abandoned mine rehabilitation in South Africa: The case of asbestos mine rehabilitation', *Journal of Geochemical Exploration*, vol. 205, <https://doi.org/10.1016/j.gexplo.2019.106354>
- DELWP 2019, *Latrobe Valley Regional Rehabilitation Strategy: Draft Preliminary Land Use Vision*, Department of Jobs, Precincts and Regions; Department of Environment, Land, Water and Planning, Melbourne, https://www.planning.vic.gov.au/_data/assets/pdf_file/0029/637085/LatrobeValley-Draft-Preliminary-Land-Use-Vision-Oct2019.pdf
- Deshaies, M 2020, 'Metamorphosis of mining landscapes in the Lower Lusatian lignite basin (Germany): New uses and new image of a mining region', *Les Cahiers de la Recherche Architecturale Urbaine et Paysagère* (Journal for the Study of Architectural, Urban and Landscape), no. 7, <https://doi.org/10.4000/craup.4018>
- DIIS 2016, *Mine Closure: Leading Practice Sustainable Development Program for the Mining Industry*, Canberra, <https://www.industry.gov.au/sites/default/files/2019-05/lpsdp-mine-closure-handbook-english.pdf>
- DJPR & DELWP 2020, *Latrobe Valley Regional Rehabilitation Strategy*, Department of Jobs, Precincts and Regions; Department of Environment, Land, Water and Planning, Melbourne, https://www.water.vic.gov.au/_data/assets/pdf_file/0034/684448/Latrobe-Valley-Regional-Rehabilitation-Strategy.pdf
- GIZ 2026, *Diagnostic Evaluation on Just Transition Interventions Focused on Mine Rehabilitation and Post-Mining Redevelopment in Mpumalanga*, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, https://www.giz.de/sites/default/files/media/els-document/2026-03/7000004061-terms-reference_0.pdf
- Jiang, Y, Palazzo, E & Raval, S 2026, 'Opportunities for Australia's regional development: Lessons from the integrated rehabilitation of co-located coal mines and power plants in Europe', *Landscape and Urban Planning*, vol. 268, p. 105564, <https://doi.org/10.1016/j.landurbplan.2025.105564>
- LVA & DJPR 2023, *Gippsland 2035: Latrobe Valley and Gippsland Transition Plan*, Department of Jobs, Skills, Industry and Regions, Morwell, https://www.rdv.vic.gov.au/_data/assets/pdf_file/0008/2324429/Gippsland-2035-Transition-Plan.pdf
- Lee, M-J 2019, 'Transforming post-industrial landscapes into urban parks: design strategies and theory in Seoul, 1998–present', *Habitat International*, vol. 91, p. 102023, <https://doi.org/10.1016/j.habitatint.2019.102023>
- Liu, Y, van Oort, F, Geertman, S & Lin, Y 2014, 'Institutional determinants of brownfield formation in Chinese cities and urban villages', *Habitat International*, vol. 44, pp. 72–78, <https://doi.org/10.1016/j.habitatint.2014.05.005>
- Loures, L & Vaz, E 2018, 'Exploring expert perception towards brownfield redevelopment benefits according to their typology', *Habitat International*, vol. 72, pp. 66–76, <https://doi.org/10.1016/j.habitatint.2016.11.003>

- NSW Government 2024, *Rhondda Colliery Rehabilitation and Development of the Black Rock Motor Sport Park*, viewed 26 March 2026, <https://www.nsw.gov.au/media-releases/450-jobs-for-hunter-as-coal-mine-transforms-into-motor-park-and-tourist-resort>
- Pavloudakis, F, Roumpos, C, Karlopoulos, E & Koukouzas, N 2020, 'Sustainable rehabilitation of surface coal mining areas: The case of Greek lignite mines', *Energies*, vol. 13, p. 3995, <https://doi.org/10.3390/en13153995>
- Rutherford, J & Coutard, O 2013, 'Urban energy transitions: Places, processes and politics of socio-technical change', *Urban Studies*, vol. 51, pp. 1353–1377, <https://doi.org/10.1177/0042098013500090>
- Shin, M & Pae, J-H 2022, 'Authenticity or homogeneity? Contextualising the urban revitalisation of a post-industrial landscape through the Red Brick Landscape Preservation Project in Seoul', *Habitat International*, vol. 124, p. 102574, <https://doi.org/10.1016/j.habitatint.2022.102574>
- Zhao, X, Hu, Y, Xia, N, Li, M, Chen, D & Xu, Y 2024, 'Urban regeneration and SDGs assessment based on multi-source data: Practical experience from Shenzhen, China', *Ecological Indicators*, vol. 165, p. 112138, <https://doi.org/10.1016/j.ecolind.2024.112138>