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Changing of the guard: navigating the post-mining transition using the Three Horizons framework

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Abstract

As the practice of mine closure continues to evolve globally, transition of former mines to other land uses is becoming more common. To provide confidence that proponents are planning effectively for post-mining transition, they are usually expected to define and sometimes 'lock in' the proposed post-mining land use (PMLU) as part of early project approvals. However, planning over long-term horizons is difficult as it involves inherent uncertainty, and the PMLU may need to be modified to reflect changes in land capability, regulatory frameworks, stakeholder profiles, community needs and expectations, and other factors. Therefore, it can be difficult to envision PMLUs while withstanding the 'revolving door' of stakeholders that occurs over a long mine life. Consequently, effective transition planning requires the use of suitable participatory and adaptive practices. Further, proponents need to be creative and innovative in engaging with communities to envision and plan for long-term futures.

This paper explores application of Sharpe's Three Horizons framework to mine closure and transition planning. This framework provides a clear process to guide strategic conversations with communities and other stakeholders that facilitate successful social transitions. It helps to articulate a shared understanding of the current situation as well as a vision for the future, and to identify pathways of transition that unfold over time. The process helps closure practitioners engage with the complexities and uncertainties of planning for social transition as mines approach and implement closure, explore and integrate key dilemmas that arise, understand and constructively work with different stakeholder values and perspectives, and identify novel and creative solutions to complex problems.

Developed in the field of futures and foresight and applied in many contexts including decarbonisation of the mining industry, this framework represents exciting new thinking in the mine closure space.

Keywords: *social values, socio-economic transitioning, social outcomes, community readiness, stakeholder engagement, post-mining land use, envisioning, futures thinking*

1 Introduction

It is increasingly recognised that mining is a temporary land use (Gagen et al. 2024), with the transition of former mine sites to another beneficial use becoming more common (International Council on Mining & Metals [ICMM] 2025a). However, positive environmental, social and economic outcomes are not always easy to achieve, and it is now acknowledged that this is a critical challenge for the global mining industry (Banfield et al. 2023), with the long timescales associated with transitioning from a mining-based economy to a post-mining diversified economy being one of the most challenging aspects of transition planning (ICMM 2025b). This paper explores factors affecting these outcomes, including the gap between strategy development and strategy implementation and the revolving door of stakeholders in this time, the challenge

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of beginning and ending at the same time, the human response of anxiety to uncertainty, and competing images of the future among different sections of the community.

The costs of not getting post-closure transitions right can be high for the community, the environment and the mining company so it is important to find new and innovative approaches that can assist with building a shared vision for a post-mining society. This requires a shift from conventional company-centric closure planning processes to inclusive and multistakeholder approaches as "ownership of the future of host communities is best led by those with a long-term stake in that future" (ICMM 2025b). It is communities who will live with the long-term consequences of transition, so it is essential that they get to define what a 'good' post-mining future looks like for them.

The field of futures and foresight has developed a range of methods to enable people to engage effectively with the dilemmas of planning over long time horizons, including the Three Horizons futures framework (Sharpe et al. 2016). This framework has previously had limited application within the mining industry, with the sole example identified by these authors relating to decarbonisation of the industry (Gloaguen et al. 2022). No examples of applying the Three Horizons framework to mine closure and transition planning have been found to date so use of this framework in this regard represents new thinking in this space. We propose that the framework would provide a useful structure to guide strategic conversations about post-mining futures with communities and other stakeholders to facilitate successful post-mining social transitions.

This paper discusses how the Three Horizons framework can be used to underpin participatory processes that build hope and agency in mining communities in transition and enable mining companies and their stakeholders to work through the dilemmas caused by competing social values and clashing images or visions of preferred futures. These processes support flexible, adaptive action to create positive post-mining futures for communities despite dynamic and sometimes uncertain contexts.

2 Changing of the guard

The ICMM (2025b) defines a successful transition as "one that achieves positive outcomes for the local economy and local communities, leaving them resilient to the potential social and economic shocks associated with a reduction in mining activity", but notes that what constitutes successful transition will depend on local context, including the characteristics of each situation and the perspective of the individual stakeholder groups. As the ICMM (2025b) notes, whilst a mining company's minimum priority will be that "a transition should enable it to fulfil its legal obligations and other requirements, and to meet all its closure and post-closure objectives", companies also have grounds to "want to see a transition process and outcome that leaves a positive legacy".

The 'changing of the guard' from the mining company to the community or other stakeholder(s) is inherently complex and requires conceptualising mine closure as a process rather than an event. It requires an understanding of the process of transition as it occurs in the context of each mining community and a commitment to transition processes that build communities' resilience and agency in the face of change.

2.1 Technical problems and adaptive challenges

In planning for the cessation of mining and post-mining socio-economic transitions, mining companies face two types of challenges: 'technical problems' and 'adaptive challenges' (Heifetz et al. 2009). It is important to differentiate between these types of challenges, and to understand which aspects of mine closure are technical and which are adaptive, as they require different responses.

While technical problems can be difficult and complex, with the right expertise, resources and time, solutions can usually be found. Adaptive challenges have greater complexity and can only be addressed through changes in people's priorities, beliefs, habits and loyalties (Heifetz et al. 2009). For example, making mined land safe, stable and sustainable after mining is a technical problem. Although this can be a complicated challenge, technical solutions can often be found. By comparison, moving a community towards a meaningful future is an adaptive challenge as there is no one agreed specific solution. Instead, it requires changes in

beliefs, values, relationships and roles. Adaptive challenges share many characteristics with 'wicked problems', a term the ICMM (2025b) uses to describe socio-economic transitions, noting that such problems are "not amenable to obvious or "best" solutions, and often only "least-worst" options". Table 1 provides a comparison of characteristics for technical problems and adaptive challenges.

Table 1 Characteristics of technical problems and adaptive challenges, adapted by Groupsmith (n.d.) from Heifetz & Laurie (1997) and Heifetz & Linsky (2002)

Technical problems	Adaptive challenges
Easy to identify	Difficult to identify (easy to deny)
May lend themselves to quick and easy solutions	Require changes in values, beliefs, relationships, roles and approaches to work
Often can be solved by an expert or authority	People with the problem do the work of solving it
Require change in just one or a few places; often contained within organisational boundaries	Require change in numerous places; usually cross-organisational boundaries
People are generally receptive to technical solutions	People often resist even acknowledging adaptive challenges
Solutions can often be implemented quickly, even by edict	Solutions require experiments and new discoveries. They can take a long time to implement and cannot be implemented by edict

To add to the complexity, most problems come mixed, with the technical and adaptive elements intertwined (Heifetz et al. 2009). This is true of the transition to post-mining futures, which involves complicated technical problems associated with making the land safe, stable, sustainable and able to support the post-mining land use (PMLU), and complex adaptive challenges associated with the social transition process. This paper is focused on the adaptive challenge of social transition, whilst recognising that this challenge is intertwined with the technical problem of PMLU.

2.2 Processes of transition

In recent years, discussions of mine closure have increasingly shifted towards the framing of it as a process of transition rather than closure (e.g. Banfield et al. 2023; Boggs et al. 2023; Gagen et al. 2024; Measham et al. 2024; O'Keefe 2024; Whitbread-Abrutat 2024). While change is an event, transition is considered to be the process of changing from one state or condition to another in a given period of time (United Nations Framework Convention on Climate Change Secretariat 2024). The ICMM (2025b) defines socio-economic transitions as "shifts or whole-scale transformations within mining-affected communities and economies triggered by a major change in mining activity in the area". This new framing requires new ways of thinking and planning that allow for adaptation over time.

In mine closure there will be a series of change events which can be planned for to a certain degree, arguably the most significant of these being the cessation of mining, potentially followed sometime later time by the transfer of the site to another landholder. For communities in transition, these events are part of the process of changing from a state in which mining is an important (and often dominant) source of employment, income, social and physical infrastructure, identity and other benefits to a new state in which the mine is no longer operating and the community has (at least in the ideal scenario) found new ways to generate and build on the benefits that the mine previously supplied.

To support successful socio-economic transitions, attention needs to be paid to both the tangible and intangible elements of transition. Tangible elements include the transition of specific mine features such as pit voids, constructed landforms and mine infrastructure, while intangible elements include social cohesion, cultural identity and sense of place, hope for the future, societal values and trust in the transition process

(ICMM 2025b). Paying attention to the intangible elements of transition involves the meaningful engagement of communities in processes that empower them to imagine and create positive futures, and to adapt to change and disruption.

Transition processes that are done well can help communities build the psychological and practical resources they need to 'prosper beyond mining' (Gagen et al. 2024). By contrast, processes that are not done well may leave the community disempowered, unprepared, vulnerable and lacking hope that they can thrive after the mine closes. The importance of this was demonstrated in research conducted with communities in the Latrobe Valley, Victoria, Australia, where the removal of the town of Yallourn and the later Hazelwood coal mine fire resulted in anger, grief, loss and feelings of abandonment, as well as a desire for hope for the future through a long-term vision for the area (Duffy & Whyte 2017). In addition, this research found that it is essential to involve the community in strategic conversations about transition that can build hope and resilience. Success in this regard is more likely if companies look beyond the technical problems of closure and recognise local values, priorities, needs and visions for the future (Xavier et al. 2015; Reeves et al. 2022). Sharpe's Three Horizons framework provides the scaffold for these conversations, as discussed in Section 4.

2.3 Community readiness for change

A key factor in a successful post-closure transition is a community's readiness for change. Communities are more likely to support change if they are ready for it and view it as reasonable, logical and doable (Finucane 2024). Success in these transitions requires that host communities are involved in creating a shared vision for their post-mining future (ICMM 2025b) and have the resources to shift to a sustainable post-mining economy (Finucane 2024). However, stakeholders may have limited capacity to visualise or co-develop post-mining futures or may lack the adaptive capacity needed to create a positive post-mining future. Factors such as uncertainty and lack of trust in mining companies and regulators can reduce these capacities within communities (Reeves et al. 2022). Consequently, it is important that both procedural and technical capacity-building processes are used to ensure that communities can fully engage in planning for their long-term sustainability (ICMM 2025a). This is illustrated by the success of the Thompson Economic Diversification Working Group in supporting the diversification of the economic base in Thompson, Manitoba, Canada, in response to the announced closure of the Thompson nickel smelter and refinery (ICMM 2025a, FemNorthNet Thompson Community Group & Schulz 2015).

2.4 Transition settings

The multilayered settings in which socio-economic transitions occur must be considered for the transition to be successful as "the context within which a transition takes place will have a major role to play in shaping how the transition will play out and how successful it will be" (ICMM 2025b). This includes consideration of the larger temporal and spatial context of the land within which a mine is located and the people who are connected to it. Recognising that the land and its people existed in relationship before the mine opened and will exist in relationship after the mine closes (Whitbread-Abrutat 2024) brings a focus on continuity as well as change into the transition process, and can elevate values of stewardship, responsibility and legacy.

The broader regional context in which the closure of a mine site will occur is another important setting to consider. Many ecological, social and economic systems function across regions, so the impacts of closure and the opportunities for transitions will often be best understood at a regional level (Measham et al. 2024). Adopting a regional view also helps bring into focus other relevant changes that may be impacting mining communities. For example, communities in the Latrobe Valley are dealing with the end of native timber harvesting and the imminent decline of offshore gas as well as the closure of three coal mines and associated coal-fired power stations (Latrobe Valley Authority 2023).

In temporal terms, the settings for post-mining transitions are always dynamic. Once established, mines create and change communities in ways that are both positive and negative, with these changes leaving an indelible and multifaceted mark on the fabric of affected communities, including their social structures

(Holmes et al. 2024). This dynamic means that the community's needs and aspirations for the future will be constantly evolving throughout the life of a mine.

2.5 The importance of getting it right

The ICMM (2025a) articulates the view that mine closure can deliver sustainable outcomes and strengthen environmental, social and economic resilience far beyond the mine's life cycle. Examples of successful post-mining transitions, such as Germany's phase-out of lignite mines (Oei et al. 2020) and the transformation of the city of Kimberley in British Columbia from a town dependent on mining to a tourism-based economy (Gagen et al. 2024), provide hope that the aspirations outlined by the ICMM can be achieved and that mine closure processes can contribute to a just transition for post-mining communities. However, it has been observed that in practice, the potential for post-mining transitions to deliver significant social benefit has only rarely been achieved (O'Keefe 2024). Communities can experience significant negative environmental, social and economic impacts post-mining, including unemployment, deteriorating public services and infrastructure, intergenerational poverty and population decline (O'Keefe 2024). A recent example is the cessation of operations at the Koniambo nickel factory and mine which resulted in the loss of 1,200 jobs, with ripple effects felt across business and communities (Williams & Wright Gittins 2025).

For companies and governments, failure to work effectively with the community through a process of transition increases reputational and other risks and may also lead to conflict between companies and communities. Conflict, as well undermining the chances of a successful transition, can result in lost production and missed opportunities as well as the cost of time and resources spent dealing with conflict (Davis & Franks 2011; Fraser 2021; Kowszyk et al. 2023).

3 The challenges of transitioning to an uncertain post-mining future

Early planning for a post-mining transition is critical, but there are several challenges associated with looking a long way into uncertain futures. Many important factors will change over the life of the mine, including stakeholders and relevant contextual factors, and events that are planned will not necessarily eventuate, including planned closure dates (ICMM 2025b). These challenges may be compounded by the anxiety that stakeholders may feel about future uncertainties, and the competing views that different stakeholders may have about the post-mining futures they would like to see.

3.1 The dilemma of planning over long time horizons

In order to achieve successful socio-economic transitions associated with mine closure, mining companies are encouraged to start planning as early as possible (ICMM 2025b). When a mine is first planned and approved there is typically a requirement to have a PMLU plan in place that is based on the expected life of the mine at the time of development. However, it is not uncommon for a mine's life to be extended when further information about the deposits and the immediate area identifies new mineable resources, new mining and processing technologies are developed, market forces change or other factors come into play. This means that planning for mine closure could involve a time horizon of some decades or even over 100 years. Whilst iteration of the closure plan throughout the life of the mine and ongoing engagement with stakeholders are important ways of managing this challenge, they do not fully resolve the predicament for closure practitioners, regulators and local communities – how do you plan in a meaningful way for something that is a long way into the future and when so much is unknown?

When planning over long time horizons the only certainty is that things will change. When a mine is first proposed it is possible that the range of relevant stakeholders will be limited, particularly if the mine is being developed in a remote area. Over the course of a mine's life the stakeholders who have an interest in what comes next will inevitably change, as will those in leadership roles within the community and stakeholder groups: a challenge described by Dzakpata et al. (2021) as "revolving stakeholder doors". Further, the community as a whole will change such that the community that will exist in the post-mine future will not be

the same community that exists now. When closure occurs several generations into the future, many of those who will be seeking to live meaningful and prosperous lives post-mining may not yet be born.

It is reasonable to expect changes to occur in technology, environment, science, geopolitics, markets and social values, in addition to demographic changes, which makes it impossible to predict exactly what communities, regions and the global context will be like at the time of mine closure. As there are divergent perspectives within communities it can be hard to get broad community agreement about what a 'good' post-mining future could or should be like. What constitutes a 'good' future is a subjective judgement based on an individual's values, and therefore there are many alternative versions of 'good' futures. It can also be hard to get community buy-in to the closure planning process as both stakeholders and their views can change over time.

3.2 The strategy-execution gap

Perhaps the biggest challenge of planning over long time horizons is the gap that can appear between intended (or planned) strategy and realised strategy (or execution). Experience shows that the longer the gap is between planning and mine closure, the bigger the gap is between what is planned and what is realised. Despite formal strategic planning processes which identify clear goals and strategies based on extensive environmental and industry analysis, planned outcomes are often not achieved. Whilst this gap is not always a bad thing and can even be positive if it emerges as an appropriate response to changing circumstances, the gap can be a problem if what actually transpires is neither planned nor desired.

One explanation for the gap is that traditional strategic planning approaches, which are well-suited to stable and predictable environments, are not so well suited to complex and rapidly changing environments. Looking a long way into the future requires a different approach to strategy; an emergent approach that can account for and respond to the high degree of uncertainty inherent in long-term futures. It is recognised that emergent strategies (i.e. strategies that emerge from practice) are particularly important for innovation and the entrepreneurial behaviour that is required to adapt to a changing environment (Neugebauer et al. 2016). For example, a review of innovative corporate closure planning practice identified novel approaches used by companies to integrate social dimensions into closure planning and found these not only promoted knowledge exchange between companies; they also provided direction for future research and innovation for mine closure performance (Worden 2020). Effective planning for post-mining futures requires a balance between traditional and emergent approaches, recognising that transition is "a dynamic, progressive and uncertain process" in which multiple possible future scenarios need to be considered rather than one assumed future (ICMM 2025b).

3.3 Beginning and ending at the same time

The expectation that a closure plan will be in place, at least at a conceptual level, when a mine development commences means that the proponent is faced with the paradoxical task of simultaneously planning for an efficient and productive operation and planning for its closure. If closure is perceived as being a long way off, internal and external stakeholders may not see it as a priority or may find it difficult to engage in discussions about closure at the same time as discussions about operational or other matters (O'Keefe 2024; Worden 2020).

Planning for mining operation and planning for closing require the ability to influence stakeholders to use their energy (physical, intellectual, emotional, intuitive and spiritual) in two different ways. When a mine opens, human energy needs to be focused on beginnings – the opportunity that a new mine provides. When a mine closes, human energy needs to be focused on withdrawing and refocusing effort in alternative directions. Cherry (2015) outlines a non-linear four-stage cycle of influencing human energy comprised of mobilising energy (attracting and influencing people to contribute their energy towards a collective effort), focusing energy in effective ways, refreshing energy and building hope when energy is low, and detaching and refocusing energy as priorities or needs change.

To successfully engage multilevel stakeholders in beginnings and endings simultaneously, and to keep them engaged over the long haul, those responsible for mine closure planning need to understand what human energies are required and utilise processes that will mobilise those energies appropriately and productively.

3.4 Uncertainty and anxiety

There is a very real and very human challenge to planning for long-term futures: the future is inherently uncertain and the human brain craves certainty. As certainty is equated with safety and survival (Siegel 2023), uncertainty is perceived as a threat. The normal human response to the threat presented by uncertainty is anxiety (Omary 2023). Anxiety motivates us to take steps to reduce the uncertainty, usually through prediction and attempts to control. However it can also have an impact on our ability to be logical, rational and reasonable, with implications at an individual and collective level (Kellerman & Seligman 2023).

At an individual level, anxiety can be a distressing and overwhelming experience, leaving people feeling hopeless and helpless. It is widely accepted that our desire to reduce the threat and to find certainty can promote black-and-white thinking, reduce our ability to see other perspectives and empathise, and lessen our ability to regulate our emotions under pressure. At a collective level this can have a negative impact on a group's ability to work well together, to care for each other, to come up with new ideas and possibilities, to make decisions and to imagine shared futures in which everyone wins.

It has been acknowledged that local stakeholders will be concerned about the socio-economic impacts of transitions before they are even announced, and that uncertainty and doubt can be damaging, especially in those areas where there are strong economic links to mining (ICMM 2025b). For individuals and communities, the uncertainties associated with mine closure and post-closure transitions are not just technical; they are existential, and the future is deeply personal – *'will I have a job, will I have to leave my friends, will my kids be okay, what will I do?'* For impacted community members, the uncertainty won't go away until final decisions are made. As this takes time it is important that planning processes build resilience, connection and the capacity for the community to work together effectively through the challenges.

3.5 Competing images of the future

Conflicting and competing values, world views and images of the future between operators, stakeholders and regulators add a high degree of complexity to the challenge of transition. As Finucane (2024) has argued, differences in values (which are often represented by competing visions of a desirable post-mining future) can create friction or conflict amongst stakeholders, particularly towards the end of a mine's life when the divergences become more pronounced. Tensions can bubble to the surface and, if trust has not been developed, there is considerable risk that relationships will break down, undermining the ability of these groups to collaborate effectively in the closure planning process.

Competing images of the future will often have their roots in tensions between social values which may not always be explicit until put to the test by their practical application in decision-making about PMLU. Communities can often get high-level agreement that they want their future to be prosperous, healthy and safe. However, what that would look like in practice differs depending on underlying values such as economic growth, environmentalism, justice and equality. Even within one value there can be divergence about the best land use. For example, working within the context of regulatory requirements to ensure that the land is safe, stable and sustainable upon closure, some who value protecting the environment may be committed to renewable energy whereas others may prioritise biodiversity.

The challenges that arise from these competing images of the future are best described as dilemmas: situations that can never be fully resolved to the satisfaction of everyone involved but which must be continuously and constructively engaged with to find a way forward that is the best that we can do at the time (Cherry 2015). The challenge in transition is to find ways forward in the face of these dilemmas that do not strip the community, stakeholders or the mining company of their sense of hope and agency or diminish their energy to continue the work of collaborating to enable a positive transition.

4 Thinking about the future in Three Horizons

When planning for post-mining futures, new and different approaches to planning that can manage the inherent uncertainty involved are needed. These approaches need to be flexible and creative, with the ability to adapt to changing circumstances. At Mine Closure 2024, Whitbread-Abruat (2024) called for the mining sector to think beyond the boundaries and barriers, stating that conventional thinking is constrained by physical, legal and conceptual boundaries, and familiarity. High quality futures thinking challenges conventional thinking and empowers people to think in different ways about the future (Hines & Bishop 2015).

4.1 Applying futures thinking to post-mining land use planning

The field of futures and strategic foresight has developed a range of methods to enable people to engage effectively with the challenges and dilemmas of planning in uncertainty. Some foundational axioms of futures thinking, based on the work of leading futurist Jim Dator, include: the future is not predetermined or fixed; there are no 'future facts', only current knowledge that might be considered relevant in thinking about the future; many potential futures are possible beyond what is currently considered most likely; and change processes never erupt without notice (Dator 2019).

What does this mean for planning for long-term post-mining futures? While we can make predictions about the future based on the best data available to us, it is important to recognise that predictions are not facts – no matter how much confidence we may have in the accuracy of a prediction, it is not certain until it occurs. Recognising that the future is uncertain, mining companies need to have the capacity to anticipate and shape developments whilst also building the capacity to respond to the unexpected and unplanned as it emerges. Instead of preparing for one assumed 'most likely' future, it is useful to think in terms of, and plan for, multiple possible futures. This is the basis of scenario planning, which is one of the foundational techniques of futures studies (Lindgren & Banhold 2009). To anticipate and be ready for change, mining companies also need to be able to explore critical uncertainties and notice early signals of change. In consultation with stakeholders and within the boundaries of regulatory requirements, they need to develop a vision for a 'good' post-mining future that is continually recalibrated in response to changes occurring in the world and community. Finally, they need to identify adaptive pathways that could lead to the desired future.

It has been recognised by the ICMM that "a participatory, inclusive and equitable process will enhance community resilience and contribute to a just socio-economic transition" (ICMM 2025b). Participatory futures methods, developed specifically to involve communities in exploring or shaping futures, have been shown to deliver a range of benefits that can be useful in mine closure planning processes, including helping people move from fear, anxiety and confusion about change to finding a sense of empowerment in working together towards a collectively developed image of a good future, helping organisations leverage collective wisdom to identify strategic blind spots and improve decision-making, and restoring trust and accountability in organisations (Ramos et al. 2019).

4.2 Planning as an adaptive process

Mine closure and transition planning over the long-term needs to be a continuous process so that the plan can adapt to changes as these occur. While there is merit to formal planning activities as discussed in Section 3.2, when things are constantly changing, planning cannot be reliant on episodic activities as much can change within short time frames. An emergent approach that develops continuously over time and that responds flexibly to unexpected events and changes is essential.

As the community is continually in a state of transition, planning itself needs to be a process that adapts as the community evolves. An important aspect of planning as a process is the identification and enactment of small adaptive moves, defined by Schein (2016) as "actions intended to improve the situation and elicit more diagnostic data for the planning of the next move... they are small efforts to improve the situation, not grand plans or huge interventions". A small adaptive move might be to provide seed funding to a small-scale

community pilot project trialling an alternative land use on an unused part of a mine site. Such moves are a process through which the mining company and the community can test and refine options, enabling them to gradually move towards a 'good enough' future rather than taking high-cost and high-risk big leaps forward.

Key capabilities in this process include being positioned to notice change early, having the capacity to respond to external developments as they arise, and learning from experience and adapting in response to that experience. Continual iteration is required as data and experience are gained, and as progress is made on implemented actions.

In order to empower the community to continually create its own future, the planning process also needs to build the capacity of the community to work productively together, including all parts of the system and at all levels. In addition to the budgetary and other constraints that both the community and the mining company will be working within, there will be conflicting values, world views and images of the future, as described in Section 3.5. In such a context, a strong focus on process provides the best chance of delivering a 'good' future and avoiding the community feeling that change has been "done to them", as Duffy & Whyte (2017) report has been the experience of communities in the Latrobe Valley.

4.3 Three Horizons framework

The Three Horizons framework (Sharpe et al. 2016) can be used by mine closure practitioners, as well as regional councils and state governments, to work with uncertain futures in imaginative ways while also identifying important features from the present to maintain for the future. It provides a structure for the adaptive planning process that moves through understanding the current situation (Horizon 1), then moving to identify 'pockets of the future' in the present (Horizon 3), before using the perspectives of the present and the future to understand and respond to the challenges that may arise during transition (Horizon 2).

The Three Horizons process is a participatory and conversational process which has the ultimate aim of identifying small adaptive moves that can be made along the pathway towards a 'good' future. While the framework was designed to be easy to understand and use, Sharpe et al. (2016) considered that good facilitation is required in order to achieve deeper insights. A facilitated Three Horizons process provides a valuable strategic conversation that engages a range of stakeholders over time and builds their collective capacity to engage with change and uncertainty in productive ways. According to Sharpe et al. (2016), "the experience of being involved in the process helps participants reframe their understanding of the relationship between the present and the future".

4.4 Three Horizons explained

The Three Horizons framework describes three patterns of activity and how their interactions play out over time. As described above and illustrated in Figure 1, the process maps the shift from the current dominant system, or 'business as usual' (Horizon 1), to the emergence of new future system (Horizon 3) via the transition zone (Horizon 2).

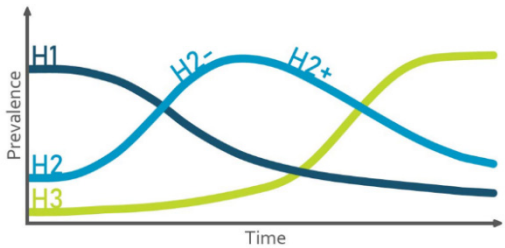

Figure 1 The Three Horizons as patterns over time. Prevalence refers to the extent to which each pattern dominates at each point in time: H1 (Horizon 1) is the dominant system at present, H3 (Horizon 3) emerges as the long-term successor to the current system, H2 (Horizon 2) is the transitional space between the first and third horizons, consisting of both incremental change (H2−) that prolongs the existing system and transformational change (H2+) that facilitates the emergence of the new system (image adapted from Sharpe et al. 2016)

The first horizon (H1) is the dominant system at present. As the world changes, business as usual no longer feels fit for purpose. In the mining context, this is the mining activity that is currently taking place, the businesses that exist around it or rely upon it, the current political and economic landscape, and the existing social values of the community. It describes the moment as it is right now but takes into account the specific context of the mine as well as its history.

The third horizon (H3) emerges as the long-term successor to business as usual and grows from fringe activity in the present. In the mining context, this represents a time some way off in the future when the mine closes and beyond. While it is impossible to predict what this future will be, there are often glimpses of the future in the present that might give some hints. For example, these could be innovations led by small- to medium-sized enterprises within the local community that are seeking to diversify away from a dependence on the mine by looking to develop renewable energy opportunities (Lumsden et al. 2023).

The second horizon (H2) is the transitional space between Horizon 1 and Horizon 3. This is the "turbulent domain of transitional activities and innovations" (Sharpe et al. 2016), some of which will work to improve and prolong the prevailing system (incremental change, or H2−) and some of which will facilitate the emergence of the new future system (transformational change, or H2+). It is 'turbulent' because it is a space of conflicts, dilemmas, innovations and options.

In the mining context, H2 represents the things that people are doing, such as investing in new industry, tourism and renewable energy in traditional areas such as agriculture. There will be conflicting values and images of a preferred future between stakeholders such as industry, government, Traditional Owners and workers. There will be different views and opinions on how resources such as land and water are used. Tensions and dilemmas exist, such as the environment versus jobs, farming versus renewables and tourism versus locals. The dilemmas of H2 are discussed in detail in Section 5.3.

Importantly, all three horizons exist in the present – there are 'pockets of the future' (H3) in the present as well as evidence of people innovating and experimenting, either to sustain the status quo (H2−) or to bring about a radically different future (H2+). As time moves forward, so do the horizons. Using this conceptualisation of time in planning assists with reducing the gap between strategy and execution as all horizons can be considered concurrently on an ongoing basis.

5 Application of the Three Horizons framework

While the Three Horizons framework has been applied in a broad range of areas it has only had limited application in the mining industry. However, there is value in applying the framework to planning PMLUs, particularly for mines with operational lives of several decades or more. The framework offers a range of benefits when applied to the complex challenge of post-mining social transitions. Key benefits identified include providing hope and managing uncertainty through early and ongoing involvement of communities in defining closure visions and corresponding post-closure land uses; navigating change throughout the life of a mine (i.e. the 'messy middle'); and increasing the likelihood of stakeholder support for important decisions through increased participation and awareness.

5.1 Existing applications of the framework

As discussed in Section 4, the Three Horizons framework was developed as way of working with transformational change. It has been applied in a broad range of areas including: exploring challenges facing rural communities; the transition to renewable energy and transformative innovation in the Scottish education system (Sharpe et al. 2016); youth insights on climate change (UNICEF Innocenti 2024); the role of human agency in achieving positive futures (Falardeau et al. 2019 in Schaal et al. 2023); agriculture and biodiversity (Schaal et al. 2023); health care (Hannah 2020); and the future of geoscience as a scientific discipline (Stewart et al. 2023).

The only example located to date in relation to the application of the framework by the mining industry is the work of Gloaguen et al. (2022), who applied it to decarbonisation of the industry and articulated three

'development pathways' for the industry: business as usual (Horizon 1); a radical visionary pathway to make mining a pillar of wellbeing and sustainability (Horizon 3); and a transitionary pathway of technological and social innovations (Horizon 2) that has the potential to create space for Horizon 3 to emerge.

5.2 Building hopeful communities

The psychological understanding of the relationship between uncertainty and anxiety, combined with the existential nature of the long-term uncertainties faced by mining communities as outlined in section 3.4, suggests that to achieve positive transitions for mining communities there is a need to move people from anxiety to hope under conditions of inherent uncertainty.

When people are hopeful they work together better, are less likely to get derailed by conflict and are more likely to come up with useful ideas in the face of obstacles. A lack of hope undermines a community's capacity to imagine positive post-mining futures and its ability to create these futures. Hope for the future is identified by the ICMM (2025b) as an intangible element of successful socio-economic transitions as, without it, "a sense of despondency sets in, the future looks bleak to most residents and mental health problems escalate". Sharpe (2013) describes the Three Horizons framework as a way "to make of hope not only an individual capacity not to give up, but a way to respond with creativity towards the not yet known". When developed collectively, this active hope is a critical resource to enable communities to create good post-mining futures.

Hope is not a synonym for positive thinking or optimism but is defined as a positive motivational state derived from people's perceptions of their capacities to clearly conceptualise goals that they want to work towards, develop 'pathways' (specific strategies) to reach those goals, and initiate and sustain the motivation to use those strategies through developing a sense of agency (Snyder et al. 2002).

In the context of post-mining transitions for communities, the Three Horizons framework can help communities to conceptualise the images of the future they are motivated to work towards, which can be incorporated into the closure vision. As a "high-level aspirational description" of what the closure plan seeks to achieve (ICMM 2025a), the closure vision should be at a high enough level to be able to support multiple images of the future. In doing so, it can support mining communities in transition to develop multiple flexible and adaptive pathways of transition from the present to a good post-mining future within practical and financial constraints rather than a single locked-in pathway that is vulnerable to becoming unachievable or obsolete in a changing world. Finally, it can help mining communities in transition to build a sense of collective agency by creating connections on multiple levels, including interpersonal connections between people, connections between future-focused initiatives which may otherwise have remained isolated, and connections between images of the future which may previously have been seen as in conflict but which may be integrated through the processes of navigating the dilemmas and tensions discussed in Section 5.3.

5.3 Navigating the messy middle

Recalling that communities are in a constant state of transitioning, and that as time moves forward, so do the three horizons, a critical aspect of successful transition is the skilful anticipation and navigation of Horizon 2, the messy middle of transition. This is a contested space of competing values and images of preferred futures, world views, dilemmas and tensions. In mine closure planning, this process of navigating tensions will be ongoing throughout the life of a mine.

As Measham et al. (2021) note, a key component in ensuring successful post-closure transitions and transformations in mining economies is the ability to explore, share and reconcile value differences. The Three Horizons framework responds to this need by enabling stakeholders to work with uncertainty about the future in imaginative ways while also creating space to explore divergent views about desirable directions for the future and which features of the present should be retained into the future. In particular, the Three Horizons process facilitates conversations for exploring and understanding the different images of the future that are present in the community, the values, beliefs, world views, fears and aspirations that underpin these, and the conflicts and tensions between them.

Another contest that occurs in Horizon 2 is between innovations that lead on to Horizon 3 (transformational) and innovations that 'prop up' Horizon 1 (maintain the status quo). The Three Horizons process helps people distinguish between these two types of innovation so that they can make wise choices about which innovations to support, based on whether they are seeking to achieve transformation or seeking incremental change.

As described in Section 4.3, the ultimate aim of the Three Horizons process is to identify strategic actions that can move the system towards Horizon 3. It provides a framework for noticing change early, making adjustments and identifying small adaptive moves, and creates a map (itself changing over time) for navigating the messy middle of transition. It also has the potential to reduce many sources of tension and conflict and increase connection and trust between those involved in the process, as people become aware of the different values at play.

5.4 Gaining community buy-in

The challenges of long-term planning discussed in Section 3 can make it hard to gain community buy-in to planning for long-term post-mining futures. The Three Horizons process involves stakeholders across the system and at all levels over time, thus potentially reducing the impact of the revolving door of stakeholders on planning. It also considers all three horizons at one time, helping to manage the paradox of the different human energy required for beginnings and endings. Focusing on incremental steps towards the future, the process can help community members see the connections between the present and a future that might otherwise seem distant.

Genuine community buy-in is underpinned by meaningful participation, which has been defined by Everingham et al. (2020) as being informative (requiring processes to be transparent and accountable), open (requiring processes to be inclusive, responsive, dialogic, well-resourced and iterative) and just (requiring processes to be impact- and opportunity-focused and equitable). A well-facilitated Three Horizons process can meet each of these criteria, creating space for diverse voices to participate in a constructive dialogue about the future that informs a realistic plan to work adaptively and progressively towards a positive post-mining future.

6 Planning for and transitioning to post-mining land uses

Sharpe's Three Horizons framework provides a clear conceptual process to guide strategic conversations with community and other stakeholders and to develop a shared understanding of the current situation as well as a vision for the future. Sharpe and colleagues at the International Futures Forum have developed a methodology that is based on this process, and which has been applied in other settings (International Futures Forum n.d.). The following methodology would be used to apply the conceptual process to mining. This would help closure practitioners engage with the complexities and uncertainties of planning for social transition as mines approach and implement closure, explore and integrate key dilemmas that arise, understand and constructively work with different stakeholder values and perspectives, and identify novel and creative solutions to complex problems.

6.1 Value of using Three Horizons in post-mining land use planning

Much of the value gained in using the Three Horizons framework for planning PMLUs lies in the relationships developed amongst participants and the insights gained by them through their participation in the conversations at each stage of the process. These relationships and insights improve a company's understanding of different stakeholder perspectives, positions and aspirations regarding post-mining futures, and facilitate development of a shared post-mining vision for the future which changes as the way in which what is considered to be a 'desired future' changes over time. Other benefits include:

- development of a strong understanding of the context for closure planning, including key trends and drivers of change impacting the local community and environment

- identification and implementation of innovations that will take the local community and the mine site towards a desired post-mining future
- identification and implementation of ideas and strategies that will keep the current system running and address immediate concerns
- development of a transition plan that is able to respond flexibly to a changing environment
- development of, and engagement with, a meaningful stakeholder network across the life of the mine.

6.2 Implementation of the Three Horizons approach to post-mining land use

The objectives and outcomes of each horizon of the framework when applied to planning PMLUs are summarised in Table 2. Recognising the importance of transparent, fair and defensible processes in identifying and selecting PMLUs, these outcomes represent critical inputs for use in: preparing and updating closure plans; engaging with the community, regulators and other stakeholders; and contributing to regional socio-economic transition planning.

Table 2 Implementation of Three Horizons approach to planning post-mining land use

Step	Objectives	Outcomes
Mapping the current land use system (H1)	Identify existing mining activity and relationships with the local community, businesses and other stakeholders Understand social values, community attitudes and other local factors Identify the relevant political, social and economic landscape as it interacts with the mine Take account of local and regional settings and history	Comprehensive documentation of the current land use system Common understanding of current mine settings Evidence of targeted stakeholder engagement as well as current concerns, values, attitudes etc.
Identification and description of potential future land uses (H3)	Develop a set of potential land uses under a range of future scenarios Understand community and stakeholders' aspirations and fears Understand potential future drivers of change over the long term Identify existing activity at the margins that points to potential future land uses ("pockets of the future in the present")	A set of well-researched future land uses options that would likely cover a range of possible future scenarios, informed by stakeholder and community input Map of community and stakeholder aspirations and fears, drivers of change, inspirational practice in the present
Development of a transition plan for how to get to a desirable future (H2)	Implement a process to anticipate the near future, shape it and respond to it as it emerges Develop an adaptive plan to progressively work towards a sustainable, appropriate post-mining land use through a process of identifying and enacting small adaptive moves (actions intended to improve the situation and elicit more diagnostic data for planning the next move) informed by defensible processes (e.g. risk assessment, multi-criteria analysis)	An adaptive and reviewable plan towards selection and implementation of an optimal post-mining land use

7 Conclusion

Mining is a temporary land use and it is expected that responsibility for the land will eventually transfer to another landholder or user, so effective planning for post-mining futures is an essential part of any project. Moving from mining to a post-mining future is a process of gradual transition rather than a one-off event. A number of factors make this process complex and challenging, including the gap between strategy development and strategy implementation, the many changes that can happen in this time, the paradox of beginning and planning for ending at the same time, the human response of anxiety to uncertainty, and competing images held by different stakeholders of what a 'good' (or 'good enough') future post-mining would be.

The field of futures and strategic foresight has developed a range of tools that can help people engage effectively with the dilemma of planning over long time horizons under conditions of great uncertainty. Futures thinking can help mine operators work effectively with communities and other stakeholders to tackle the adaptive challenge of social transition to a 'good future' for communities post-mining whilst also addressing the intertwined technical problems of post-mining land use (PMLU).

Sharpe's Three Horizons framework provides both a conceptual framework and the structure for participatory processes to facilitate PMLU planning and the transition to the next land use in an integrated and iterative way. It provides a clear process to guide strategic conversations between miners, communities and other stakeholders to articulate in closure plans a shared understanding of the current situation as well as a vision for the future, and to manage pathways of transition that unfold over time. The process allows multiple perspectives and multiple objectives to be properly considered and integrated into a plan that has genuine community and stakeholder buy-in. Through the process, mine operators, the community and stakeholders develop understanding, connection, agency and hope – building their capability to navigate the challenges of transition to create positive post-mining futures.

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References

Banfield, D, Moisi, A, Carranceja, JF, Cohen, J & Srinivasan, V 2023, *Enabling Mine Closure and Transitions: Opportunities for Australian Industry*, CSIRO, viewed 10 April 2025, https://crctime.com.au/macwp/wp-content/uploads/2023/12/23-00511_FUT_REPORT_MineClosureRoadmap_WEB_231129-1.pdf

Boggs, G, Measham, T & D'Urso, J 2023, 'What are we transitioning into? Re-thinking the model of mine closure', in B Abbasi, J Parshley, A Fourie & M Tibbett (eds), *Mine Closure 2023: Proceedings of the 16th International Conference on Mine Closure*, Australian Centre for Geomechanics, Perth, https://doi.org/10.36487/ACG_repo/2315_022

Cherry, N 2015, *Energising Leadership*, Oxford University Press, South Melbourne.

Dator, J 2019, 'What futures studies is, and is not', in Jim Dator (ed.), *A Noticer in Time*, Springer, Cham, pp. 3–5, https://doi.org/10.1007/978-3-030-17387-6_1

Davis, R & Franks, DM 2011, 'The costs of conflict with local communities in the extractive industry', *Proceedings of the First International Seminar on Social Responsibility in Mining*, Santiago, Chile.

Duffy, M & Whyte, S 2017, 'The La Trobe Valley: the politics of loss and hope in a region of transition', *Australasian Journal of Regional Studies*, vol. 23, no. 3, pp. 421–446.

Dzakpata, I, Qureshi, M, Kizil, M & Maybee, B 2021, *Exploring the Issues in Mine Closure Planning*, CRC TiME, Perth.

Everingham, J-A, Svobodova, K, Mackenzie, S & Witt, K 2020, *Participatory Processes, Mine Closure and Social Transitions*, Centre for Social Responsibility in Mining, The University of Queensland, Brisbane.

FemNorthNet Thompson Community Group & Schulz, K 2015, *Critical Reflections on Economic Planning in Thompson: An Analysis of TEDWG*, Canadian Research Institute for the Advancement of Women, FemNorthNet, Ottawa, viewed 20 April 2025, https://www.criaw-icref.ca/wp-content/uploads/2021/04/Critical-Reflections-on-Economic-Planning-in-Thompson-An-Analysis-of-TEDWG.pdf

Finucane, SJ 2024, 'Ready, set, close! Assessing social values and community readiness for mine closure and post-closure transitions', in AB Fourie, M Tibbett & G Boggs (eds), *Mine Closure 2024: Proceedings of the 17th International Conference on Mine Closure*, Australian Centre for Geomechanics, Perth, pp. 213–230, https://doi.org/10.36487/ACG_repo/2415_14

Fraser, J 2021, 'Mining companies and communities: collaborative approaches to reduce social risk and advance sustainable development', *Resources Policy*, vol. 74, 101144, https://doi.org/10.1016/j.resourpol.2018.02.003

Gagen, E, Nicholls, J, Innis, S, Rowntree, A, Tang-Lee, D & Martin, D 2024, 'Social, economic and environmental resilience through mine closures: why collaboration and partnership are key', in AB Fourie, M Tibbett & G Boggs (eds), *Mine Closure 2024: Proceedings of the 17th International Conference on Mine Closure*, Australian Centre for Geomechanics, Perth, pp. 17–28, https://doi.org/10.36487/ACG_repo/2415_0.02

Gloaguen, R, Ali, SH, Herrington, R, Ajjabou, L, Downey, E & Stewart, IS 2022, 'Mineral revolution for the wellbeing economy', *Global Sustainability*, vol. 5, no. 15, pp. 1–4, https://doi.org/10.1017/sus.2022.13

Groupsmith n.d., *Technical Problems vs. Adaptive Challenges*, viewed 20 April 2025, https://ncs.uchicago.edu/sites/default/files/uploads/tools/NCS_PS_Toolkit_DPL_Set_B_TechincalProblems.pdf

Hannah, M 2020, *The Fife Shine Programme*, viewed 18 April 2025, https://medium.com/@britishholistic/the-fife-shine-programme-49751695769f

Heifetz, RA & Laurie, DL 1997, 'The work of leadership', *Harvard Business Review*, vol. 75, no 1, pp. 124–34.

Heifetz, RA & Linsky, M 2002, *Leadership on the Line: Staying Alive through the Dangers of Leading*, Harvard Business School Press, Boston.

Heifetz, RA, Grashow, A & Linsky, M 2009, *The Practice of Adaptive Leadership: Tools and Tactics for Changing your Organization and the World*, Harvard Business Press, Boston.

Hines, A & Bishop, P 2015, *Thinking about the Future: Guidelines for Strategic Foresight*, 2nd edn, Hinesight, Houston.

Holmes, D, Coakes, S & Jaeger-Michael, R 2024, 'Institutional, stakeholder and regulatory constraints to the redevelopment of mine sites to alternative employment-generating land uses: Hunter Valley case study', in AB Fourie, M Tibbett & G Boggs (eds), *Mine Closure 2024: Proceedings of the 17th International Conference on Mine Closure*, Australian Centre for Geomechanics, Perth, pp. 309–324, https://doi.org/10.36487/ACG_repo/2415_22

ICMM 2025a, *Integrated Mine Closure Good Practice Guide*, 3rd edn, London, viewed 10 April 2025, https://www.icmm.com/website/publications/pdfs/environmental-stewardship/2025/guidance_mine-closure_update.pdf?cb=95109

ICMM 2025b, *ICMM Handbook: Multistakeholder Approaches to Socio-Economic Transitions in Mining*, May 2025, London, viewed 18 June 2025, https://www.icmm.com/en-gb/guidance/social-performance/2025/multistakeholder-approaches-socio-economic-transitions

International Futures Forum n.d., *Applying Three Horizons in Practice*, Fife, viewed 24 April 2025, https://www.iffpraxis.com/3h-application

Kellerman, GR & Seligman, MEP 2023, *Tomorrowmind: Thriving at Work with Resilience, Creativity, and Connection, now and in an Uncertain Future*, 1st edn, Nicholas Brealey Publishing, London.

Kowszyk, Y, Vanclay, F & Maher, R 2023, 'Conflict management in the extractive industries: a comparison of four mining projects in Latin America', *The Extractive Industries and Society*, vol. 13, https://doi.org/10.1016/j.exis.2022.101161

Latrobe Valley Authority 2023, *Gippsland 2035: Latrobe Valley and Gippsland Transition Plan*, Morwell.

Lindgren, M & Bandhold, H 2009, *Scenario Planning: The Link Between Future and Strategy*, 2nd edn, Palgrave Macmillan, Basingstoke.

Lumsden, L, Bell, J, Webb, L, Bailey, O & Cahill, A 2023, *What Next? Community Perspectives on the Energy Transition in the Latrobe Valley*, The Next Economy, Brisbane, viewed 23 Jun 2025, https://nexteconomy.com.au/wp-content/uploads/TNE-Latrobe-Report-21_0903.pdf

Measham, T, Ackermann, F, Everingham, J, Barber, M, Haslam-McKenzie, F & Maybee, B 2021, *Understanding Stakeholder Values in Post-mining Economies: A Literature Review*, CRC TiME, Perth.

Measham, T, Walker, J, Haslam McKenzie, F, Samper, A, Brereton, D & Boggs, G 2024, 'Progress towards implementing a research agenda towards post-mining transitions', in AB Fourie, M Tibbett & G Boggs (eds), *Mine Closure 2024: Proceedings of the 17th International Conference on Mine Closure*, Australian Centre for Geomechanics, Perth, pp. 99–106, https://doi.org/10.36487/ACG_repo/2415_05

Neugebauer, F, Figge, F, & Hahn, T 2016, 'Planned or emergent strategy making? Exploring the formation of corporate sustainability strategies', *Business Strategy and the Environment*, vol. 25, no. 5, pp. 323–336.

O'Keefe, E 2024, 'It's complex: reframing narratives around the social impacts of mine closure', in AB Fourie, M Tibbett & G Boggs (eds), *Mine Closure 2024: Proceedings of the 17th International Conference on Mine Closure*, Australian Centre for Geomechanics, Perth, pp. 199–212, https://doi.org/10.36487/ACG_repo/2415_13

Oei, PY, Brauers, H & Herpich, P 2020, 'Lessons from Germany's hard coal mining phase-out: policies and transition from 1950 to 2018', *Climate Policy*, vol. 20, no. 8, pp. 963–979, https://doi.org/10.1080/14693062.2019.1688636

Omary, A 2023, 'How uncertainty causes anxiety', *Psychology Today*, viewed 23 June 2025, https://www.psychologytoday.com/au/blog/natured-nurture/202304/how-uncertainty-causes-anxiety

Ramos, J, Sweeney, JA, Peach, K & Smith, L 2019, *Our Futures: by the People, for the People. How Mass Involvement in Shaping the Future can Solve Complex Problems*, Nesta, London.

Reeves, JM, Baumgartl, T, Morgan, D, Reimers, V & Green, M 2022, 'Community capacity to envisage a post-mine future: rehabilitation options for Latrobe Valley brown coal mines', in AB Fourie, M Tibbett & G Boggs (eds), *Mine Closure 2022: Proceedings of the 15th International Conference on Mine Closure*, Australian Centre for Geomechanics, Perth, pp. 173–186, https://doi.org/10.36487/ACG_repo/2215_09

Schaal, T, Mitchell, M, Scheele, BC, Ryan, P & Hanspach, J 2023, 'Using the three horizons approach to explore pathways towards positive futures for agricultural landscapes with rich biodiversity, *Sustainability Science*, vol. 18, pp. 1271–1289.

Schein, EH 2016, *Humble Consulting: How to Provide Real Help Faster*, Berrett-Koehler Publishers Inc, Oakland.

Sharpe, B 2013, *Three Horizons: The Patterning of Hope, Triarchy Press*, Axminster, Devon.

Sharpe, B, Hodgson, A, Leicester, G, Lyon, A & Fazey, I 2016, 'Three Horizons: a pathways practice for transformation', *Ecology and Society*, vol. 21, no. 2, p. 47.

Siegel, DJ 2023, *Intraconnected: Mwe (Me + We) as the Integration of Self, Identity and Belonging*, WW Norton & Company, New York.

Snyder, CR, Rand, KL & Sigmon, DR 2002, 'Hope theory: a member of the positive psychology family', in CR Snyder & SJ Lope (eds), *Handbook of Positive Psychology*, Oxford University Press, Oxford, pp. 257–276.

Stewart, I, Capello, MA, Mouri, H, Mhopjeni, K & Raji, M 2023 'Three Horizons for future geoscience', *Earth Science, Systems and Society*, vol. 3, https://doi.org/10.3389/esss.2023.10079

UNICEF Innocenti 2024, *Emerging Horizons: Youth Insights on Climate Change and Breakthrough Solutions*, UNICEF Innocenti and UNDP, Florence, https://www.unicef.org/innocenti/media/8286/file/UNICEF-Innocenti-Emerging-Horizons-2024.pdf

United Nations Framework Convention on Climate Change Secretariat 2024, 'Defining and understanding transformational adaptation at different spatial scales and sectors, and assessing progress in planning and implementing transformational adaptation approaches at the global level', *UN Climate Change Conference*, https://unfccc.int/documents/641403

Whitbread-Abrutat, P 2024, 'A mine ends. Then what? Some reflections on best practice', in AB Fourie, M Tibbett & G Boggs (eds), *Mine Closure 2024: Proceedings of the 17th International Conference on Mine Closure, Australian Centre for Geomechanics*, Perth, pp. 3–16, https://doi.org/10.36487/ACG_repo/2415_0.01

Williams, C & Wright Gittins, Y 2025, 'Nickel, paradise and 'emancipation'', *ABC News*, viewed 23 April 2025, https://www.abc.net.au/news/2025-04-11/new-caledonia-koniambo-nickel-mine-shutdown/105151562

Worden, S 2020, *Integrated Mine Closure Planning: A Rapid Scan of Innovative Corporate Practice*, Centre for Social Responsibility in Mining, The University of Queensland, Brisbane.

Xavier, AM, Veiga, MV & van Zyl, D 2015, 'Introduction and assessment of a socioeconomic closure framework', *Journal of Management and Sustainability*, vol. 5, pp. 38–49.