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Understanding stakeholder values in post-mining economies: a literature review

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PROJECT PARTNERS:

Commonwealth Scientific and Industrial Research Organisation
Curtin University
The University of Queensland
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[1]CSIRO Land and Water; [2] School of Management and Marketing, Curtin University; [3]Sustainable Minerals Institute, University of Queensland; [4]Department of Geography and Planning, University of Western Australia; [5]WA School of Mines, Curtin University

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Contact Details
Dr Tom Measham
Email: Tom.Measham@csiro.au

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TABLE OF CONTENTS

1. Introduction

This literature review considers a range of factors regarding the concepts of 'value' and 'values' (including financial, tangible and intangible, measurable and non-measurable). The review is the first output from a project that examines ways of thinking about possible complementarities and trade-offs between values (and systems of values) held by stakeholders. In doing so, the project provides a foundation for other projects concerned with diverse aspects of transformations in mining economies (e.g. relating to tools to manage closure and strategic planning processes).

The literature review provides a synthesis of key insights into the rationale for considering values in the transition to post-mining land uses in section 2. The different dimensions of value differences are summarised in section 3, including the degree to which values change over time and space. Following on from this, a synthesis of the different ways of negotiating differences in values is provided in section 4. Together these sections help to understand values from different perspectives as well as possible ways to achieve 'win-wins' for different systems of values.

This literature review takes a broad approach to what we mean by 'values', rather than a narrow emphasis on 'financial value' or 'financial worth'. One of the underlying rationales for this review was the need to shift post-mining land use evaluation from a focus on singular 'value' to plural 'values'. While both are crucially important to the resources sector, the latter takes a wider and more inclusive approach. The singular 'value' focuses on those aspects of mining that can be reduced to a single measure, often conceptualised as financial worth expressed as net present value (NPV), return on investment (ROI), or as a measure of size in weight or volume. These measures of value have the benefit of being expressed in a single unit which makes them more tractable and easier to communicate. While a singular value (e.g. expressed as NPV) is important, to focus exclusively on a 'value as financial worth' runs the risk of ignoring a wider range of considerations which speak to things that matter to people (i.e. 'values') and potentially missing opportunities for post-mining land uses.

This wider range of values incorporates a suite of issues which are often less tractable and more difficult to represent in balance sheets or quarterly reports. The implication of this tendency is that these broader 'values' may receive relatively less attention, despite their importance in transitions to post-mining economies. These issues are broad but may include externalities related to quality and quantity of resources such as water, opportunity costs and a range of intangibles such as sense of identity, connection to country, appreciation of natural wonder and human endeavour. Despite being less tractable, these broader values can be reflected in concepts such as 'social licence' which, from an industry perspective, can lead to disruption to mining activities (Owen, 2016). In extreme situations, failure to come to terms with a wider set of values can lead to conflict. The cost of this conflict has been estimated to be US$20 million per week of delayed production in NPV terms (Franks et al., 2014). It is important to emphasise that a broader recognition of values is not only about avoiding costs. It is also about realising opportunities and this is why moving from 'value' to 'values' is a key consideration in the context of post-mining transitions.

2. Why focus on values?

Rationale for considering values in general

Changes in mining economies accompanying mine lifecycle transitions – notably mine closure – do not follow a uniform pathway. Many factors in the local context explain this variability including the social setting in which a lifecycle transition occurs as well as motivations for engaging with proposed options for post-mining economies. This is because major economic transformations require the support and active participation of stakeholders including government at different levels, trade unions, industry and business, civil society, and academia. These different actors and social groups may hold a diversity of views about the most desirable development trajectories and transition options for mining regions. Their levels of power and influence also vary considerably, meaning that some values may have a greater impact on decisions about mine rehabilitation and closure and the transition to a post-closure economy. For instance, the post mining transitions may threaten the economic positions and business models of some stakeholders. If these are the largest and the most powerful stakeholders, they are likely to protect their vested interests and contest the need for, and speed of, transitions. As well, competing values (say of a job versus higher education) may be resolved by win-lose compromises that favour the majority but increase the marginalisation of a minority. Hence, values often lie at the root of contestation and conflict and require understanding of power and influence (addressed further later in this report).

This literature review provides an overview of what is already known about how values influence post-mining options and site rehabilitation and closure decisions. It also shows the diversity of values and their influence on economic transitions in mining communities, regions and states.

Definitions of Values

Values are about 'what matters' and 'what's important' to different groups or the characteristics of an object, or option that makes it welcome or undesirable to some perceiver (adapted from Higgins 2007 p455). Values are understood in various ways through distinctive concepts, constructs and units of analysis (see Table 1). Following Forget & Rossi (2021 p177), we adopt a broad conception of "value" as "a socio-cultural construction that means something important to a person or a social group". We further understand that a complex configuration of economic, social, environmental and governance characteristics shapes what a stakeholder group will perceive as 'allowable procedures' for moving towards cultural objectives that are 'worth striving for' (Merton in Higgins, 2007 p456).

Our definition implies that the value of mining, and any successor industry to a regional economy relates not only to the financial or wider economic benefits from the industrial activity, but also to its environmental, social, and cultural impacts and both the physical and socio-political context. In that sense values are a complex configuration of economic, social, environmental and governance characteristics that will be assessed differently by various stakeholders depending on their context, beliefs, interests, and experiences (Ang et al., 2015). While there are seminal studies of values (Higgins, 2007), recent expansion and diversification of interest in values and recognition of its relevance to regional development and industry transitions has resulted in bodies of research in disciplines such as psychology, economics, anthropology and sustainable regional development that all endorse the consideration of values in decisions about socio-economic directions. As Dumont says (2013 p289), there is a "complex nexus of meanings and preoccupations to which our word [value/s] is attached, a tangle to which all kinds of thoughtful efforts have contributed".

This review identifies two elements in studies of value systems generated by regional characteristics representing the cumulative mining contribution and legacy: they define dimensions of value (or types of value) that they focus on and they outline their ways of measuring or observing value. Scholars are interested in different dimensions of value and use different lenses to understand or appreciate relevant values in different ways, often in terms of their discipline specialisation. Table 1 portrays a synthesised view according to six different disciplines. However, it needs to be said that none of these disciplines themselves agree on a single definition of value – even within disciplines there are disputes and different emphases. Similarly, the extent to which diversity and relevance of some 'stakes' are acknowledged defies a simple summary. For instance, business studies can investigate the influence of organisational culture on the value proposition of an industry to a region concentrating on commercial value, but not acknowledge any divergent values as significant (Magsi et al., 2018; Ang et al., 2015).

Despite different emphases, these definitions share some intertwined commonalities that are relevant to the CRC-TiME concerns. Most significantly, none portray the value as objective and inherent, but imply that it is relative and subjective involving people's perceptions, beliefs and/or biases. In fact, some even argue that values establish a hierarchy (Dumont, 2013; Schwartz, 1994). This in turn, links to another shared feature – that attributing value involves evaluation with processes or outcomes congruent with one's values seen as positive and dissonant ones regarded as negative. Additionally, the definitions imply both process and outcome dimensions. Finally, there is a sense that values are not fixed but likely to change and hence have potential for exchange and trade-offs, although some do suggest stable, or core, values that may be resistant to change (see for example Magsi et al., 2018). More flexible values evolve through the influence of many factors and processes that similarly shape attitudes and behaviours with the result that they vary across cultures, across geographical space, and over time.

Table 1 Conceptualisations of value in the literature

Conceptualisation of value	Key assumptions and way of measuring/ observing values	Body of literature	Sample literature
An **instrumental concept** linked to financial worth – measured by amount of money (or other material) for which it can be exchanged. Focusses on commercial and customer value.	A dollar figure can be attached to most things and gives an indication of how highly people esteem something. Related research attempts to monetise, the value of an ecosystem or of women's domestic labour for instance. Key measures include Gross Domestic Product at the national scale, Gross Regional Product at the sub-national scale and Net Present Value for an investment, assett or operation such as mine.	Economics, Finance (e.g., Monetary value, usefulness)	Perter and Kramer (2019) Laudal (2018) De los Reyes (2017)
Individual assessment of the worth of something as an antecedent to someone's goals, attitudes and behaviours/ actions	Values refer to beliefs pertaining to desirable end states that guide selection or evaluation of behaviour, people, and events, and are ordered by relative importance to form a system of value priorities (Schwartz, 1994:20)	Psychology (e.g. honesty, diligence)	Schwartz (1994) Shepherd et al., 2009
A coherent **pattern of core principles** and ideals within a community reflecting people's way of seeing, experiencing and responding to their physical, social, spiritual and human environment.	Values are grounded in a particular place and time and are multidimensional including customs, traditions, rituals, ideas, beliefs, and guidance. "Values are human judgments of equivalence and hierarchy within social systems" linked to purposeful social action toward what people deem to be important.	Anthropology (e.g. heritage), Human geography	Dumont (2013)
Values are **shared ideals** (aspirations) that express group conceptions of the relative desirability of means and ends and inform attitudes and behaviours.	Values give direction to the way that individuals, organizations, and societies act; what they strive for; and what they deem important. "Values are the criteria people use in assessing their daily lives; arranging their priorities and choosing between alternative course of action"	Sociology (e.g. equality, liberty, fraternity)	Merton (in Higgins, 2007)
Contributions to the **economic and non-economic gains** (e.g. five capitals, ecosystem services) that ensure inter- and intra-generational equity and wellbeing	Need an integrated view of ecological, socio-cultural and economic values and a view of the dynamic system as a whole – not separated elements of value. "Restoring ecosystem functions is restoring our economy" (Ferweda, 2016:29)	Sustainable development (e.g., Triple Bottom Line or SDGs)	Magsi et al. (2018); Villegas-Palacio et al. (2016) Ferweda (2016) Leiserowitz et al. (2006)

Role of values for transitions in regional economies

There are many reasons for carefully considering values when planning transitions in regional economies:

- seeking outcomes that will have broad, equitably distributed, and lasting benefits.
- reducing the likelihood of conflict if outcomes can be accepted by diverse groups even though actors will likely be ‘‘forced to choose, consciously or unconsciously, between competing values… these values are often incommensurate, and trade-offs have to be made” (Leiserowitz et al., 2006 p440).
- learning about what has worked (and not worked) from examples of considering values in decision making (Leiserowitz et al., 2006).
- Managing risks by being aware of values.
- Ensuring that processes such as trade-offs are used in an appropriate context

Mechanisms for collaboratively building a shared vision of post mine options are limited, placing the future of mining regions at risk (a key part of the raison d’être of the CRC). This literature review is the first step in a process of identifying those with a stake in post-mining economies, their diverse values and potential ways to identify or negotiate mutually acceptable goals. In that way it can support a wide range of future research.

This literature review outlines what is already known about the concept of value in landscape use and planning across a wide range of contexts (not limited to mining). It also recognises unrealised opportunities for value creation for multiple stakeholders in mining region transitions and assesses the extent to which the implications of past research have influenced practice and outcomes. A broad consensus of strongly held public values is one factor in the contrasts between successful application of values-informed approaches and examples of lack of traction when applying knowledge about stakeholder values. As well, rapid transformative change tends to occur when there is vivid imagery (or focussing events), institutions and organisations ready and able to act and available or readily constructed solutions (Leiserowitz et al., 2006 p437). This suggests alternative ways to approach post-mining transitions to be tested in future research as well as priorities for practitioners such as institutional capacity building in regions and R&D to ensure the requisite technology and regulation is available.

Need for novel values research

Knowledge of what people value, and the diversity of values in a region related to mine closure transitions can assist decision-makers to develop policies and practices that work towards delivering environmental and socio-economic outcomes that have broad acceptance (Lechner et al., 2017). Dismissing the values (i.e. the preferences and aspirations) of one set of stakeholders as irrelevant, strange, aberrant, or incomprehensible, presents a fundamental obstacle to smooth post-mining transitions and the changes they will require. Current research interest goes beyond ‘fit and conform’ models of change where prevailing values are identified to support continuation of the status quo. For regional post-mining transitions, a ‘stretch and transform’ model that enables change is needed to support an alternative, prosperous future (terms from Kohler et al., 2019 p5). This implies the importance of understanding the dynamics of values and how they change over time and with other circumstances). It also emphasises non-monetary values – and the awareness of affected and interested stakeholders of what is important for their well-being and for that of others, even if they do not possess sufficient resources (including financial, technological or institutional) to operationalise their visions.

Hence, after establishing what may be value dimensions and whose values are important to consider in respect of post-mining economies, a further challenge is how to observe and then measure them. Available frameworks suit different purposes. While financial values are easily quantified and monetised, they are criticised for implying that a material or immaterial feature of the regional landscape has a single, objective value that is immediate and tangible rather than recognising its multiple values. For example, land may have a market value, sentimental value, ecosystem value, and spiritual value for a single individual as well as for different groups of people.

Consequently, other approaches are favoured for more abstract and intangible values. Psychological surveys have widespread application in businesses to predict the means and ends that will be either welcome or undesirable to participants. There are four common values dimensions in one of these - the Schwartz (1994) Value Survey (altruism, egoism, traditionalism, and openness to change). These dimensions have been found to significantly predict the goals people will seek and also their level of satisfaction with both outcomes and processes for designing and implementing post-mining goals (Bidwell and Schweizer, 2020). For example, altruistic values predict adherence to emancipatory participation goals, while egoism (i.e., self-interest) is associated with a coercive goal orientation. In turn, preferences for public participation goals are predictors of respondents' levels of satisfaction with public participation techniques such as public hearings and public advisory boards. Instrumental participation goals are associated with greater satisfaction with public hearings, but holding functionalist-deliberative goals predicts satisfaction with advisory boards (Bidwell and Schweizer, 2020).

However, a similar value survey developed by IBM has been criticised for not distinguishing between what people do and what they aspire to (i.e. between their practices and values) (Hofstede, 2011). This highlights another difficulty with establishing the post-mining options and processes of transformation that are broadly acceptable and meet collective ideals. There is increasing recognition that understanding value “commonly requires non-monetary approaches with no specific units of measurement. These include (i) deliberative approaches, such as group-discussions or opinion polls; or (ii) analytical-deliberative approaches, such as participatory modelling, multi-criteria analysis, or deliberative (group) monetary valuation” (Folkerson, 2018 p2)

It follows that, any attempt to plan or work towards a transformation of economies in mining regions must clarify the extent to which it is taking values into account – whose values, what type of values and how they are determining them. This means that we need to improve knowledge of how the full range of values can be considered by the right people at the right time to lead to better outcomes. It is an accepted ideal that the potential of mining projects to generate value involves consideration of their whole life-cycle with post-mine planning starting from the outset of a mining project. However, less clear is how to understand the values that will prevail in a region decades later when mining is completed or how mine planners can consider non-financial and non-technical value as they design for efficient production. As well, how do transformation initiatives recognise the likely logical contradictions within any value systems detected or applied (since people do not always behave consistently with their espoused values and many values are relative or contingent upon other conditions or circumstances). In turn these assumptions, may involve confronting some current gaps in understanding such as reconciling (or establishing the commensurability of) ‘expert’ and common sense concepts of value (while recognising that the source of expertise is not necessarily agreed either). A major challenge then to practitioners and researchers alike is deciding the processes that might work to sample the full range of stakeholders given the diversity of stakeholders and of their values.

Risk of ignoring values

There are significant risks for mining regions, and their stakeholders, and research to support economic transitions if post-mining planning and implementation proceeds without sufficient consideration of values. This lack of consideration may arise because the existence of values is not recognised, because their role in decision making is not recognised, or because particular values are ignored or de-prioritised in favor of others, leading to a blinkered view of what matters. Where these risks are present, pathways to post-mining transitions in mining regions are likely to have sub-optimal [and/or perverse] outcomes that may even be fiercely resisted. Being responsive to public values, resolving conflict, and building trust are regarded as important yet challenging for those with a collective interest in any future-oriented program directed to mutual benefits (Beierle and Konisky, 2000). This will be discussed further in section 4.

Implications for transitioning to post-mining economies.

The transition of a regional economy involves balancing the use of resources, structures and processes to generate value and meet multiple expectations. The transition process needs to complement broader regional development and it is not the sole responsibility of a single organization. A major uncertainty in considering post-mining transitions in regions is how various groups of people will react to the range of feasible options. Hence, it is important to grasp the promise and challenge of understanding what is already known about what values are, whose values influence mining (and post-mining) activities, and various responses and preferences with respect to post-mining options as well as whether, when and with what results that knowledge has been used in working towards regional transitions. Otherwise, it is likely that:

- Conflict, protests and loss of social licence occurs;
- Reputation for corporate social responsibility is challenged;
- Efforts to use post-mining assets in a mutually beneficial way will not be successful;
- It will prove difficult to find collaborators or successors to implement and maintain subsequent uses of previous mining territory or assets.

Building on early work on value chains, Barraket et al. (2018) have promoted the idea of “social value chains” as a valuable conceptual framework to explain the processes by which organizations seek to generate progressive social outcomes along the value chain. They observe that this involves embedding collaborative activity related to social value creation in the routines of business operation, including supply chain decisions, customer interactions and operational practices.

3. Dimensions of value differences

Across the diverse literature are a number of common threads and questions. These are discussed below focusing on the difference between relative and absolute values and how values change over time. In considering the dimensions of value differences, this review takes a broad view of stakeholders and their interests.

Relative values

Relative values can be expressed as preference: a relative ranking of different phenomena. This way of thinking about values underlays many processes and institutions in society and the economy, including trade-offs and compromise between different considerations. For those values which can be expressed as preferences, it is possible to conduct detailed analysis of the relative importance of

a range of factors including intangible non-market values. Economists have developed ways to measure non-market and intangible values including methods such as choice experiments and willingness to pay for different attributes. Much of this research has focused on environmental values as an attempt to express issues such as water quality, ecological integrity and aesthetic appreciation in a comparable format to more easily quantified factors. By translating non-market preferences into dollar equivalents, economists have incorporated these values into benefit cost analysis for the mining sector (Gillespie and Kragt, 2012; Narrei and Ataee-pour, 2020). At the heart of concepts such as choice experiments and willingness to pay studies is that humans are able to state that they prefer one thing to another, and hence determine relative importance, and that different values can be traded off (more of one thing for less of another). It is important to note that 'willingness to pay' has been critiqued from various perspectives. In part these critiques relate to various correlations which can make assessments more difficult to interpret. For example, that willingness to pay is correlated with level of income, thereby granting more power to those with increased access to monetary resources (Hudson and Ritchie, 2001). Another question relates to the validity of asking members of the public accustomed to private individual transactions about their willingness to pay for major public assets, with an important critique being that these types of approaches fail to consider that private choices may not fully reflect preferences over public goods (Mouter, 2021). Relatedly, there are questions over the validity of comparing hypothetical value choices (how much a person would pay for something) with actual or real choices (how much people do pay for their preferences). Unlike absolute (or core) values which are generally fixed throughout life, relative values may change quite quickly, either due to a change in circumstance for the value holder (i.e. people) or the item of value (e.g. its accessibility).

Timeframes of change

Much of the literature on relative values demonstrates that the timeframes over which they change are often long. A recent review that brought together two decades of research showed that values held by individuals about places tend to be relatively stable over the medium term (5-10 years) (Brown et al., 2020). As values change over time, so do our understanding of values change. This occurs for individuals and for groups at higher scales (what we may call community values or social values). Therefore, the ways we categorise values has also evolved over time (Brown et al., 2020).

Drivers of value change

Several factors have been linked to changes in values. Generally, these types of changes refer to a shift in prioritisation of relative values, rather than fundamental changes in absolute values which, by definition are independent of preference orders.

Rapid change and crisis: The COVID pandemic provides a recent example of how values can change quickly. For example, a recent study showed that the special circumstances of the COVID crisis in Europe led to value flux for certain issues (Reeskens et al., 2021). Key examples include acceptance of state intervention (e.g. acceptance of lock-downs) and concern over privacy infringes (e.g. example the role of contract tracing in public health) for which values changed considerably since the pandemic began. However the same study demonstrated that some values remained steady throughout the COVID pandemic in Europe, namely those that form the basis of human identity such as cultural background, religious views and moral positions (discussed under absolute values below) (Reeskens et al., 2021).

Population changes: Patterns of human settlement can change considerably over time. As people move to different locations they bring with them different types of values and expectations. For example, changes to infrastructure (e.g. a new road) facilitate the arrival of different types of people

compared to those who were there previously and who bring additional values with them (Brown et al., 2020). This is highly relevant to mining regions because mines bring changes to infrastructure, demographics and values. New people may include those directly employed by the mine in addition to mine services plus those associated with indirect effects which may include professional services, hospitality and additional services (Fleming and Measham, 2014). Newly introduced values may not displace previously held values in relation to the same landscape, but rather add an additional layer of values on top of those that were already present. In circumstances where newly introduced values are at odds with previously held values this may lead to friction and potential contests (Sherren, 2020).

Absolute values

Absolute values are different from relative values. They cannot easily be traded off and may stem from moral convictions, spiritual principles or cultural reasons. These types of values are sometimes referred to as 'core values' because they are stable and endure beyond specific situations (Reeskins et al., 2021). Absolute (or core) values provide an overarching guide to behaviour and events (Schwartz and Bilsky 1987) and tend to be developed through socialisation processes during the formative years of childhood (Inglehart 1977). In many cases, these are the values we learned from our parents or our elders that got anchored in our belief systems. The circumstances or context of our childhoods influence these values which in turn underpin our belief systems (Converse, 1964). It is possible for us to change our absolute values, but to do so requires a fundamental change to our identity (Uslaner, 2002). Values that relate to the core of a belief system tend to be very stable, as they form the basis for one's morality and have become part of who we are (Converse, 1964; Uslaner, 2002).

Dynamics of values

One aspect to consider is how values are formed. There is a degree of uncertainty regarding the extent to which values are part and parcel of who we are, and the extent to which values change according to our circumstances. This can be expressed as a question of 'nature vs nurture', with many instances being a combination of both.

Spatial and social contexts

Values can vary across space and across social contexts. The extent to which spatial context is relevant is a subject of ongoing inquiry. Brown et al. (2020) argue that there are changes in values across space, however that there are also notable similarities for different stakeholders, and that the similarities tend to be stronger than differences across geographies. This is partly an issue of diversity in the sets of stakeholders involved in post-mining transitions. For some stakeholders whose interests span large spatial areas, their values could be broadly consistent across their areas of interest. As the sets of values change according to place, (e.g. from coastal geographies to inland geographies) the sets of stakeholders may change and therefore the range of values may change. While there are clearly differences across space, a key point from the literature is that there is sufficient consistency across different contexts to warrant some kind of framework for considering values (Brown et al., 2020).

A broader view of 'stakes' and stakeholders

When thinking about values, it is also important to think about who holds those values. We can consider values as different 'stakes', and those who hold a stake are 'stakeholders'. The term 'stakeholder' is used widely to mean different things in different contexts, therefore it is important to define what we mean by stakeholders (Reed et al., 2009). In part this is related to different types

of stakeholders. For example, one way to distinguish stakeholders is between those who *affect* a decision and those who are *affected by* a decision (Freeman, 1984). In part these definitions relate to the different reasons for considering stakeholders in the first place. From an organisational perspective, a narrow definition may focus on people without whose support a given organisation would cease to exist (Bowie, 1988). For the purposes of this review, we propose a wider definition of stakeholders, *as any individual or organisation involved in or affected by the transition to post-mining land uses*. Adopting this approach does not pre-dispose us to any presumptions about what counts as a stake, therefore it is important to think about *what is of value to all* (including ourselves). Thinking about stakeholders this way challenges us to think beyond any pre-conceived notion of who counts as a stakeholder and recognises that different people may have different cultures and different ways of thinking about what matters in the transition to post-mining land use.

Implications for transitioning to post-mining economies

Values can change gradually and sometimes quickly following certain events. Even slowly changing values are likely to evolve over the course of a mining operation. Therefore, values held today may not be the same as the values held in the future, just as what matters in one place may be different to values held elsewhere. Transitioning to a post-mining economy is best seen as a dynamic process so that regional economies adapt as values change over time and space. This literature review highlights that there are risks involved in taking a 'set and forget' response when conceptualising the transition to post-mining economies. It is important to maintain a process of ongoing stakeholder engagement including re-visiting post-mining land use aspirations which may evolve considerably over time.

4. Negotiating difference

Negotiation of stakeholder values has been considered by a wide array of researchers ranging from project management (Eskerod and Lund, 2013), to strategy (Ackermann and Eden, 2011), from conflict resolution/negotiation (Fisher and Ury, 1982) to management (Keeney, 2013). Whilst not directly relating to mine rehabilitation, each of these bodies of work can reveal important considerations about values relating to mine transitions and the need to take a long term, process oriented, outcome focused approach. For example, mine transition can be seen as either a project or a program of projects, with each stage i.e. i) development of a mine, b) mine operations and c) transition are projects in their own right. Mine transitioning needs to account for the different value lenses being brought to the process and outcome, and consider how these values can be identified, understood, and negotiated avoiding or reducing conflict. In addition, they need to take a long-term strategic approach. Drawing on the literature can assist in the negotiation process and provide valuable insights in what to do and what not to do.

Negotiating differences in values has at least two challenges. The first, possibly less considered, lies in stakeholders understanding their own values, particularly in entirety. Values are often tacit, subconscious and therefore poorly understood (Keeney, 1996). What we each espouse that we value is not necessarily what we value in practice (Argyris and Schon, 1974) – and so finding appropriate mechanisms to surface and explore these values provides the basis for negotiation – a starting point. The second challenge is centred on determining the means to 'come to terms' with the values of others and any inherent differences. According to Ang and Biesenthal (2017 p.297), "the alignment of values between organisations and stakeholders is critical when managing the outcomes of projects, programs, and portfolios". There have been a number of high-profile instances where lack

of attention to stakeholders and their values has resulted in poor outcomes (for at least a number of the stakeholders).

- One example is Brent Spar (Glindemann, 2017) where the seemingly insignificant NGO Greenpeace was able to force Shell to tow the decommissioned platform to Norway rather than sink it in the North Sea – Shell's preferred option. Greenpeace achieved this change through building coalitions with the German media and subsequently German petrol consumers who boycotted Shell petrol.
- Another example of stakeholder value misalignment is the 30 M telescope (Ravazzani & Maier, 2017) in Hawaii. Here the construction program received planning permission but did not listen or take account of the local populace. As the telescope was situated on a mountain considered by those living there to be of religious importance, the local population resisted and working together ensured that the planning permission was rescinded.
- Finally there is the Jukkan Gorge example (Wensing, 2021) where Rio Tinto destroyed a site of indigenous significance having been awarded regulatory permission in order to continue its mining production without anticipating the significant adverse community response that unfolded.

As these examples illustrate, working to understand values and related responses can therefore reduce risk for the focal (and possibly other) stakeholder. In addition, through understanding the range of values, stakeholders can see how other stakeholders perceive the situation and why, enabling a more comprehensive conception of the situation. Furthermore, structured conversation around values helps reveal biases and potentially break them down.

Managing transitions in mining can be seen to a degree as analogous to the decommissioning of oil and gas platforms where there are those responsible for the infrastructure needing to transition these structures in a manner that is acceptable to other stakeholders – for example regulators and communities. The transition (which can straddle from inception of mine to subsequent use of the site) means that they are long-lasting projects affecting a range of stakeholders with differing degrees of interest and power/influence depending on the point of time being considered. Thus, when negotiating differences in values amongst stakeholders it is important to consider:

a) not only who are the stakeholders throughout the entire transition but when are they 'interested',

b) what are the values being used to inform interest,

c) what are the actions stakeholders may take in response, and

d) whether there is any likelihood of these values changing over time. A longitudinal consideration is necessary.

This section will explore the importance of attending not just to outcomes (the transition) but also to the processes adopted to arrive at these transitions. It will also explore the implications of differences in terms of behavioural responses and touch on the range of different ways outcomes can be construed before concluding with some reflection on the implications for transitions in mining.

Process and outcome

Once values have been identified, negotiating differences in values with diverse stakeholders, is not just about determining the best possible outcome (Keeney, 1993) in a procedurally rational manner (Simon, 1976). It is also about the process by which we work towards outcomes ensuring procedural justice (Kim and Mauborgne, 1995). This socially negotiated order (Eden and Ackermann, 1998) can

have additional value independent to the outcome(s). For example, as noted by Keeney (1993), ExxonMobil was successful in building credibility and fostering an image of responsibility when they took initiatives to negotiate differences in values with their stakeholders regarding the Valdez oil spill clean-up. Having a strong engagement process with stakeholders also ensures procedural fairness, which can be argued to be the key to securing stakeholder acceptability on mining decisions (Moffat & Zhang, 2014; Franks et al., 2014; Lacey, Edwards & Lamont, 2016; Lacey et al., 2017; Zhang et al., 2018) (see Table 2). The benefits of having a strong stakeholder communication is also emphasised by early findings from the South Alligator Valley and Rum Jungle mines remediation projects in Northern Australia (Waggit, Leurencont and Fawcett, 2015) although even these projects have received negative responses. Overall, negotiating differences in values is highly relevant when we think about transformation in mining economies because transformation puts the focus on the process by which the end state is realised. Negotiation in this instance can be seen as:

a) negotiating meaning of the value to ensure a shared understanding, and/or

b) negotiating agreement as to the validity of the value as a value and

c) negotiating the agreed set of values against which the transition is measured.

It is important to note that some values might not be negotiable.

Part of the process of negotiation lies in sense-making (Weick, 1995). For example, understanding not only what the values of each stakeholder are, but how they inter-relate – both in terms of each stakeholder's values but also the entirety of stakeholder values being used to inform how the transition is viewed. This concept of value *systems* is noted in the discussion in the second section of this review when it is stated that there is the potential for values establishing a hierarchy (Dumont, 2013; Schwartz, 1994) where values support other values. Systems of values are also touched on in the third section where it discusses the additional layer of values on top of those that were previously existing (reflecting longitudinal implications) and that belief *systems* comprising values need to be taken into consideration. Research in decision making has noted that humans are multi-objective oriented selecting options/alternatives depending on how they perform across a range of differently weighted criteria – multi-criteria decision making (Esteves, 2008, Cegan et al., 2017).

Furthermore, when exploring stakeholder value sets, there can be values that are shared (to a greater or lesser degree) between stakeholders. These shared values provide a powerful starting point for negotiation when considering outcomes. However, outcomes not only have to be considered alongside the shared values but also considered against the full set of values. Collaborations often fail due to a lack of realisation that actions taken to support a set of shared values, negatively impact on some of the other 'core' stakeholder values (sometimes because they are not known, or not considered etc.) and so the outcomes are resisted (Bryson et al., 2016).

Providing an environment that facilitates structured and equitable conversations whereby values can be captured, explored in terms of their inter-relationships, their degree of heterogeneity and homogeneity, and a holistic understanding accrued by all stakeholders, can provide a sound starting point for considering outcomes. Returning to the sense-making consideration, an important part of negotiation is for each stakeholder to understand how other stakeholders' view and value outcomes recognising the plurality of values associated with outcomes. Values may differ in terms of their position in a network (some values are more superordinate than others), they may be different in terms of their construal i.e. we can agree to value something but we value it differently. This ties in with the above quote noting stakeholders may be ''forced to choose, consciously or unconsciously, between competing values"… ''these values are often incommensurate, and trade-offs have to be made" (Leiserowitz et al., 2006 p. 440). This ties back to the earlier comments made regarding the

different values associated with land namely, that land may have a market value, sentimental value, ecosystem value, and spiritual value for a single individual as well as for different groups of people. The discussion in section 3 regarding relative versus absolute discussions also adds depth to this consideration.

Allowing for a degree of ambiguity initially can provide a good starting point in negotiation processes recognising that the process straddles various stages. From initial identification through to exploration leading to agreement. Precision early on in the process isn't helpful. Whether that is in the term being used i.e. value versus goal, or the value itself, the process of negotiation requires a starting point – where openness is encouraged. In some cases, the allowance for a degree of ambiguity can enhance the negotiation processes and hence project performance (Eskerod & Jepsen 2013; Wu et al., 2018). For example, providing flexibility in terms of schedule toward contractors can open up the possibility for negotiating cost reduction. Values are about 'what matters' and 'what's important' to different groups or the characteristics of an object, or option that make it welcome or undesirable to some perceiver (adapted from Higgins 2007 p. 455). Values can be relative and subjective involving people's perceptions or beliefs.

Conflict, consensus and compromise

There are potentially three different responses to situations where heterogenous values emerge. These are conflict, consensus and compromise reflecting a spectrum of responses – each one being sensitive to the context surrounding it. In the case of mine rehabilitation, contextual considerations would include; the site/location, the stakeholders, and the nature of the mine i.e. deep pit, open cast etc.

The differences in values i.e. heterogeneity of values between different stakeholders can be a source of conflict between them (Gregory and Keeney 1994; Larrick, Sole and Keeney 2015). As noted in the previous section "these values are often incommensurate, and trade-offs have to be made" (Leiserowitz et al., 2006 p. 440). It was also noted by Leiserowitz et al. (2006) that the likelihood of conflict is reduced if outcomes can be accepted by diverse groups even though actors will likely be ''forced to choose, consciously or unconsciously, between competing values" (Leiserowitz et al., 2006 p.439-440).

Consequently, for stakeholders to move forward towards agreeing a set of goals, they may need to either work towards a consensual position or one of compromise. To do this, as noted above, stakeholders need to identify the full suite of the values through which the mine is being viewed i.e. be cognisant as to what they are, and what they demand, in order for consensus or compromise to be effective (Akbar et al., 2021). Better understanding of values can be achieved through teasing out the goals that are informed by values, the strategies conceived as achieving the goals, and the actions for implementing the strategies and possibly, as noted in section 3, the beliefs underpinning the values. As such understanding the *systemic* picture is important for effective negotiation.

A further important question to consider is whether there is a need to achieve complete agreement on values amongst stakeholders. In some cases, it can be impractical for complete agreement to be achieved (Hajkowicz, 2008). For example, in the oil and gas decommissioning sector, while there are stakeholders who prefer a complete restoration of the area used to its original pre-explored condition, such an endeavour can be impossible to achieve (Chandler et al., 2017). Similarly, according to Vivoda and Fulcher (2017), the complete restoration of a mine may be an impossible task. Regardless whether a 'lowest common denominator' exists in the case of mining transition, it is likely that at one level we still need to have at least some degree of agreement about what are the values in question. It may not be necessarily to agree on how we rank these values or who holds

those values, with one way of reconciling values to seek consensus and general agreement rather than accept a 'lowest common denominator' (Renn, 2006).

One successful means of achieving negotiation is the creation of shared options – that is the coproduction of outcomes. This is reflected in the work of Fisher and Ury (1982) and has been used to great effect in conflictual situations such as the Israeli-Palestine conflict. Situations which comprise many stakeholders who perceive themselves in a conflictual position, can find, when provided with effective meeting design, that there is scope for collaboration and consensus. Better understanding helps them move from opposite positions to a more central view. This touches on the earlier points regarding attending to both processual considerations as well as outcomes.

Seeking a win-win outcome allows for consensus and shared outcomes (Keeney, 1993; Keeney & Oliver, 2005; Jiang and Fu, 2019; Akbar et al., 2021). According to Renn (2006, pg. 36-37), a win-win "*a solution that serves the common good and each participant's interests and values better than any other solution*". Furthermore, Keeney and Oliver (2005) note that win-win outcomes are often newly discovered alternatives that surfaced through the process of negotiating differences in values with stakeholders. Nutt and Backoff (1996, p. 313) also advocate for such a position noting "Win-win solutions deal with these larger interests without disadvantaging either of the disputing parties". However, when reviewing the literature, it is noticeable that successful win-win outcomes, sometimes termed as value co-creation by some scholars, appears to be more prominent in the arena of product development rather than mining. This finding may suggest that a win-win scenario might be difficult to achieve in the mining industry or that the techniques have not yet been applied and therefore offer potential.

Some values may take precedence over others, either implicitly or explicitly. For example, the notion of relative versus absolute value (see also section 3.1). Relative values are based in comparison with other values. For example, people value protecting the environment whilst at the same time, also value recreational use of the environment and when making judgements weigh the different values accordingly – thus giving rise to multi-criteria decision making (MCDM). "The relative value of an object is dependent on the values of the other available objects in the same context (e.g., higher or lower), whereas the absolute value of an object is not influenced by the values of other available objects" (Kim & Beck, 2020 p735). Moreover, when making decisions, both types of values often are represented simultaneously and separately (Grabenhorst and Rolls, 2009) however, these two types of values do not necessarily equally influence human behaviour and decision making (Kahneman and Tverskey, 1979). Categorising stakeholder values when considering mine rehabilitation may give useful insights.

Another key consideration is the power/influence stakeholders have, over the situation and one another. 'Power may be tricky to define but it is not that difficult to recognise' (Salancik and Pfeffer, 1974, p. 3). When considering negotiation of values, attending to the different power bases of stakeholders helps navigate towards more consensual outcomes.

Outcomes

Outcomes are informed by values but are also often referred to as goals, objectives etc. (Keeney, 1993). From the perspective of traditional project management, values are often measured in the form of cost, quality and time (Atkinson, 1999). For example, when considering options for future NASA missions, the most desirable outcome was one that is closest to achieving the strategic objectives of the NASA Space Programme (Keeney, 1993) – with objectives, similar to goals being informed by values. Similarly, the success of construction projects are often determined by how well the project performs in terms of cost and schedule (Chan, Scott & Chan 2004; Eden, Williams & Ackermann, 2005). However, as noted by Invernizzi et al., (2019), for decommissioning projects in

the oil and gas and nuclear sectors, traditional incentives (cost, quality, and time) are absent as there is little or no revenue to be generated, and in most cases, no product nor infrastructure to be built. This suggests for mine rehabilitation projects (which has been mentioned earlier to be analogous to decommissioning projects), there is perhaps a need to consider different ways of thinking about values and outcomes. As noted by stakeholder management literature in the field of nuclear energy, the most desirable outcome is one that resulted in the least shortcomings (Mulholland, Ejohwomu & Chan, 2019). Similarly, in the field of mining transition, the consequences of the decision are usually considered when thinking about outcomes (Akbar et al., 2021; Everingham et al., 2020) typically reflecting multiple values.

As noted in the previous section trade-offs may be appropriate in some circumstances but not for every situation. In instances where there are a multitude of stakeholders and multiple values to consider, finding an appropriate trade-off can be challenging as some values can be difficult to quantify (Keeney, 2002; Henrion, Bernstein & Swamy, 2015). Henrion, Bernstein and Swamy's (2015) study, for example, found that it was extremely difficult to measure environmental and social impacts in terms of monetary values when developing their PLATFORM multi-criteria decision analysis tool for determining offshore decommissioning options.

Outcomes can also encompass diverse but complementary values. According to literature in the field of mining rehabilitation, the environmental impacts of mining can also have further economic and social consequences as well (Worrall, Brereton, and Mulligan, 2009; Doley and Audet, 2013; Akbar et al., 2021; Everingham et al., 2020). Again, this indicates that values are not independent of one another but are complementary of each other, adding to the complication of balancing the values and reflecting the need to see values as part of a system.

The processes by which outcomes are determined can vary considerably. While some scholars argued that majority rules or most powerful rules is the most likely outcome, there are others that argued that each stakeholder value should be considered as equally important (Gordon, Poot & O'Connor, 2019). This is also touched on in the business ethics literature (Freeman, 1984) and policy literature (Bryson and Crosby, 1993). The literature review showed that in many mining economies across the globe, the process of determining an outcome has been simplified in the form of various multi-criteria decision analysis (MCDA) tools – frameworks that allow users to compare between different alternatives using stakeholder values as criteria (Neves et al., 2009; Georgiou, 2012; Marttunen, Lienert & Belton, 2017). As the processes of determining outcomes can vary considerably, there were many different MCDA tools being developed over the years, each with a different set of criteria and weightings (Cegan et al., 2017, Sommer et al., 2019). For example, the Comparative Assessment (CA) tool divides stakeholder values into five equally-weighted categories (technical, safety, social, environment, and cost), while the Best Practicable Environment Outcome (BPEO) tool, as its name suggests, appears to prioritise environmental values (Sommer et al., 2019). In addition, the stakeholder preferred MCDA tool also varies across different regions. For example, while the use of the CA tool is regarded as best practice by oil and gas decommissioning regulators in the UK, BPEO is much preferred by stakeholders in the South-East Asian region (Jagerroos & Kayleigh, 2019). Overall, this reflects the phenomenon that values are dynamic and can vary across space and across social contexts.

Regardless of the type of MCDA tool adopted, MCDA tools are based on the idea that there is one best solution, similar to a decision-tree where the best solution is at the end point. While MCDA tools have been historically proven to improve the management of stakeholders in various industries (Marttunen, Lienert & Belton, 2017; Gordon, Poot & O'Connor, 2019), it must be emphasised that as discussed earlier, there can be multiple possible outcomes (trade-off, win-win, etc.). As such,

outcomes that are generated from these MCDA tools can arguably be said to improperly represent what people think. For example, while the MCDA used by Shell UK appeared to scientifically prove that the sinking of Brent Spar was the best option taking into account stakeholder values, but the numerous protests and campaigns that took place across Europe throughout 1995 clearly demonstrated that the MCDA-generated outcome did not reflect the values of Greenpeace (Löfstedt & Renn 1997). MCDA also does not explicitly consider the power/influence of stakeholders – manifested in the options they have to hand. As with Greenpeace, building coalitions can increase power, as can lobbying and other such behaviours. Additionally, there is also a risk of bias when making judgement in the assessment of values. User-bias has been noted as an issue by scholars when applying MCDA tools (Lahtinen, Hämäläinen and Jenytin, 2020). Overall, the literature review suggests that ensuring procedural fairness is just as important as generating the outcome that best maximises values.

Activity	Value Differences	Value Balancing Strategy	Outcome	Lessons Learnt	Reference Literature
1977 to Present – Rum Jungle Uranium Mine – Northern Territory, Australia	Cost of rehabilitation and ongoing maintenance works vs Creation of productive site.	Compromise Strategy.	Inconsistent. Finniss River was left untouched, while 5km away, a reactional area was created.	unclear	Waggitt, Laurencont and Fawcett (2019)
1982 - 1985 Mary Kathleen Uranium Mine – Queensland	Cost of rehabilitation and ongoing maintenance works vs Creation of productive site.	unclear	Awarded Award from the Institution of Engineers Australia for Environmental Excellence in 1986	unclear	Waggitt and Zapantis (2002)
1995 - Nabarlek Uranium Mine – Northern Territory	Cost of rehabilitation and ongoing maintenance works vs Creation of productive site.	Trade-Off. Compensation in monetary value	unclear	unclear	Waggitt and Zapantis (2002)
1995 - Brent Spar Decommissioning – United Kingdom	Environmental Value of Sinking Brent Spar vs. Environmental and Safety Value of Towing it Onshore.	Utilised BPEO (A MCDA Tool) to compare alternatives by weighing the value differences.	Concerns regarding the procedure in which samples were obtained from Brent Spar to justify BPEO argument.	Stakeholder perception on the fairness of the process is more important than the outcome.	Glindemann (2017) Löfstedt and Renn (1997)
2000-2010 – IBA-SEE Regional Regeneration Project – Germany	Value of creating an environmental that maximises economic growth in the region vs. value of creating an environment that maximises greenery.	Integration of opportunities (values) to add value to the concept and design of the project. Win-win – sustainable economic growth – a tourism economy that promotes renewable energy and industrial heritage as a coal mine.	The project successfully implemented a vision for the regeneration by stabilising open pits, creating a large, interconnected lake system, water management, landscape rehabilitation, conservation of mining heritage features, and new infrastructure to support tourism	Using resources effectively3. Fostering identity (link between industrial heritage and new landscapes) The importance of a long-term planning perspective Shaping the process with strong leadership Allowing for creativity and innovation	Unger (2010) Unger et al. (2012) Deshaies, (2018)

			Discovered a new tourism future (promoting industrial heritage, economic growth, and greenery through renewable energy)	Generating pictures by visualisation of completed landscapes. Ensuring transparency Building the organisational structure The role of all levels of government collaborating to take responsibility	
2008 – Mt. Kembla Mine Rehabilitation and Memorial Pathway Stage 1 – New South Wales	Varying values amongst stakeholders (cultural heritage, biodiversity, community spirit, aesthetics, recreational amenity)	Integration of opportunities (values) to add value to the concept and design of the project.	Seeking win-win	Develop a shared vision amongst all stakeholders is an essential first step (alignment?)	Larance (2012)
Eden Project, England	Value of creating an environmental that purely maximises economic growth in the region (to support abandoned communities in Cornwall) vs. Value of reversing environmental degradation in the region.	Integration of opportunities (values) to add value to the concept and design of the project. Win-win – sustainable economic growth – a tourism economy that promotes bio conservation and its industrial heritage as a kaolinite mine.	The project has been described as a 'sustainability theme park'. Established within a reclaimed kaolinite clay pit, the project is a charity and tourist attraction focused on community education about sustainable development. In addition, a Post-Mining Alliance was formed to communicate what has been learnt from this project as well as reflect on mine rehabilitation projects globally)	Development of local solutions to fit local circumstances. Leadership, vision and commitment. Creative new partnerships for funding, development and implementation. Collaboration with 'unusual' suspects.	Unger et al. (2012)

Implications for transitions in post-mining economies

The ability to share, explore and reconcile value differences is one component in ensuring successful transformations in mining economies. The process of reconciling values may be a catalyst for achieving desired outcomes (as much as is realistically possible) both during the transition and the final state. Negotiation not only allows for the values of various stakeholders to be made explicit (a useful exercise as it reveals biases and allows others to gain a more comprehensive understanding) but also the degrees of value homogeneity/heterogeneity, their systemic impacts, and hence, gaining insights into the underlying actions available (reflecting the power dimension). From structured conversations seeking to promote negotiation, a greater likelihood of realising some degree of consensus or compromise is achieved, and where conflict is inevitable, a better understanding of why and possible actions. Communication and education through negotiation can provide valuable assistance in mine transitions.

5. Where to from here?

Implications for the CRC

As a key component in the *Understanding stakeholder values in post-mining economies* project, one of 22 foundation projects for the Cooperative Research Centre for Transformations in Mining Economies, this review has emphasised several key considerations for transition to post-mining economies. The first is the importance of value plurality: we all have different perspectives on what matters. In doing so, it is important to recognise that each of us has our own system of values which we may not always be overtly cognisant of due to the tacit nature of values. Following on from this is the need to move from 'value' to 'values'. While many values can be expressed in a comparable unit, some can not, notably absolute or 'core' values, and it is important to keep this in mind when presented with different values. For those values that can be expressed in comparable units, it is equally important to keep in mind that the relative importance of different values is likely to vary between stakeholders.

Values are central to creating a positive legacy

A key focus of the CRC is creating a positive legacy in the form of a vibrant post-mining economy. In order to achieve this, it is imperative to have a clear understanding of the values of those who participate in the post-mining economy and how they see the mine closure process contributing to achieving those values. A key point here is the importance of thinking about values as both a challenge and an opportunity. Understanding what matters to people, and how values vary over time and space, is not always easy. This review has provided a way of thinking about what is meant by values, the extent to which they change and the causes of change. Moreover, it has provided a way of thinking about reconciling differences in values and how these align to different types of values. Take the example of trade-offs: a widely used approach to reconciling differences in values. This approach can be highly effective for preference values, yet flawed when it comes to absolute values or in effectively balancing stakeholders with vastly different resources. Based on the literature reviewed in this report, it is important for other projects to consider taking a systems perspective – recognizing the plurality and interconnectedness of values.

Next steps in project

In this review we have argued that values are about 'what matters' and 'what's important' to different groups. We adopted a broad conception of value as *"a socio-cultural construction that means something important to a*

person or a social group". We have also shown that some values are easily quantifiable, others can be quantified but there are limitations in doing so, while other values are not quantifiable at all.

The next stage of the project will be to conduct workshops and interviews with CRC partners to explore different notions of value and what this means for transforming to post-mining land uses. In doing so, the next stage aims to consider how diverse stakeholders view land differently as it transitions from pre-mining to mining to post mining states and moreover what is the role of values in the transition between the mining and post-mining land uses. Throughout the next stage of the project, a key consideration will be seeking to understand the role of context (including cultural context) as it relates to values.

To address these issues, the workshops and interviews will inquire what does the term 'value' mean to different partners, and what do people see as important in transforming to post-mining land uses. The workshops and interviews will ask about the challenges and opportunities when it comes to values. The research team will ask participants whether they see a link between culture and values, and if so, how? Another important focus will be on how participants see land transitioning through the mine lifecycle to a post mining state, and whether the value of land changes over the lifecycle. The transition is not only about land-use: the literature review suggests that it is also about skills, identity, access to markets and movement of people. To explore these issues the workshops and interviews will explore how participants see the transition process occurring between mining and post-mining land uses. Finally, as precursor to third stage of the project, the research team will address the question of who else should they be engaging with on the topic of values in post-mining economies.

Throughout the next stage of the project, the research will consider what factors enable a systems perspective and at what scale is it most appropriate to engage with values. The issues of dynamics raised in section three of this review will be an important consideration, including whether participants think about changes in values as a gradual or abrupt process, and why.

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