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SYNTHESIS ARTICLE

Transitional assistance policies for just, equitable and smooth low-carbon transitions: who, what and how?

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ABSTRACT

While the decarbonization of the global economy will bring immense benefits in the aggregate and to many individuals, it will also be disruptive and costly for some, at least in the short term. As these disruptions and costs have become increasingly salient in recent years, there has been an explosion of interest in the climate policy community about how low-carbon transitions can be implemented justly, equitably, and politically smoothly. A key part of what is needed in responding to this growing interest is a better understanding of the suite of 'transitional assistance policies' and strategies that can be deployed, alongside or as part of climate change mitigation policies and processes. Responding to this need, we survey a wide, multi-disciplinary literature to answer the 'who', 'what' and 'how' of transitional assistance policy: who is likely to be adversely affected by the low-carbon transition, and in what ways? What substantive strategies and policy instruments are available to governments to mitigate the burdens of low-carbon transitions? And how can governments implement such strategies and policies successfully? In the course of answering the first two of these questions, we develop a novel typology of transitional assistance policies, in which multiple policies are parsimoniously classified according to one of four coherent policy strategies, and one of five kinds of beneficiaries. In answering the third question, we emphasize the importance of certain 'state capacities' for shaping transition processes and managing vested interests.

Key policy insights

- Without transitional assistance policies, consumers, workers, businesses, specially-affected communities, and states that are highly dependent on emissions-intensive assets stand to lose from decarbonization.
- Transitional assistance policies can be narrow (addressing financial losses only) or broad (addressing a wider range of losses), and conservative (backward-looking) or adaptive (forward-looking).
- Combining these elements yields four coherent transitional assistance strategies: compensation; exemption; structural adjustment assistance; and comprehensive adaptive support.
- Comprehensive adaptive support strategies have greatest potential for just, equitable and smooth transition outcomes, but are costlier and more complex to implement.
- State capacities to steer complex, long-term transitions are therefore a crucial variable in transition success.

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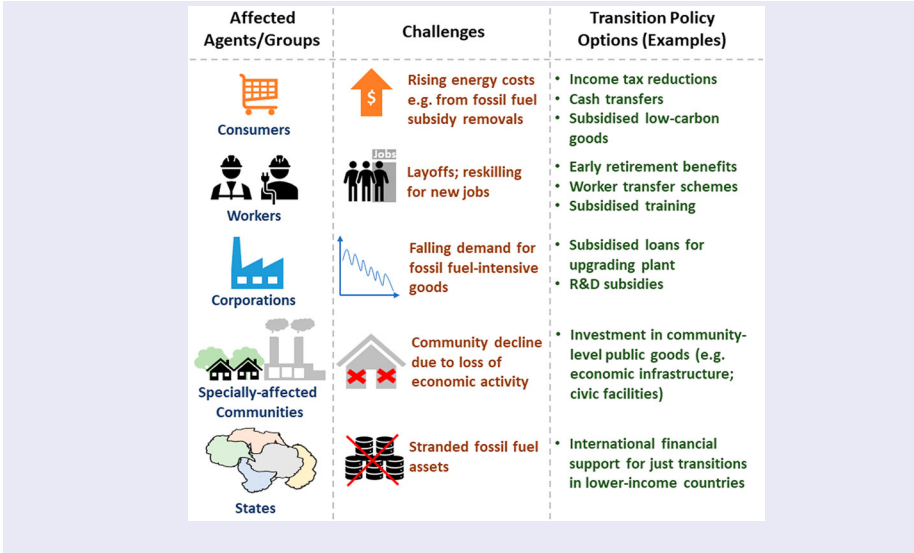

1. Introduction

The decarbonization of the world economy is one of the most urgent and difficult challenges facing humanity. The substitution of low-carbon for high-carbon technologies and practices will fundamentally alter the nature and viability of many economic activities, with some industrial sectors and businesses shrinking or disappearing altogether and others emerging and flourishing (Fankhauser, 2013; Fankhauser & Jotzo, 2018; Simpson, 2017). Much of this story of transition is profoundly positive, bringing immense benefits quite apart from the mitigation of climate change. As the World Bank has put it, '[t]here is no reason to think that a zero-carbon economy would be any less prosperous in the long run than a high-carbon one (if anything, it is likely to be more prosperous)' (Fay et al., 2015, p. 154). Arguably, in the aggregate and over the medium to long term, the outcome is likely to be net-beneficial even at a national scale (GCEC, 2014; Green, 2015; ILO, 2018; OECD, 2017; Stern, 2015b). But it will also cause significant disruption, dislocation, costs and losses to many individuals, groups, and possibly countries, at least in the short term. This reality raises complex normative and political questions about which of these burdens on which kinds of agents and groups should be mitigated, and how this should be done. How, that is, can low-carbon transitions be made (more) just, equitable and politically 'smooth'?

A growing literature on past and current transitions, in the energy sector and in others, offers many examples of relative success and failure in the application of 'transitional assistance policy' (hereafter 'TAP') to mitigate the burdens of transitions that would otherwise be experienced by those adversely affected. Yet that literature is extremely heterogeneous in its disciplinary origins, methodologies, scope, aims, findings and even the concepts that are used. Recognizing the calls from the climate policy and sustainability transitions communities for policy-relevant analysis in this area (e.g. Köhler et al., 2019; Stern, 2015a), this article synthesizes key findings from this literature insofar as it helps to answer three critical questions, around which the article is organized: (i) *who* is likely to be adversely affected by low-carbon transitions, and in what ways? (ii) *What* strategies and policy instruments are available to governments to mitigate the burdens of low-carbon transitions? And (iii) *how* can governments implement such strategies and policies successfully?

We first survey the literature associated with question (i) to identify and classify the kinds of *agents and groups* at greatest risk of short- and medium-term adverse effects from low-carbon transitions. We identify five distinct categories – consumers, workers, specially-affected communities, corporations, and states. We discuss the ways in which structural change is likely to adversely affect each different kind of agent/group, and flag where our later analysis in Parts 3 and 4 is most relevant to each. We also emphasize the importance

of considering diverse forms of loss – and not merely *financial* losses – when designing TAP and caution against some of the pitfalls of providing assistance to group agents (corporations and states).

We then survey the literature relevant to question (ii) to identify the policies most commonly used and recommended for managing transitions. In identifying policies, we draw principally on Schneider and Ingram's (1997) policy design framework, in which policy designs are conceived as institutional structures consisting of elements including normative goals/objectives, target groups, tools/instruments, rules, rationales, implementing agents and structures, and causal assumptions. We use most of these elements to identify four coherent TAP strategies, each occupying a unique position at the intersection of two binary dimensions – the TAP's *objective* ('conservative' vs. 'adaptive') and its *scope* ('narrow' vs. 'broad') – which we argue best capture the main TAP design variables. The four resulting TAP strategies are: compensation; exemption; structural adjustment assistance; and what we call 'comprehensive adaptive support'.

Combining the four policy strategy categories with our five categories of agents/groups, we generate a novel typology of TAP possibilities that enables us to parsimoniously map the logical space of TAP. We explain how this can be used in future research and policy analysis on low-carbon transitions.

Finally, we apply this typology to shed light on question (iii). Specifically, we review case study analyses of past transitions and highlight common 'best practice' lessons for successfully mitigating the burdens associated with low-carbon transitions. We then draw on wider social-scientific research that calls into question the generalisability of these lessons, highlighting the important role that state capacities play in shaping the potential for governments to implement alternative TAP strategies and manage vested interests. We conclude by positing further questions that future research could usefully address.

The paper's scope encompasses climate change mitigation-related[1] structural change at the international, national and subnational level, including structural changes caused by both proximate climate policy interventions (e.g. carbon pricing) in the relevant jurisdiction and structural changes not resulting from any proximate climate (or other) policy interventions, such as those resulting from changes in the availability and costs of clean technologies or in the market structure and business strategies used in relevant sectors. Within this scope, the paper's focus is on the role of government alongside or in response to such transitions, and primarily on the (re)distributive aims of government policies. This means we only touch on, but do not address in detail, the procedural dimensions of policy that implicate normative-political questions of 'recognition' and 'procedural justice/fairness' (Jenkins, McCauley, Heffron, Stephan, & Rehner, 2016), and we do not address other pre-transition issues such as the role of impact assessments and effective stakeholder engagement and communication strategies (Rentschler & Bazilian, 2017). Crucial though these are to both the normative justifiability and political effectiveness of low-carbon transitions, their analysis would require another synthesis article at least.

We also leave aside here the complex normative and political questions about *specifically* which agents *ought* to be the beneficiaries of which kind of TAP, if any, and why – and who should bear the costs of the redistribution, and why – in any particular case. We simply take it for granted that many governments may, for various normative or pragmatic reasons, be motivated to mitigate the adverse short- and medium-term effects of low-carbon transitions on various agents and groups, and so we focus most of our attention on the policy options and strategies available to them to do so and the means by which to implement these successfully.

In light of the above-mentioned scope of the article, it overlaps considerably, and thus engages where relevant, with the rapidly growing body of international law, policy/practice and scholarship pertaining to the concept of a 'just transition' away from high-carbon sectors for workers and their communities. However, our analysis is neither coextensive with, nor limited to, the 'just transition', so understood.

Our analysis also overlaps with literature about good institutional design with respect to social protection, labour markets, industrial policy and the business environment *in general*. Countries that have effective institutions in these domains will tend to do better in assisting workers, consumers, firms and communities to manage all kinds of change smoothly and equitably, including but not limited to the low-carbon transition. In general, economy-wide institutions for managing change, such as effective employment protection schemes, will be superior means of managing the effects of climate mitigation compared with excessive reliance on *ad hoc* TAPs, such as one-off cash transfers to fossil fuel workers (ILO, 2018). That said, general schemes may

not always be sufficient to address the large-scale, rapid and multidimensional transitions entailed in decarbonizing an economy. In this article we focus on the basic components of transitional assistance measures that can be applied to those adversely affected by low-carbon transitions; where these can be delivered through a general institutional scheme *or* an ad hoc measure, we remain neutral as to this choice.

2. Who is likely to be adversely affected by low-carbon transitions, and in what way?

2.1. Review of literature on affected agents and groups

The first key variable of TAP is the category of agent/group targeted, i.e. the main 'losers' from the structural change, absent TAP, and the main potential 'beneficiaries' of TAP.

A number of groups have been identified as potentially at risk. Those most frequently singled out are: fossil energy-intensive and trade-exposed states and subnational communities; companies in the fossil fuel production sectors and energy utilities reliant on centralized fossil fuel-based electricity generation; workers in these industries; and poor and middle income consumers facing higher energy and food prices due to fossil fuel subsidy removal and carbon pricing (Helm, 2017; Vogt-Schilb & Hallegatte, 2017; Spencer et al., 2018). These agents/groups will later be included in our typology of TAP options, so we here discuss the key effects of low-carbon transitions on each of them (and on related groups, such as labour unions and industry associations, where relevant).[2]

There is a tendency, in the vast literature relevant to transitions, to focus on only one or two of these kinds of agents to the exclusion of the others. For example, much of the 'just transition' literature tends to focus primarily on workers and, to a lesser extent, on specially-affected communities (e.g. Mertins-Kirkwood, 2018).[3] This is entirely understandable, given the concept's origins in the labour movement and the worker-focused text of the just transition paragraph in the preamble to the Paris Agreement. If, however, analysis of TAP is to be comprehensive and relevant to climate policymakers, all categories must be considered. But this is not to say that all agents should receive transitional assistance, let alone that the TAP applied to all kinds of agents should be the same. Our aim here is purely to identify and classify the agents and groups most likely to be adversely affected by climate mitigation-related structural change – i.e. the *potential* beneficiaries of TAP.

2.1.1. States

Analysis using energy and integrated assessment models indicates that different economies could face very different costs of reducing their emissions in line with a scenario which limits global warming to 2°C, with large fossil-fuel exporters (Middle East members of the Organisation of Petroleum Exporting Countries, Russia and Former Soviet States of Central Asia) particularly affected (Blanford, Kriegler, & Tavoni, 2014). In such a scenario, several regions would hold fossil fuel reserves deemed to be 'unburnable' (meaning they cannot be exploited in a manner consistent with meeting climate goals). A detailed regional analysis shows the Middle East carrying over half of the globally unburnable oil and gas and the Former Soviet States a third of the globally unburnable gas (McGlade & Ekins, 2015). Where fossil fuel assets are state-owned, profit reductions and stranded assets will directly be reflected in state balance sheets. Where assets are privately owned, states may experience fiscal pressures from losses in tax revenue and increased expenditures on social transfers (e.g. for newly unemployed workers), depending on general equilibrium effects and adjustment periods. Of course, this has considerable implications for the interests and incentives of particular *governments, parties* and *officials* who benefit privately or politically from fossil fuel and other carbon-intensive industrial activity. Accordingly, our discussion of distributions within group agents (in Part 2.2, below) and of state-industry relations (in Part 4.2, below) should be borne in mind.

For the purposes of our typology and analysis, we treat the state as a potential *beneficiary* of TAP only in the sense that it is the potential recipient of *international* assistance from other countries. For that purpose, we treat states as unitary agents / 'group agents' for simplicity. However, when we discuss *other* agents and groups, we assume a domestic policy focus, in which states are the *providers* of TAP. We therefore assume a degree of state autonomy to provide such assistance; however, as we emphasize in Part 4.2, it is important to understand the

state in a relational way, as both structuring and interacting with other agents/groups (Johnstone & Newell, 2018).

2.1.2. Corporations

Corporate owners of energy-intensive or emissions-intensive business assets will also be adversely affected by low-carbon transitions.[4] A number of analyses have estimated the potential for stranded fossil fuel-intensive assets such as coal-fired power plants under 2°C and 1.5°C scenarios (Bertram et al., 2015; Gambhir et al., 2017; Johnson et al., 2015; Spencer et al., 2018). The corporate owners of stranded assets will face losses in the form of asset write-downs, lower profits and reduced stock valuations, with further potential repercussions for relations with creditors and regulators. Some firms will become insolvent/bankrupt if they fail to adequately prepare for and manage these risks in the context of low-carbon transitions.

For the purposes of our analysis, we treat corporations as unitary agents (group agents) for the simple reason that in most jurisdictions they are separate legal entities. This is often the case also for state-owned enterprises, which are especially prevalent in the fossil fuel sector in OPEC countries and China, though obviously the state-corporate nexus in such cases is much denser, and this must be taken into account when analysing alternative transition strategies as well as appropriate TAPs (see Part 4.2, below).

Due to the concentration of corporate impacts on particular industries, industry associations will also tend to be politically important in low-carbon transitions, and they will be particularly important in countries with industry concertation and corporatist institutions that structure interest group interactions with the state (Finnegan, 2019; and see below Part 4.2).

2.1.3. Workers

It has been estimated that the transition to low-carbon energy production and use under a 2°C scenario would lead to the loss of 6 million jobs globally by 2030, while creating 24 million new jobs, compared with a 'business as usual' pathway (ILO, 2018). But this significant net job creation would not be experienced by all regions, with the Middle East and Africa experiencing net losses of over 300,000 jobs each, assuming their economic structure were to stay in line with historical trends (ILO, 2018). A key driver of the net economic and employment impact on economies is the degree to which they can adjust to meet the challenges of decarbonization. Job losses will tend to be concentrated in carbon-intensive industries and possibly their suppliers (see above) and spatially in the communities where such industries are concentrated (see below).

Because of the importance of paid work to individual livelihoods and household economies, and the social-cultural roles work plays in many people's lives, the employment-related aspects of transitions will be among the most important to manage, yet they will often also be the most challenging. Labour unions have a crucial role to play in informing, organizing, representing and assisting their members in relation to the employment and other aspects of low-carbon transitions, and many of them have been instrumental in advocating at global and national levels for the creation of decent 'green' jobs and for a 'just transition' of the workforce – including many of the measures highlighted in Parts 3.1 and Part 4.1, below – as crucial conditions for decarbonization (Felli, 2014; Rosemberg, 2010; Stevis & Felli, 2015). Accordingly, unions are recognized as a key partner in the social dialogue processes that are enshrined in international guidelines on the just transition to low carbon economies (ILO, 2015). In practice, unions will tend to be more influential over the political course of low-carbon transitions, including securing particular TAPs, in countries with union concertation and corporatist institutions that structure interest group interactions with the state (Finnegan, 2019; and see below Part 4.2).

2.1.4. Communities

Industrial closures and associated job losses will often be concentrated in regional communities where they generate a significant share of the region's economic activity, meaning their closure would cause knock-on or 'multiplier' effects in these specially-affected communities. As is the case globally, the effects of decarbonization within countries will therefore also be unevenly distributed across regions. For example, whilst coal mining constitutes just 0.1% of total Indian employment, some Indian states such as Jharkhand and Odisha in the East earn 50% of their revenues from coal royalties (Spencer et al., 2018).

Much of the relevant literature urges particular attention to these spatially uneven distributional effects, and accordingly we include specially-affected communities within our TAP typology. Of course, communities are not group *agents*, but rather spatially-defined collectives. Accordingly, we suggest that this category be understood somewhat more flexibly than group agents such as corporations. Essentially, this means that the appropriate direct beneficiary of community-focused TAP could vary from case to case, as suggested by relevant examples in Part 3.1, below (e.g. local governments, firms with high growth potential in the region, etc.). In particular, the provision of community-level public goods and services – combining economic infrastructure with social, cultural, civic and environmental public goods and services – has the potential to yield genuinely shared community benefits.

As well as the impacts on communities entangled in fossil fuel economies, low-carbon technologies can themselves be the source of adverse community impacts (Galvin, 2018; Newell & Mulvaney, 2013; Yenneti, Day, & Golubchikov, 2016). However, in the interests of parsimony we leave them out of our classification scheme.

2.1.5. Consumers

As well as uneven impacts across economies, industries and workers, the impacts of decarbonization are likely to be felt unevenly by consumers. For example, the higher energy prices that typically result from fossil fuel subsidy removal and carbon pricing can disproportionately affect poor consumers (Dorband, Jakob, Kalkuhl, & Steckel, 2019; Hills, 2012; Rentschler & Bazilian, 2017). Decarbonization policies therefore also risk compounding poverty and economic inequality. But this risk can be mitigated – and indeed eliminated – with conscious effort, careful planning and multi-stakeholder engagement by policymakers (Markkanen & Anger-Kraavi, 2019). Well-designed and implemented TAP has a crucial role to play in this regard.

2.2. In what ways are different agents adversely affected by low-carbon transitions? The nature and scope of losses

When considering who is affected by low-carbon transitions, researchers should attend to the *ways* in which they are adversely affected. This matters because it can inform decision-making about the gravity of impacts on agents and can inform policy design choices about the appropriate kind of response strategy, policy instrument and scope of assistance. Yet, in economic, policy and even philosophical discussions of transitions, there is a tendency to focus on *financial* losses, such as lost asset value, lost profits and lost wages (Caldecott, Sartor, & Spencer, 2017). Such losses are clearly relevant. But such a focus – at least as far as human agents are concerned – is too narrow, for two reasons.

First, a wide range of other kinds of losses are often experienced by individual persons in the course of structural change. Broadly, these can include losses of: external resources of a non-financial nature, such as social support networks and the structures through which such networks can be formed, accessed and sustained; attachments a person has to particular people, material things, places and traditions; and mental and physical functionings, such as self-esteem, self-efficacy, time-structure, identity, and physical health, vigour and energy (see, e.g. Brand, 2015 on the various economic and non-economic effects of job loss generally; and Strangleman, 2001 for a dicsussion of such effects in former coalmining communities). Moreover, loss is 'given meaning through lived, embodied, and place-based experiences' (Tschakert et al., 2017, p. 1). Appreciation of diverse kinds of loss opens up a larger set of possible TAP responses than is typically conceived, since non-financial responses may more effectively mitigate non-financial losses than financial responses. Such an appreciation also illuminates the fact that for some agents (e.g. wealthy consumers) modest financial losses will have no or very limited effect on their valued non-financial capabilities and functionings – a fact that is relevant to the normative assessment of their claim to transitional assistance.

Second, focusing on financial losses alone can obscure an important distinction between losses arising at the level of a group agent and losses experienced by real human beings as a consequence of group agent-level losses. Strategic group agents like corporations and (in an international policy context) states may incur financial losses, but such losses have no independent moral value – they are mere 'paper losses' that only have moral significance insofar as they flow through to the wellbeing or interests of real persons. Of course,

group-level losses *do* flow through to real persons. But, crucially, the causal chain that links losses at the group agent (corporate or state) level with effects on the wellbeing of real persons is *mediated by choices* – by boards and managers, or by governments – about how group agent-level losses are to be distributed among the group's members and stakeholders. Some members and stakeholders, such as shareholders of corporations and wealthy citizens of states, will be better placed to absorb and adapt to those losses (and will often have greater causal and moral responsibility for failing to mitigate the group-level losses in the first place) than others, such as lower-level workers and poorer citizens. Targeting transitional assistance at group agents leaves these important secondary distributional decisions to group-level governing bodies.

3. What policy strategies are available to governments?

3.1. Review of the literature on TAP instruments

From the literature on TAP, it is clear that governments often have a wide range of instruments at their disposal to mitigate substantive transition losses. These instruments are summarized below.

First, governments can provide grants or other kinds of cash payments, or issue loans, to any kind of agent. These can be unconditional or (more or less) conditional on the money being spent on a certain class of eligible goods/services/projects or on the agent taking particular actions.

Conditionality is often an indicator that the objective of the payment is to facilitate the agent's *adaptation* to new (e.g. low-carbon) circumstances. For example, governments sometimes provide 'structural adjustment assistance'[5] payments to workers made unemployed by structural change, as has often occurred in relation to trade liberalization (see Porto, 2012) and industrial restructuring (Beer, 2015). These can include subsidies for relocation costs, employment search costs or training costs, or earnings subsidies that supplement wages earned from re-employment (which incentivises re-employment and facilitates adjustment to lower-wage jobs) (Porto, 2012). Structural adjustment assistance can also be provided to firms, as a subsidy to help them retool or otherwise restructure their operations so as to remain viable under new policy or market pressures (Beer, 2015; Spencer et al., 2018) or for technology research, development and demonstration. Conditional financial assistance can also be provided to consumers (to help them upgrade energy-intensive household assets like fuel-intensive vehicles and poorly insulated housing stock, as has occurred in many jurisdictions) (Vogt-Schilb & Hallegatte, 2017). Conditional funds can also be supplied internationally to other states, for example to help them diversify their economies away from fossil fuel production (Barnett & Dessai, 2002).[6] This has occurred to some extent at the EU level, through the provision of EU funds for structural transitions in coal-dependent regions, and there have been calls to expand such assistance in future EU budget cycles (e.g. Pilsner, de Pous, Reitzenstein, & Gaventa, 2018). There are also growing calls for state and multilateral development finance institutions and private financial institutions to strategically prioritize and allocate funds for just transitions (Reitzenstein & Popp, 2019; Robins, Brunsting, & Wood, 2018a, 2018b).

By contrast, unconditional payments may indicate that the payment is intended as 'compensation', in the sense of mitigating or fully offsetting financial losses incurred by the agent. In the context of climate and energy reforms, such payments are commonly made to consumers (uniformly or in a targeted way), and sometimes to adversely-affected firms, to offset tax or price increases (Klenert et al., 2018; Vogt-Schilb & Hallegatte, 2017). They can also be made to subnational governments to offset lost tax revenue (Caldecott et al., 2017). Unconditional transfers could in principle also be made by one country or group of countries to another country as compensation for the cross-border 'impact of response measures' – something the OPEC group has long sought within the UN climate change regime, but which other countries have long resisted (Barnett & Dessai, 2002).[7]

Unconditional payments can also take the form of categorical social welfare payments. These can be part of a general unemployment protection scheme (where these exist) or made uniquely available in a particular sector or region undergoing structural change, as with special retirement, redundancy or unemployment benefits that are additional to existing contractual or legislative entitlements (Caldecott et al., 2017; ILO, 2018).[8] Sometimes governments also pay out a firm's legal liabilities to its employees (e.g. redundancy or retirement benefits, healthcare costs) or cover its site remediation costs arising under planning and environmental laws. Such

payments are effectively subsidies to the recipient firms since government is stepping in to cover firms' existing legal liabilities (Caldecott et al., 2017). The Coal Transitions Project identified that special unconditional payments to workers were common in past coal transitions across the studied jurisdictions, while unconditional payments to companies were more common in the more state-planned/coordinated European economies of Poland, the Czech Republic and Spain (Spencer et al., 2018).[9]

Second, governments can provide public goods and services 'in-kind'. Some such services can be provided to workers, for example education, training, psychological counselling, employment placement, careers counselling, advice on establishing a small business, and transportation/relocation services (Beer, 2015; ILO, 2018; Wiseman, Campbell, & Green, 2017). For businesses in affected regions, business consulting and technical assistance are sometimes recommended as an alternative to cash assistance (Haney & Shkaratan, 2003). Sometimes consumers are directly provided with goods in-kind, such as free smart meters or energy-efficient products (Vogt-Schilb & Hallegatte, 2017). The direct provision of home insulation has been recommended as a means to tackle the economic effect of carbon pricing on fuel-poor households (Hills, 2012).

More typically, in-kind public goods and services are provided at the community level in specially-affected communities, with the intention of stimulating aggregate demand in that area or providing other community-scale social, cultural, civic or environmental/amenity benefits (Caldecott et al., 2017; Sartor, 2018). These often include infrastructure such as public transport facilities, renewable energy generation facilities, electricity transmission and distribution infrastructure, social housing projects, environmental restoration or beautification projects, educational institutions, sports stadia, recreational facilities, and so on (Caldecott et al., 2017; Klenert et al., 2018). They sometimes include facilities whose purpose is to memorialize a region's industrial past, such as museums and monuments (Caldecott et al., 2017; Harfst, 2015). Community-level in-kind services provided by governments can include local government capacity-building, regional economic diversification planning, research and development projects, innovation strategy development, and consultancy services such as tourism, marketing and investment facilitation assistance (Beer, 2015; Haney & Shkaratan, 2003). Public employment programmes can link community-scale public works with employment and wider social objectives, and there is increasing interest in developing such programmes to achieve joint decarbonization and social objectives (Hess, 2019; ILO, 2018). At the international level, there is also increasing interest in and provision of technical assistance, capacity-building services, and knowledge-sharing focused on TAP via regional and multilateral platforms. Examples include the activities of the Forum on Response Measures (and its subsequent derivations) under the UN climate change regime,[10] the European Commission's Platform on Coal Regions in Transition,[11] and the Just Transition Taskforce of the Powering Past Coal Alliance.[12]

Third, *sui generis* policy programmes or schemes of a more policy-intensive kind can be established to provide special kinds of assistance to manage the restructuring or decline of an industry in an orderly and efficient way. Historical examples include Japan's use of fiscal policy and planned capacity reductions to manage the decline of its textile and ship-building industries in the 1960s and 70s (Vogt-Schilb & Hallegatte, 2017), the establishment in the 1980s of the job-creation agency British Coal Enterprise in the former British coalfields (Beatty, Fothergill, & Powell, 2007), and the structural adjustment programmes applied to various primary industries in Australia in the 2000s (Beer, 2015). More recent examples from the climate context include the multi-stakeholder German Coal Commission, which in early 2019 agreed a plan to phase out coal power by 2038 (Egenter & Wehrmann, 2019) and Chile's multi-stakeholder process for phasing out coal-fired power generation.[13] These kinds of programmes often facilitate a more systematic approach to firm and workforce transitions, for example through intra-industry 'worker transfer schemes' or on-the-job retraining schemes (Caldecott et al., 2017; Wiseman et al., 2017). In this vein, long-term decarbonization strategies (e.g. as called for in Article 4.19 of the Paris Agreement) can also be an important source of, or platform for, TAP. Such strategies can help governments and other stakeholders to anticipate the costs of the transition, and TAPs can be incorporated into their design and implementation.

Fourth, where a structural change is proximately caused by a new policy or law in the relevant jurisdiction – in our case, a climate change mitigation policy/law – an additional suite of TAP options becomes available through the provision of various kinds of exemptions or cross-subsidies in the new law or policy itself. These could include blanket or partial exemptions for particular industries, sectors, or activities from compliance with the law or policy, and they could apply to incumbents only (known as 'grandfathering'), or to new entrants, too.

They could also be time-limited in various ways, including through delays in the policy's application, graduated implementation, or temporary relief from liability (e.g. 'tax holidays') (Trebilcock, 2014).[14] Where the new law or policy raises new revenue – as with carbon pricing, for example – some of this revenue can be 'recycled' to finance expenditures on the other kinds of transition policies discussed in this section. Klenert et al. (2018) review the way revenues were recycled in a number of carbon pricing schemes.

Fifth, governments may accompany policy reforms with wider changes in fiscal policy, such as changes to other taxes and transfer schemes, as part of policy 'packages' (Ahmad & Stern, 2009). These bring the potential for numerous economic co-benefits while also facilitating wider political support for carbon pricing (Klenert et al., 2018; Vogt-Schilb & Hallegatte, 2017). Tax breaks can also be used as a means to attract inward investment into declining regions (Beer, 2015).

Finally, while the abovementioned kinds of assistance implicate the state's (re)distributive functions, the state via its representatives is also capable of engaging in expressive acts that may well be important facets of a comprehensive response to structural change. This may include, for example, the state's public acknowledgement or recognition of a region, industry, firm or group of workers' contribution to society (and see above regarding museums and memorials).

3.2. Classification of TAP instruments

Drawing on the above literature review of TAP instruments and on Schneider and Ingram's (1997) policy design framework, we classify such instruments into four categories based on two binary variables that in our view capture their most important features.

The first variable is the policy's *objective*. We distinguish between TAPs whose objective is *conservative*, in the sense that the policy aims to stabilize the agent's or group's interests over time by restoring the agent/group, partially or fully, to the condition they were in before the structural change occurred (or would have been in but for the structural change), and TAP that is *adaptive*, in the sense of facilitating the agent's or group's adjustment to the new circumstances. Conservative policy is more backward-looking and static, whereas adaptive policy is more forward-looking and dynamic.[15]

The second variable is the *scope* of the losses that the policy aims to remedy. As discussed in Part 2.2, theory and practice concerning TAP in large part focus on addressing only financial losses, though it is possible and, in some cases, desirable also to address certain non-financial losses. Accordingly, our scope variable distinguishes between transition policies aimed at addressing 'narrow' losses (financial only) and 'broad' losses (financial plus other kinds of value).

Combining the 'objective' and 'scope' variables yields four ideal-type (and, for the moment, agent-neutral) TAP strategies:

1. *Compensation* (conservative; narrow): includes unconditional financial payments that are intended to mitigate financial losses incurred by the agent, as well as accompanying fiscal policy changes (tax, subsidy and transfer schemes) that serve such a purpose. Since non-instrumentally-valued goods are in principle non-compensable, compensation is assumed to be narrow in scope (but see Goodin, 1989 on 'ends-displacing compensation').
2. *Exemption* (conservative; broad):[16] includes legal exemptions from relevant primary laws, including climate change mitigation laws. Since the objective of such exemptions is to *de facto* maintain the pre-reform legal position (i.e. in all relevant respects, not merely financial) of a relevant class of agents, the objective is conservative and the scope is broad.
3. *Structural adjustment assistance* (adaptive; narrow): this category involves conditional monetary payments and in-kind assistance to individuals, the objective of which is to facilitate agents' adaptation or transformation to the new economic conditions that exist as a result of the structural change, but whose scope is narrow (e.g. conditional cash payments or in-kind retraining or relocation support to workers).
4. *Comprehensive Adaptive Support (CAS)* (adaptive; broad): this category includes the adaptive financial measures associated with structural adjustment assistance but goes beyond these to include adaptive measures of a non-financial nature (see Part 2.2). Specifically, it includes in-kind adjustment assistance,

Table 1. Typology of substantive TAP options[a].

	1. Compensation	2. Exemption	3. Structural adjustment assistance	4. Comprehensive adaptive support
Consumers	E.g. lump sum payments; tax reductions; increased transfer payments	(Downstream effect of exemptions to companies)	E.g. subsidies for home insulation, energy efficient appliances, solar panels etc.	E.g. items from column 3 plus: schemes to prevent household displacement due to rising costs associated with climate policies (e.g. for fuel poor households)
Corporations	E.g. lump sum payments; corporate tax cuts; 'grandfathered' emissions permits	E.g. exemptions from new climate laws	E.g. R&D subsidies; conditional grants to upgrade plant and equipment	Not applicable (equivalent to items in column 3)
Workers	E.g. government-financed redundancy benefits; early retirement benefits / pension 'bridging'; unemployment benefits	(Indirect effect of exemptions to companies employing the workers)	E.g. wage subsidies; education and training subsidies; relocation subsidies	E.g. items from column 3 plus: counselling and other social services to workers and their families; facilitating reemployment opportunities in industries of a similar social standing, in a similar industry and/or the same community (e.g. through worker transfer schemes and community-based public investment, especially as part of comprehensive decarbonization planning).
Communities	E.g. revenue replacement grants for local governments	E.g. geographically-defined exemptions to new climate laws	E.g. place-based public investment in economic infrastructure, innovation (e.g. regional innovation strategies), education and training institutions	E.g. items from column 3 plus: place-based investment in local public goods of a social, cultural or environmental nature, especially as part of comprehensive decarbonization planning.
States	E.g. international unconditional grants or side-payments from other countries or from development finance institutions; 'grandfathered' international emissions permits	E.g. exemptions under international climate treaty obligations	E.g. place-based international public investment in a state's economic infrastructure; technology transfer; or capacity-building assistance	E.g. items from column 3 plus: international investment in public goods of a social, cultural or environmental nature

Notes: Policy 'ideal types' (column headings) are described in Part 3.2 (which draws on Part 3.1). Agent/group types (row headings) are discussed in Part 2.1.

[a]This typology was created by Green for use in the Coal Transitions Project: https://coaltransitions.org/. Earlier versions of the typology were published in Green (2018) and Spencer et al. (2018, p. 340).

conditional cash payments, public employment schemes and community-level public investment in economic infrastructure, as well as public investment in non-economic infrastructure, expressive responses, and *sui generis* government policy programmes whose objective is to assist relevant agents adapt comprehensively (not merely financially) to the new circumstances brought about by a structural change.

For completeness, it should be acknowledged that not offering any transitional assistance is itself a policy choice and therefore could be considered as a fifth category of TAP.[17]

3.3. TAP options: a typology

Combining the four ideal-type TAP strategies just discussed with our five agent/group categories from Part 2.1, we generate a novel typology of TAP possibilities that enables us to parsimoniously map the logical space of TAP (Table 1). Of course, a TAP package may encompass more than one combination of agent types and policy strategy types.

Though necessarily somewhat simplified, it is envisaged that this typology will prove useful in at least two ways to policymakers, researchers and other stakeholders working in the field of climate change governance. First, it communicates in a clear and simple way the basic TAP options, mapped according to the most important design elements or variables: objective, scope, and target agents/groups. Policymakers and others, such as labour unions, specially-affected communities, and activists campaigning for a 'just transition' can use the typology to think through the key questions and issues associated with TAP.

Second, by focusing on theoretically meaningful distinctions among TAP options, we hope to have provided researchers with a useful scheme for classifying variation in TAPs. Policy-relevant research on mitigating the adverse socioeconomic effects of low-carbon transitions has grown rapidly over the last few years, but our review finds that, so far, this research is quite fragmented, dominated by single-case case studies that vary considerably in their concepts and measures. Our theoretically-informed typology facilitates ongoing efforts to build a more unified and mature research programme on low-carbon transitions.

4. How can governments successfully implement TAP?

The growing literature on TAP is imbued with an understandable sense of urgency to discover 'what works'. In the present article, we cannot hope to provide a comprehensive answer to this complex and contingent question. Our more modest aims are two-fold. In Part 4.1, we aim to provide a brief synthesis of the 'best practice' lessons emanating from the existing literature. However, since much of this literature consists of single-case case studies, there are pitfalls in generalizing these 'lessons' to other cases. Accordingly, in Part 4.2, we draw on a wider body of social science research to emphasize the importance and cross-national variability of *state capacities* to implement alternative TAP strategies and to manage vested interests.

When analysing 'what works', one should always ask: works *for whom* and *to what end*? We have been deliberately ecumenical about the normative justifications of various particular TAP possibilities, recognizing that governments will have varied and often multiple reasons for pursuing TAP, including ensuring equity/fairness, justice and/or simply a socio-politically smooth low-carbon transition. The case study literature on transitions that we analyse here often takes an implicit stand on what success looks like, which can roughly be defined as one or both of (i) the needs and interests of workers, consumers and communities that are already vulnerable and likely to be adversely affected by low-carbon structural change are identified, recognized and taken into account, and these groups are adequately assisted in a distributive sense; and (ii) the transition was widely politically accepted and sustained, without significant political backlash or policy retrenchment. Accordingly, we adopt this rough working definition of success in the below analysis. Our analysis focuses on the substantive/distributive aspects of successful TAP. However, we first make two brief points about two sets of issues that are largely excluded from our analysis, but that need mentioning.

First, as this definition of success makes clear, the manner and extent to which affected groups are recognized and included in *processes and procedures* (e.g. information-provision, consultation, dialogue, policy design) relating to low-carbon transitions is an important determinant of a just and equitable low-carbon transition (Healy & Barry, 2017; Jenkins et al., 2016; Kumar, Americo, & Billingham, 2016; Markkanen & Anger-Kraavi, 2019). It is also likely to have a material influence on the political acceptability and sustainability of transition policy, since low-carbon policies and transition strategies that are determined through processes perceived to be inclusive and fair are more likely to be publicly accepted and politically sustained (Maestre-Andrés, Drews, & van den Bergh, 2019; Miller, Richter, & O'Leary, 2015). At a minimum, transition processes should include 'social dialogue', or tripartism between the state and affected businesses and labour unions (ILO, 2015). But participation should not necessarily be limited to these groups. Efforts to include vulnerable consumers and other groups typically underrepresented in policy processes – including women and (where applicable) informal workers, indigenous communities and ethnic minorities – are also normatively desirable in their own right and conducive to politically successful policy outcomes (Brugnach, Craps, & Dewulf, 2017; Buckingham & Le Masson, 2017; Markkanen & Anger-Kraavi, 2019; Rentschler & Bazilian, 2017). For some transitions and in some regions – e.g. pertaining to the land sector, and especially in poorer regions – unions and potentially even corporate firms may not be relevant stakeholders, in which case the imperative to include other affected stakeholders is even stronger.

Second, our rough definition of success focuses on the social benefits produced by TAP without reference to its *costs* and the distribution of those costs. The literature on coal transitions suggests that the costs of TAP programmes are rarely systematically analysed *ex ante* or evaluated *ex post* (Caldecott et al., 2017). In the wider literature, we are aware of only a few attempts to analyse the costs of actual TAP programmes (Beatty et al., 2007; Frondel, Kambeck, & Schmidt, 2007; Gray, 1995, 2001; Hallegatte, Fay, & Vogt-Schilb, 2013; Magee, 2001). We return to the question of costs in Part 5.

4.1. Lessons from transition case studies

There is now a considerable, and expanding, literature on recent-historical energy-industrial transition cases in which adverse impacts on specific groups and agents were mitigated. Some cases have been seen as relatively successful (see generally Altenburg & Assmann, 2017; Caldecott et al., 2017; Hallegatte et al., 2013; Klenert et al., 2018; OECD, 2017; Rentschler & Bazilian, 2017), including: the West German Ruhr region's transformation from a coal- and steel-based economy in the 1960s to a knowledge-based service economy during the 1990s and early 2000s (Galgóczi, 2014; Herpich, Brauers, & Oei, 2018); a major steelworks closure in New South Wales, Australia, in the late 1990s (Evans & Phelan, 2016); and the coal phase-out of Ontario, Canada, completed in 2014 (Harris, Beck, & Gerasimchuk, 2015). Other lessons have been inferred from case studies that have been identified as less successful, more mixed, or still embryonic, including: the decline of the British coalfields (Beatty & Fothergill, 1996; Beatty et al., 2007); the post-unification decline of the East German coal industry (Herpich et al., 2018); and the current challenges facing upper Silesia in Poland (Bukowski, Śniegocki, & Wetmańska, 2018). Beyond the energy sector, lessons from case studies of TAP in trade liberalization and other structural adjustments are discussed by Trebilcock (2014).

Synthesizing from these transition case studies, the 'best practice' lessons offered are:

- *Pre-transition*: implement long-term economy-wide or sectoral decarbonization planning, to enable early implementation of policies for a managed decline of industries, and articulation of a long-term vision to support the growth of new industries; and ensure transparent communications, consultation and co-design processes, including collaboration between governments, businesses, labour unions, consumer groups and other affected stakeholders, to ensure inclusion, input and buy-in from the most affected groups;
- *In the short-term*, put in place social protections and wider support for vulnerable workers and consumers. For vulnerable workers, this includes redundancy benefits, unemployment benefits, early retirement benefits, pension 'bridging', and healthcare benefits to mitigate workers' economic losses, and non-financial support such as psychological and careers counselling. For vulnerable consumers, this includes in-kind social support, conditional or unconditional cash payments, offsetting reductions in applicable taxes or offsetting increases in transfer payments;
- *Over the medium-term*, boost government and business investment in economic, social, cultural, environmental and civic public goods and services in affected regions to facilitate new linkages (e.g. via transport and telecommunications infrastructure), revitalize public spaces, attract and support alternative industries and new residents; and provide skills development and retraining for affected workers to facilitate labour market adjustment and more comprehensive adaptation, with an emphasis on on-the-job retraining;
- *Over the longer-term*, invest in education and innovation, to support long-term regional and national growth and prosperity. (see Gambhir, Green, & Pearson, 2018, pp. 7–13 for elaboration).

4.2. The limits of 'lessons': the importance of state capacities and institutions

Best practice recommendations from the case study literature are targeted at vulnerable workers, consumers and communities, consistent with our earlier discussion of the pitfalls of providing financial assistance to group agents. Moreover, the recommendations are clustered around adaptive policies, especially CAS (with the exception of short-term measures, which are concentrated on measures from our 'compensation' category). Given the multi-dimensional nature of these kinds of transitions, we are not surprised that CAS policies, *if*

designed and implemented well, have the greatest potential to produce just, equitable and smooth transition outcomes. But this is a big 'if'. CAS strategies are also the most complex kinds of TAP to design and implement, and they are more likely to succeed in states that have particular *state capacities*, including the ability to overcome or manage vested interests.

By way of illustration, we focus on CAS policies to facilitate regional development in specially-affected communities – arguably the most complex category of TAP to implement successfully. Scholars of 'regional innovation systems' have identified various barriers – organizational, institutional, and network-related – to economic diversification in old industrial regions, and have emphasized the complex mix of state capacities required to overcome them (Coenen, Moodysson, & Martin, 2015; Grabher, 1993; Tödtling & Trippl, 2005). Governments typically require not merely the financial resources and hierarchical authority to 'push' new technologies into such regions, but also the capacity to steer long-term, participatory, cooperative processes that empower diverse local actors to recombine their existing knowledge, skills and competences in new ways. These may include the capacity to experiment with new governance processes, to broker dialogue among the various actors (especially firms), to build or reconfigure networks, to disseminate information, and to facilitate shifts in cultural norms and worldviews (Campbell & Coenen, 2017; Loorbach, 2010; Rotmans, Kemp, & van Asselt, 2001; Stroud, Fairbrother, Evans, & Blake, 2014).

The importance of these capacities is underscored by attending to the role of *vested interests* in low-carbon transitions, especially where these are closely integrated with the state in one way or another. In regions and countries overly-reliant on a particular carbon/energy-intensive industry or industries, the patterns of mutual dependence among industry stakeholders and governments can create a political 'lock-in' effect that is difficult to overcome (Baeten, Swyngedouw, & Albrechts, 1999; Baker, Newell, & Phillips, 2014; Grabher, 1993; Hess, 2014; Newell & Mulvaney, 2013; Swilling, Musango, & Wakeford, 2015). Variations in state capacities, and in the interests and power of interest groups, can significantly affect not only whether a particular 'best practice' recommendation is feasible, but also whether it is desirable, since the potential for TAP to be co-opted by vested interests may militate against CAS-type policies that are more complex and resource-intensive. To understand the suitability of alternative transitional assistance policies and strategies, it is therefore necessary to draw on political science theories to illuminate various phenomena, including the power, objectives, strategies and tactics of vested interests and the way they organize to influence politics and the policy process (Downie, 2017, 2019; Kern & Rogge, 2018; Meadowcroft, 2009, 2011) as well as the strategies and tactics of relevant political parties, and party competition/cooperation dynamics (Aklin & Urpelainen, 2013). It is also necessary to incorporate theories of the state into such analysis and, more specifically, theories of state capacities and institutions, dominant state discourses and paradigms, and the historical, spatial and material forces affecting states (Hall, 1993; Hughes & Urpelainen, 2015; Johnstone & Newell, 2018; Kern, 2011; Meckling & Nahm, 2018). In this respect we echo Johnstone and Newell's call to understand the state in a 'dynamic, relational and practice-oriented manner' (2018, p. 80) when analysing TAP possibilities and prospects.

One useful set of analytical tools for understanding the dynamics, relational configurations and practices of states is provided by comparative politics and comparative political economy. These disciplines are increasingly being applied to the analysis of state capacities to steer low-carbon transitions in general (Ćetković & Buzogány, 2016; Finnegan, 2019; Kern and Markard 2016; Kuzemko, Lockwood, Mitchell, & Hoggett, 2016) and offer insights that can be applied to transitional assistance strategies and policies in particular (Wiseman et al., 2017). Scholarship on 'varieties of capitalism' (Hall & Soskice, 2001) and 'patterns of democracy' (Lijphart, 2012) suggests that state capacities for long-term governance processes like industrial transitions are likely to vary systematically across jurisdictions according to their political and economic institutions. For instance, 'coordinated market economies', like Germany and Denmark, have corporatist structures of interest-group representation, which consolidate interest groups into peak bodies and systematically incorporate them into policymaking processes in a way that promotes intra-sectoral compromises among employers (via industry associations), workers (via unions) and the state (Hall & Soskice, 2001; Lijphart, 2012, chap. 9). These countries possess the kind of steering and consensus-building capacities necessary to manage comprehensive and sustained regional and industrial transitions such as decarbonization, giving them an intrinsic advantage (Finnegan, 2019; Stroud et al., 2014). By contrast, the institutions of 'liberal market economies', like the UK, the US and Australia, characteristically foster competitive-market modes of interaction among plural interest groups, respond to short-term incentives, adopt

a more *laissez faire* approach to innovation, training and industrial development, and tend to be more sensitive to consumer interests (Hall & Soskice, 2001; Lijphart, 2012). In these countries, policymakers and stakeholders motivated to steer just, equitable and smooth low-carbon transitions will need to think more creatively about the TAP strategies likely to be most effective. For example, they may need to be more opportunistic in the exploitation of the state's policy levers, entrenching transition processes when policy windows open by creating new institutions and using fiscal measures to consolidate political support (Finnegan, 2019; Lockwood, 2013). Meanwhile, they may also need to work through civil society to build surprising alliances and to utilize private governance channels, such as shareholder activism (Wiseman et al., 2017).

Overall, the above observations counsel attentiveness to the contingencies of particular transition contexts, suggesting that there are likely to be limits to the generalizability of universal 'best practice' recommendations. But the need for more contingent and tailored recommendations does not leave motivated policymakers and stakeholders bereft of guidance from experiences in other places and times. As we hope to have illustrated here, various factors tend *systematically* to affect state-economy-society interactions and state capacities to steer low-carbon transitions. The point to underscore is that policymakers and stakeholders should draw lessons that are relatively transferable to *their* institutional and other relevant circumstances.

5. Conclusion: future research directions

We conclude by suggesting areas for future research that could usefully address knowledge gaps we identified during our review, organized around our three section themes.

5.1. The negative effects of low-carbon transitions

The literature provides a fairly consistent body of evidence as to which *kinds* of agents and groups are likely to be adversely affected by low-carbon transitions. However, there remains considerable scope to identify at a more fine-grained, sub-national level which firms, workers and communities are most likely to be affected by specific low-carbon transitions.

In addition, we see merit in future research on exactly *how* these agents and groups are affected, and how such effects ought to bear on the prioritization of TAP. In particular, the issue of non-financial losses deserves further consideration, especially with regard to how TAP can help mitigate people's loss of the wellbeing that stems from their attachments to people, places and traditions, and from their status in their communities.

5.2. TAP strategies and policy instruments

In Part 3 of our paper we proposed a typology of TAPs, noting that part of our motivation was to provide a system for classifying variation among them. The greatest gap we see in this regard is a need for an empirical database of past/current TAPs. We see merit in collaborations between researchers to compile such a database with appropriate haste.

5.3. TAP implementation and success

Understanding more systematically the drivers of and barriers to successful implementation of different TAP strategies remains the greatest area of future research need. Substantively, we see particular value in studies that focus on the state capacities necessary to steer just, equitable and smooth low-carbon transitions, and on the role of economic interest groups, both capital and labour, in shaping or resisting such transitions. We also urge greater attention to the role of political and political-economic institutions in shaping TAP design and implementation. Such research holds the potential to generate a more systematically variegated set of 'best practice' recommendations that are specific to *clusters* of jurisdictions that share similar institutions and other circumstances. In this regard, we see a particularly great need for research on liberal market economies where non-market coordinating institutions are weaker, since these weaknesses limit the extent to which

tripartite social dialogue and cross-party negotiation can be relied upon to achieve just, equitable and smooth low-carbon transitions.

For this purpose, we see particular value in studies that use a comparative research design – be they qualitative or quantitative. As TAP data on a sufficiently large number of countries become more widely available, studies using statistical methods would be of value. Having said that, detailed case studies will continue to be crucial to understanding the complex dynamics of transitions and the effects of TAP. In this regard, we note with concern an under-representation of developing country case studies in the current literature, with the possible exception of South Africa. We identify a particular need for greater attention to low-carbon TAP in China, India, Brazil, and other high-emitting industrializing countries.

We also see great potential value in scholarship in a more constructivist vein that considers cultural-sociological variables to shed light on the causes and effects of TAP success. On the one hand, we would expect entrenched, dominant cultural norms and values to shape the possibilities for and success of TAP, as they shape the possibilities for climate action more generally (Eckersley, 2016). Yet we would also expect new ideas about TAP to influence the course of such transitions, at least in some contexts – moments of crisis and transition are, after all, occasions when ideas are most influential (Blyth, 2002).

Furthermore, we see an important opportunity to incorporate TAP into the following emerging research themes within the 'sustainability transitions' literature, whch are among those identified in a recent review by Köhler et al. (2019): the destabilization, decline, and phase-out of existing systems and regimes; the speed of transitions and how can they be accelerated; the politics of winners and losers from sustainability transitions and the resistance of incumbent/vested interests; forward-looking and policy-applied transitions research; traditional policy instruments, and policy mixes, in sustainability transitions; just transition commissions or authorities (and similar organizational innovations) as 'intermediating agencies' and 'governance experiments'; the role of civil society organizations in promoting just transitions, and the just transition 'movement' from the perspective of social movement theory; the role of finance capital in sustainability transitions; consumers and everyday sustainabilities (i.e. how forward-looking/adaptive TAP can facilitate these); place-based and spatially-sensitive aspects of transitions; the transformation of urban infrastructure; and the ethical aspects of transitions.

Finally, as flagged at the beginning of Part 4, there is a greater need for research on the costs of alternative TAPs and, more importantly, their cost-effectiveness with respect to key common aims of TAP. The research community would also benefit from quantitative and qualitative assessments (*ex ante* and *ex post*) of the wider impacts of TAP so as to better capture both the financial and non-financial impacts of transitions and TAP, as an aid to multi-criteria analysis in policy decision-making. Likewise, there is a need for more rigorous normative analysis of TAP that goes beyond an efficiency framework – and even beyond a utilitarian framework – to incorporate justice-related concerns, including the effects of transitions and TAP on people's core capabilities, basic needs, basic rights and legally protected human rights.

In sum, we see manifold fruitful directions for future research on strategies and policies to enable just, equitable and politically smooth low-carbon transitions. We could imagine few topics more urgent and important for the social sciences today.

Notes

1. We therefore leave aside issues associated with climate change adaptation, 'loss and damage' and geoengineering.
2. The focus on these agents/groups reflects the dominant focus of the literature on the fossil fuel-intensive stationary energy and transport sectors. Additional categories are likely to be needed for analysis of TAP in the land (agriculture and forestry) sectors, for example indigenous landholders and farmers. For simplicity, and to reflect the current dominant focus on the energy sector, we leave these additional groups out of our typology. However, our typology could easily be expanded to include such additional categories of groups/agents, as we think that the categories of TAP that we develop in Part 3 could equally be applied to them.
3. Many other scholars and practitioners, however, apply the term 'just transition' to a wider range of agents.
4. In special cases where suppliers of goods or services to energy-intensive or emissions-intensive companies are highly dependent on their energy-intensive or emissions-intensive customers (e.g. due to highly specific assets and limited alternative markets to sell into) it is conceivable that this category could be expanded to include such suppliers.

5. 'Adjustment' arguably does not quite adequately capture the transformative impulse behind this forward-looking approach to assistance, but it is the English word conventionally used in policy circles.
6. However, in light of our comments in Part 2.2, international donors motivated to support a just transition in other countries should consider forms of assistance that are more directly targeted at the individuals and groups who will be adversely affected in those other countries.
7. See footnote 6, above.
8. Firms themselves typically have legal obligations to pay redundancy, retirement or other benefits to workers, which may be contractually or legislatively required. We are focusing here on government transition policies that are *additional* to such pre-existing entitlements. In countries that have generous, pre-existing social welfare schemes and worker protections, the case for such additional transitional payments will be correlatively weaker.
9. In some of these cases, the firms themselves were state-owned enterprises, so such transfers essentially involved one arm of the state giving to another.
10. See https://unfccc.int/topics/mitigation/workstreams/response-measures#eq-2.
11. See https://ec.europa.eu/energy/en/topics/oil-gas-and-coal/coal-regions-in-transition/working-groups-meetings.
12. Both authors are academic partner members of the Taskforce.
13. See http://www.energia.gob.cl/pagina-mesas/405.
14. With respect to climate change, since liability-imposing climate policies typically apply only to business corporations and other large energy- or carbon-intensive incorporated entities (such as hospitals and universities), this class of TAP is usually available only to such entities. That said, the benefiting firms may pass the cost savings onto customers and the ultimate consumer, depending on the firms' competitive environment.
15. Though the process of adaptation may itself involve some backward-looking cognitive work, such as appropriately memorializing the past (Thompson, 1998).
16. In our classificatory scheme, this class of TAP is only available in the case of structural changes induced by a proximate legal/policy change. While governments could of course pass new laws that protect incumbents against changes in technology or market conditions, we consider this to be outside the scope of TAP.
17. As noted in Part 1, some persons may be entitled to general social protection policies available to a wider class of persons, such as unemployment benefits.

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