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# A SYSTEMATIC REVIEW OF THE KEY ELEMENTS OF A JUST TRANSITION FOR FOSSIL FUEL WORKERS

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# A systematic review of the key elements of a just transition for fossil fuel workers

**Sandeep Pai**[1,*], **Kathryn Harrison**[2], **Hisham Zerriffi**[3,4]

## Abstract

As global pressure for climate action increases, several countries are beginning to create plans for phasing-out fossil fuel-based energy systems. These energy system changes would entail significant employment impacts for fossil fuel workers and their communities resulting from massive technological and infrastructural changes. Anticipating the implications of fossil fuel industry declines on workers and communities, scholars in many academic fields are focusing on both understanding and developing "just transition" strategies that aim to minimize the impact of climate policies on fossil fuel workers and their communities. Depending on their academic field, scholars focus on various elements of just transition, yet these elements have not been systematically synthesized. In this paper, we reviewed articles that focus on a just transition for fossil fuel workers and their communities in the context of climate change to describe the state of the literature and synthesize elements of just transition that scholars in different academic fields identify. We then used Heffron & McCauley's (2018) legal geography 'JUST' framework to characterize each of these elements. We identified 33 articles for analysis based on our inclusion criteria. These articles focus on different geographies—United States (11), Global (9), Australia (6) and other countries (7). They also focus on just transition for different types of workers: coal (18), unspecified (10), and fossil fuel (5). Overall, we find a predominant focus on OECD countries and on coal workers. No articles focused solely on other major fossil fuel producing countries such as Saudi Arabia, Brazil, India or oil & gas workers. Collectively, the articles we reviewed identify 17 key elements (or strategies) of just transition ranging from requirements of long-term planning to importance of retraining. Moreover, these 17 elements vary in terms of the type of justice they further (distributional, procedural, recognition & restorative justices), spatial scales, and timeframe. While this review will provide scholars in the field new ideas for future work and policymakers strategies that they can focus on, more research is required to clarify the elements further and assess their feasibility of implementation.

**Keywords:** Just Transition, Energy Transitions, Fossil Fuel Workers, Climate Change
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# 1. Introduction

The Intergovernmental Panel on Climate Change's (IPCC) 2018 special report stated that fossil fuel-based energy systems need to decline rapidly to keep global warming to 1.5°C (IPCC, 2018). Before and after this much-publicized IPCC report, several national and state/provincial governments have initiated explicit plans to phase-out different fossil-fuel industries or introduced policies such as carbon tax that might implicitly result in fossil fuel industry contractions. For instance, nearly 32 national governments including Canada and the United Kingdom (UK), and several sub-national governments from the United States (US) have joined the Powering Past Coal Alliance (2018), which is a global alliance whose mission is to work towards phasing-out coal-fired electricity generation by 2030 in Organisation for Economic Co-operation and Development (OECD) countries and by 2050 in all countries.

Any transition away from the current fossil fuel-based energy systems will not only involve massive changes in energy production and infrastructure but will also impact workers in these industries, their families, and the communities in which they live (Healy & Barry, 2017; Johnstone & Hielscher, 2017). If workers in fossil fuel-dependent regions do not find alternative livelihood opportunities, these regions could witness severe economic weakening and alienation, which might result in political unrest and degradation of the social order (Johnstone & Hielscher, 2017). Apart from employment impacts on workers and their communities, many regions that host fossil fuel industries such as coal mining, power plants, oil production and refining are heavily dependent on these industries for taxes and revenues. Today, several fossil fuel-producing regions are effectively single-industry economies, which can expect to see a serious economic decline if energy transition happens without planning (Carley, Evans, &

Konisky, 2018; Johnstone & Hielscher, 2017). Given the possible economic and social implications of low carbon transitions on fossil fuel regions, scholars in various academic fields are now focusing on "just transition" strategies for minimizing the impacts of such transitions on workers and their communities (Johnstone & Hielscher, 2017; Olson-Hazboun, 2018; Vona, 2019; Weller, 2019).

### 1.1 Brief background of just transition

The concept of just transition was born the US in the 1970s when Tony Mazzocchi, a trade union leader representing the Oil, Chemical and Atomic Workers' Union sought the support of environmental groups to help fight the Shell company over safety and health issues affecting workers (Morena et al., 2013). At that time, Mazzocchi and other unionists acknowledged that the industries in which their members were working were causing severe environmental problems. They advocated action aimed at addressing workers' livelihoods, health and safety issues, and preserving the natural environment. Their advocacy was shaped by the growing discourse of 'jobs versus the environment' that industry was advancing in the US in response to proposed environmental regulations (McCauley & Heffron, 2018; Morena et al., 2013). Since the mid-2000s this concept is featuring in climate change negotiations and is being advocated by many within academia and outside.

As the just transition concept was adapted to climate change discourse, for some the meaning of just transition changed. For some scholars just transition means focusing exclusively on fossil fuel workers and their communities (in line with the labour focus of the original concept) (Johnstone & Hielscher, 2017; Olson-Hazboun, 2018; Vona, 2019; Weller, 2019). But for others,

just transition is not only about fossil fuel workers, but also climate, environmental and energy justice for all (Heffron & McCauley, 2018; McCauley & Heffron, 2018).

In this paper, we focus on the original labor-focused concept of just transition, which centers around helping workers and communities in declining industries. Specifically, we focus on just transitions for fossil fuel workers and their communities in the context of possible fossil fuel industry declines resulting from bold climate action.

### 1.2 The Politics and Ethics of a Just Transition Framing

Job losses due to industry change are not unique to the transition from fossil fuels. Collapses of industries (globally or regionally) have occurred in the past for a wide variety of reasons, including relocation of production, collapse of demand, over-harvesting of resources, and technological change. Within that context, what is the justification for a "just transition" for fossil fuel workers?

Two broad categories of argument have been made. The first is that governments have an ethical duty to support affected workers because many of these workers have sacrificed their health to provide the fuel necessary for their countries' growth and prosperity (Cha, 2017). This argument is of course also valid for workers in other industries' facing closures and is not limited to fossil fuel industry workers alone. A second, more pragmatic, argument is often advanced that climate change mitigation policies will be more politically feasible if the affected workers and communities are accommodated. Scholars argue that in order to ensure that fossil fuel workers and their communities do not impede energy transitions, it may be important to create just transition plans for these workers and their communities (Cha, 2017; Eisenberg, 2019; Haggerty, Haggerty, Roemer, & Rose, 2018; Healy & Barry, 2017; Johnstone & Hielscher,

2017; Olson-Hazboun, 2018). This is because fossil fuel companies and their partisan allies often deploy “jobs vs the climate” argument (Evans & Phelan, 2016; Vona, 2019; White, 2019) to mobilize the support of the fossil fuel-dependent communities (who are understandably anxious about losing employment) and prompt them to support candidates who favor the fossil fuel industries (Cha, 2017; Eisenberg, 2019). For example, in the last US presidential election, when pro-fossil fuel President Donald Trump campaigned on a platform to save the coal industry and coal jobs, he got tremendous support from coal communities (Pai, Zerriffi, Jewell, & Pathak, 2020). After getting elected, President Trump pulled the US out of the Paris climate agreement. Apart from democratic countries, even autocratic states like China have faced political resistance when attempting to close down coal mines “from a powerful coalition of local cadres, mine bosses, workers and farmers” who depend on coal mining for their living (Wright, 2007).

### 1.3 Why review?

Scholars from different academic fields employ different methods and focus on different aspects of just transition for fossil fuel workers and their communities. These scholars identify various elements of just transition but the nascent literature remains quite scattered. A clear and comprehensive synthesis of the existing literature will be useful in highlighting and understanding where the knowledge gaps might exist, both theoretically and empirically. Here, we aim to fill the above knowledge gap by synthesizing the elements (or strategies) of just transitions and describing the literature and the state of knowledge in this field.

In this paper, we focus on the question: **“What elements of a just transition for fossil fuel workers and their communities do scholars in different academic fields identify**?” The

synthesis of this important and emerging literature will also provide policymakers, environmental and trade union organizations who are already invested in creating just transition strategies insight on the kinds of issues they can target in their efforts.

In the next section (2) we provide an overview of our methods and then summarize results in section (3). In the final section (4) we contextualize our findings, discuss policy implications and highlight gaps in the field.

## 2. Methodology

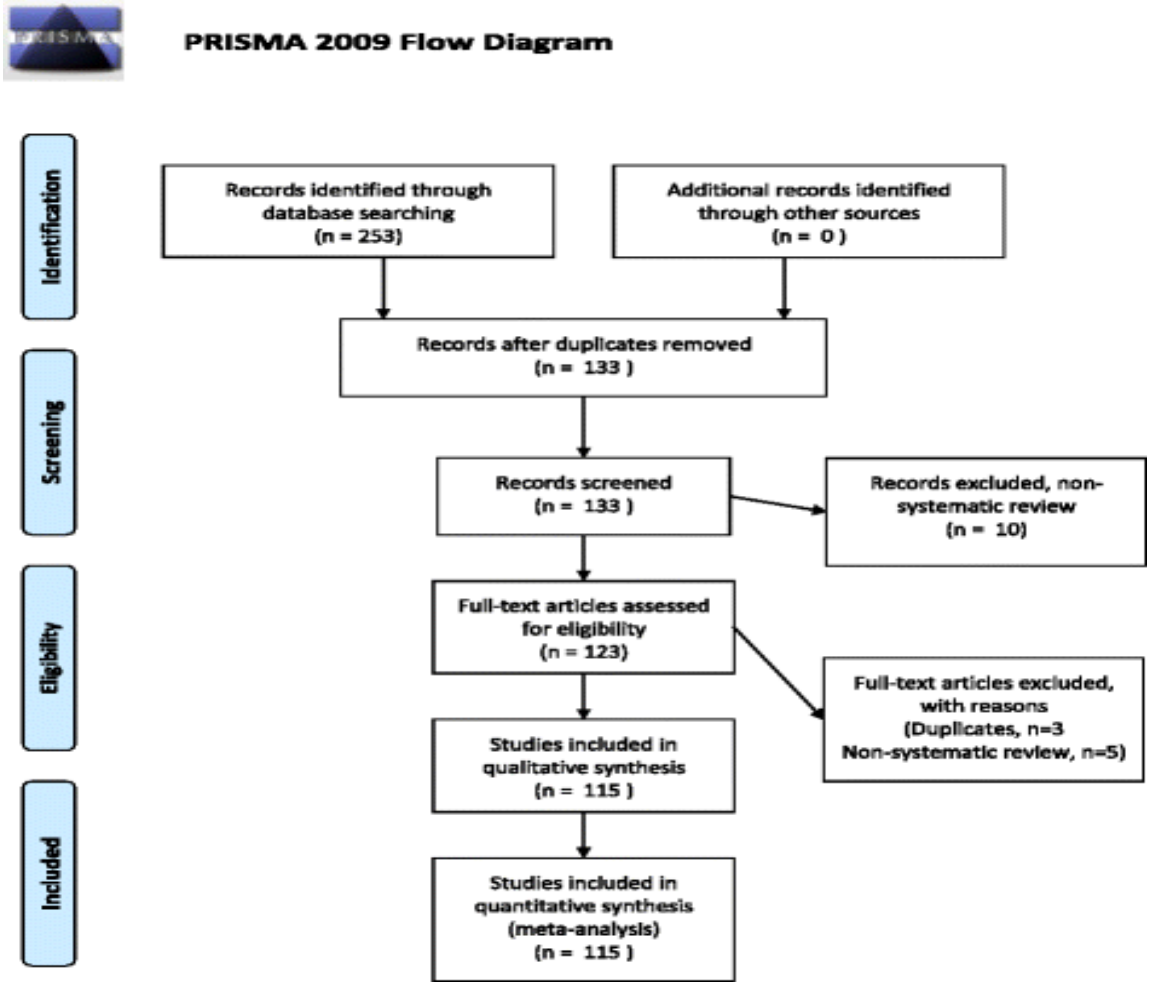
We conducted a systematic literature review of published peer-reviewed literature on just transitions in order to synthesize elements of just transition identified by the authors. To enhance our understanding of these elements further, we characterized the identified elements based on a framework that emerged from our review. In the first stage, we systematically searched standard databases and collected relevant articles that adhere to our pre-determined inclusion criteria (Grant & Booth, 2009). We also reviewed some key non-academic reports as they are considered relevant for the topic, given the strong policy relevance of this topic. For non-academic literature, we focused on reports by government commissions and international organizations. We applied inductive coding techniques to our final list of articles to generate elements or strategies of just transition that scholars identify. In the second stage, we used a just transition framework that emerged from our review to characterize each identified element.

### 2.1 Search strategy for peer-reviewed literature

We searched standard databases such as Google Scholar and Web of Science using various permutations and combinations of words: “just transition,” “just transitions,” “workers,” “coal,”

"oil," "gas," "fossil fuel workers," "coal workers," "oil workers," "gas workers," "climate change," "jobs," "green jobs," "communities," "just transition policy," "elements," "principles." This search was conducted from June to August 2019. Along with articles generated by our search strategies, we also deployed a snowball technique to identify more articles. To be systematic in our searches, we followed the preferred reporting items for systematic reviews and meta-analysis (PRISMA) flow diagram steps to report the identified literature at various stages of the systematic literature review (see **Figure 1** for a generic example). This PRISMA method has been utilized by various past studies (Lee et al., 2017; Lewis & Pattanayak, 2012).

**Figure 1: Preferred Reporting Items for Systematic Reviews and Meta-analysis flow diagram for searching & extracting data (adapted from (Lee et al., 2017))**



## 2.2 Inclusion criteria & coding of results

After identifying the articles through keyword searches and removing duplicate articles, we applied our pre-decided inclusion criteria (**Table 1**) to generate the articles to be included for analysis.

### Table 1: Inclusion criteria for assessing the articles

| Item | Details | Reason |
|---|---|---|
| Context | Just transitions for fossil fuel workers and their communities in the context of climate change | This context was chosen to answer the research question |
| Language | English | We limited the scope of our review to articles written in the English language due to our lack of proficiency in other languages |
| Types of publications | Academic journal articles | We focused on peer-reviewed journal articles in line with previous systematic reviews (Lewis & Pattanayak, 2012) |
| Geographical Focus | Global | To address the issue of publication bias and the fact that fossil fuel industry decline will impact countries in global South and North alike, we chose to have a global focus |
| Period | 2000 – 2019 | This is the period when just transition in the context of climate change was first talked about |
| Databases | Google Scholar, Web of Science | Past studies have also utilized these databases for conducting systematic reviews (Lewis & Pattanayak, 2012) |

After collecting our final list of articles for review based on the above inclusion criteria, we used inductive coding to generate the element themes (Elo et al., 2014; Thomas, 2006). This

inductive coding process began by reading articles carefully and creating the list of elements (Elo et al., 2014) and recording relevant text under element. As we read every new article, depending on what emerged from the articles either the relevant content was added to the existing elements or new elements were created. Finally, we went back to the text and elements to re-check the elements to reduce the overlap and redundancy.

### 2.3 Use of framework for characterization of elements

For characterizing the elements, we used Heffron & McCauley's (2018) legal geography 'JUST' framework as this is a comprehensive framework that allows further understanding of elements on the basis of Justice, Universal, Space & Time (**Figure 2**).

**Figure 2: Legal Geography 'JUST' framework for the Just Transition**

| | | | |
|---|---|---|---|
| J | TRANSITION | Justice | Justice takes the form of 3 forms of justice<br>Distributional<br>Procedural<br>Restorative |
| U | | Universal | Universal takes the form of two universal forms of justice<br>Recognition<br>Cosmopolitanism |
| S | | Space | Space brings in location, where are 'events' happening ? (in principle, at local, national and international levels) |
| T | | Time | Time brings into transition timelines such 2030, 2050, 2080 etc. and also 'speed' of the energy transition (i.e. is it happening fast enough?). |

**Source: Heffron & McCauley (2018)**

Within the Justice and Universal categories, we focus on four forms of justice that are often highlighted in the context of climate, environment and energy studies (Heffron & McCauley,

2018; McCauley & Heffron, 2018; McCauley et al., 2019; Pellegrini-Masini, Pirni, & Maran, 2020):

1. **Distributional justice** concerns the equitable distribution of burdens and benefits of energy and environmental decisions.

2. **Procedural justice** highlights the right to a fair process for different stakeholders to take part equitably in the decision-making process.

3. **Restorative justice (R1)** primarily aims to repair the harm done to individuals, instead of focusing upon punishing the offender.

4**. Recognition justice (R2)** entails recognizing that parts of the society might suffer as a result of energy and environmental decisions and identifying individuals and groups who might be impacted by such decisions.

We did not use cosmopolitan justice[1] as it reinforces the above justice forms but states that the above forms of justice must apply universally to all human beings. From our analysis of elements, it is clear that the elements identified are general and broadly apply to all nations and individuals. For each element, we used the above forms of justice to identify "what justice is needed and/or expected" (Heffron & McCauley, 2018).

Apart from justice forms, we use spatial and time scales to further characterize the elements. Heffron & McCauley's (2018) framework defines space as where "events" are happening. Here, we grouped each element under national, provincial/state or local level as many articles clearly

[1] McCauley, Ramasar, Heffron, Sovacool, Mebratu, & Mundaca (2019) "Cosmopolitan justice suggests that principles—such as those from distributive and procedural justice—must apply universally to all human beings in all nations. Cosmopolitan justice acknowledges that all ethnic groups belong to a single community based on a collective morality."

define the spatial dimensions of these elements at these three levels. Finally, we also grouped each element in terms of timescales—long-term, medium-term and short-term. We defined long-term as a time period of over a decade, medium-term as 3-10 years and short-term 0-2 years.[2]

# 3. Results

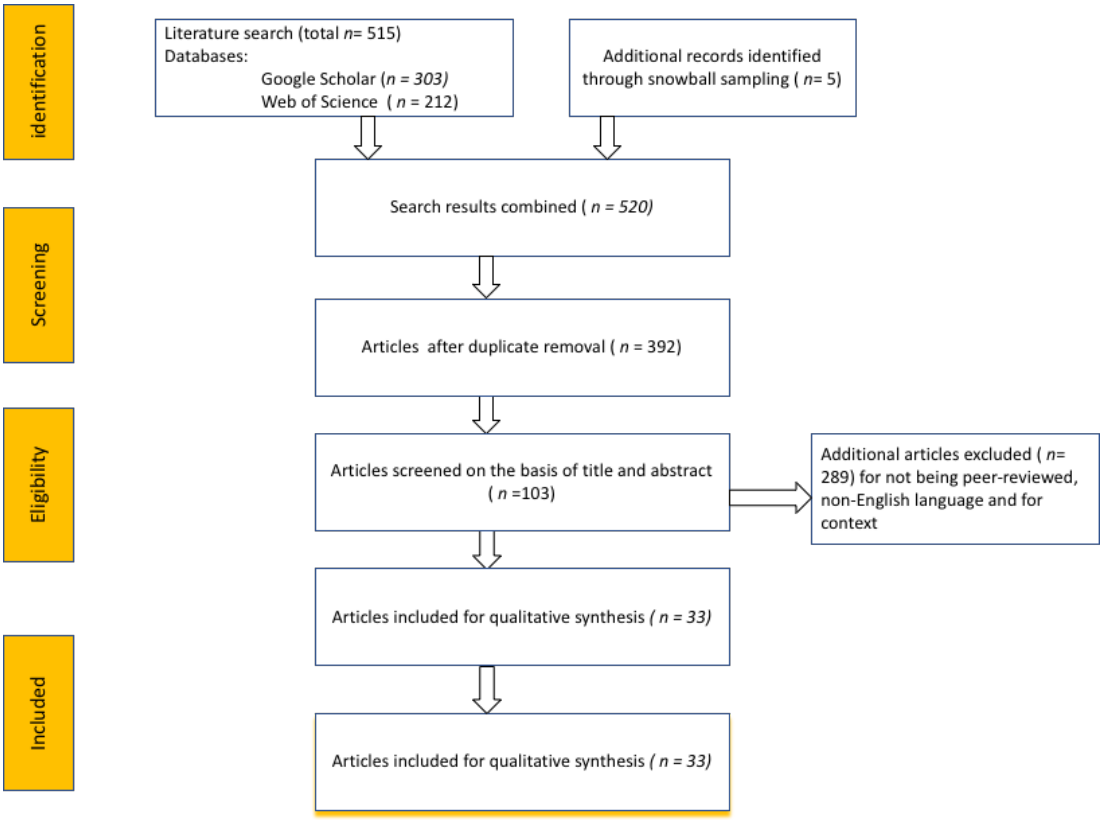
In this section, we first describe the results about the state of the literature. Next, we highlight the elements of just transition for fossil fuel workers and their communities that scholars in different academic fields identify and use the legal geography 'JUST' framework to characterize each element in terms of justice forms, space & time (Heffron & McCauley, 2018).

## 3.1 State of the literature

Our search yielded 520 articles (**Figure 3**). Of these, 515 articles were identified by the database search and 5 others were found via the snowball method. After applying the inclusion criteria, we identified 33 articles for full-text review and analysis. These 33 papers are written by scholars from different academic fields: labour, economics, geography, law, urban studies, energy transitions and policy, and interdisciplinary studies.

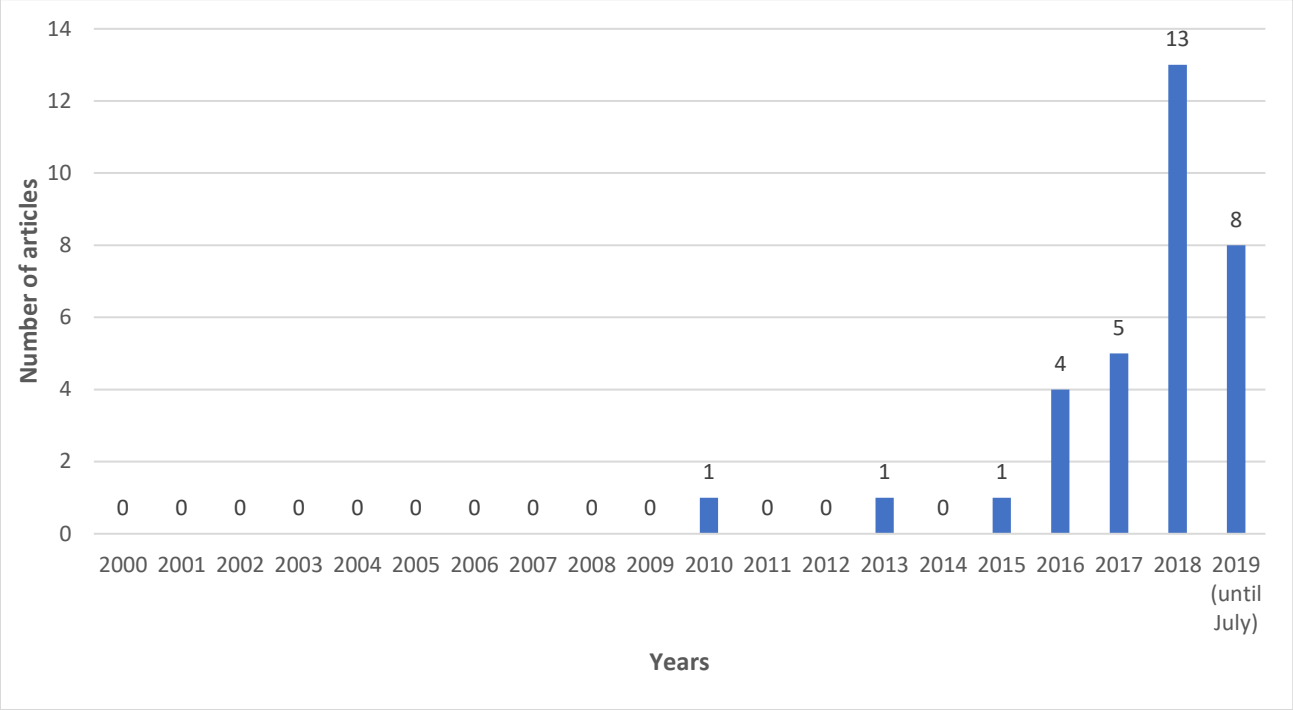
[2] We choose this timeline keeping in mind the PPCA's timelines for phasing out coal-fired electricity generation by 2030 in Organisation for Economic Co-operation and Development (OECD) countries and by 2050 in all countries. Thus, by choosing this timeline, the characterization might be useful for policymakers in countries such as Canada that has decided to phase-out coal by 2030.

**Figure 3: Search results reported in the PRISMA flow diagram**




The number of articles focusing on just transition in the context of climate change has increased since 2015 (**Figure 4**). This increased focus on this topic can be possibly attributed to the adoption of just transition as a principle by the United Nations Framework Convention on Climate Change during the 2015 Paris Climate accord (Cha, 2017; Healy & Barry, 2017).

**Figure 4: Number of articles focused on just transitions for fossil fuel workers & communities per year**

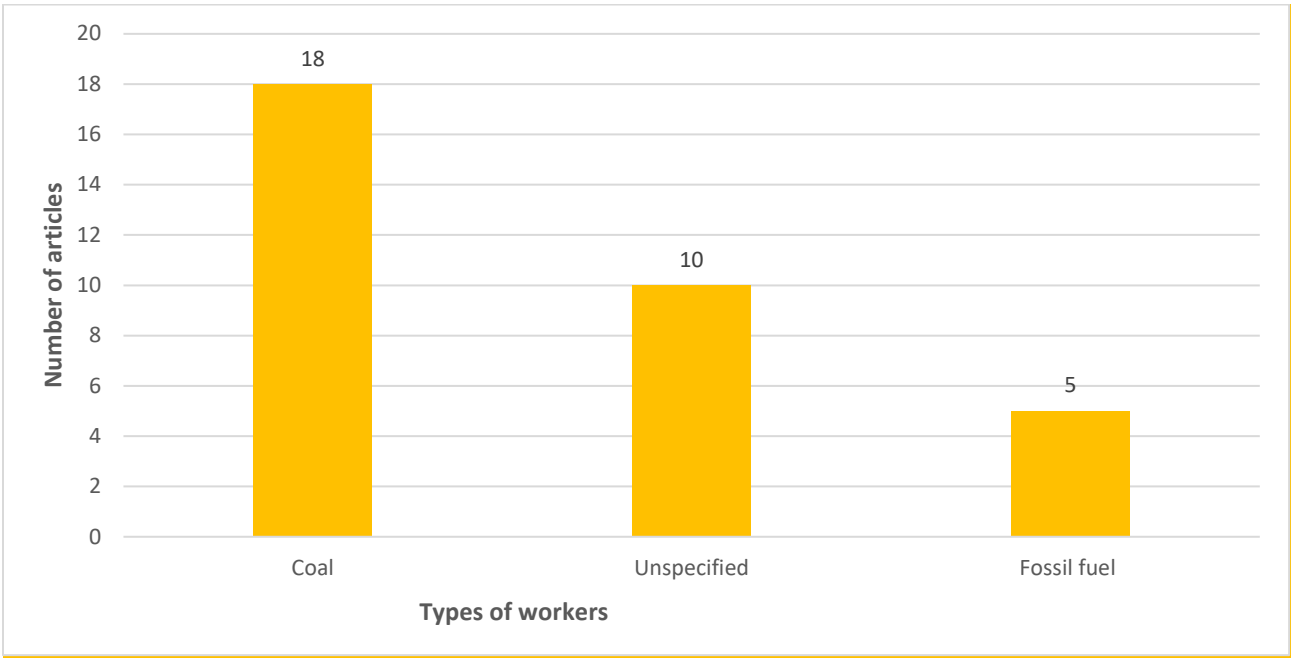



Scholars are focusing much more on coal workers compared to other fossil fuel workers (**Figure 5**). This is not surprising given that coal is already in decline in some western countries (Jewell, Vinichenko, Nacke, & Cherp, 2019) and coal jobs have become a topic of heated political debate in some of these countries.

Coal is arguably more readily substituted within the electricity sector while natural gas has itself been a substitute for coal. The transportation and industrial sectors (e.g. process heat) have less readily available substitutes at the moment. Moreover, the combination of higher emissions per unit energy and lower cost of replacement suggests a greater urgency to replace coal than other fossil fuels. Modelling scenarios in the IPCC special report find that to keep

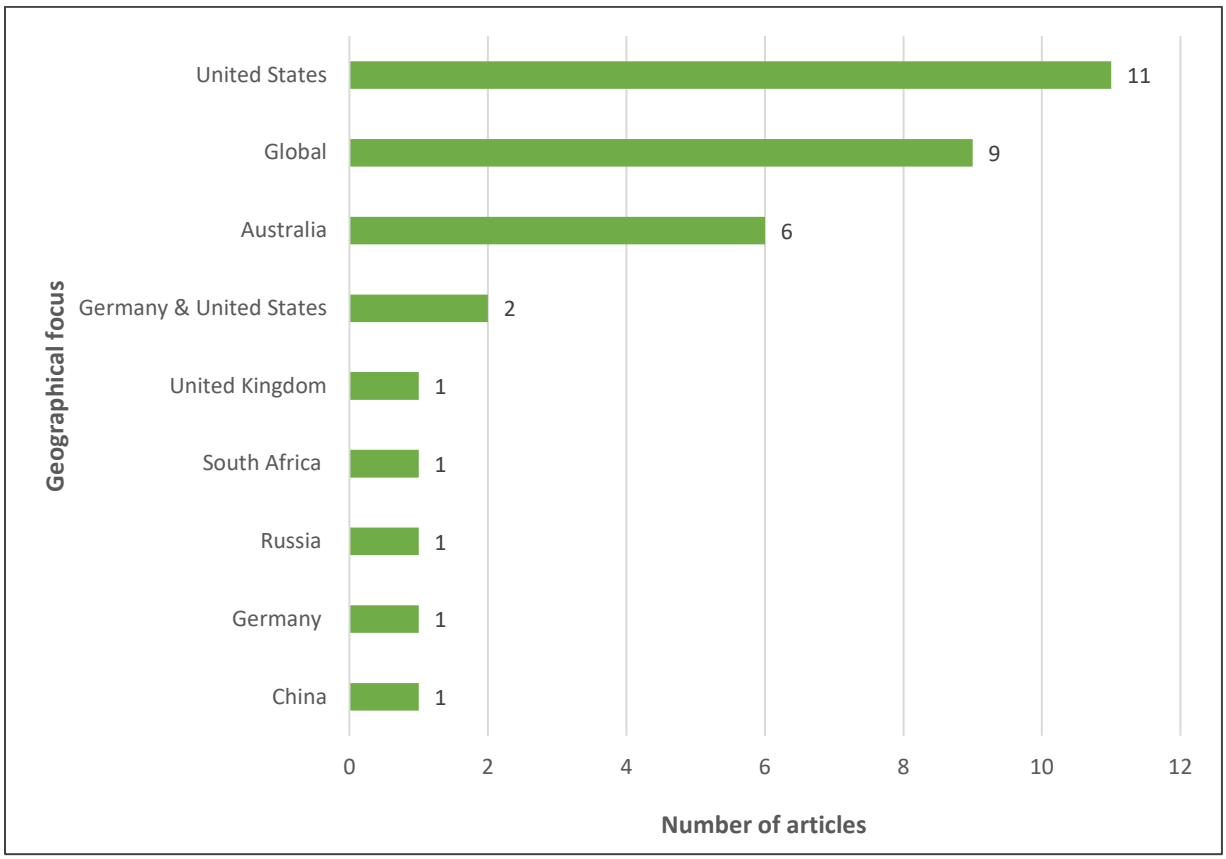
global warming below 1.5°C, the share of coal in total primary energy supply will need to decrease by 59-78% by 2030 and 73-97% by 2050 (IPCC, 2018).

**Figure 5: Just transition articles focus mostly on coal workers**




To date, much of the scholarly focus has been on workers in the US and Australia, while some literature has eschewed regional analysis in favour of a global scope (**Figure 6**). We identified one (English language) article each on China (Zhang, Y., & Wang, 2018), Russia (Martus, 2019) and South Africa (Swilling, Musango, & Wakeford, 2016). Remarkably, no article specifically focuses on major coal producers such as India and Indonesia or oil producers such as Saudi Arabia, Iran, Iraq, Brazil, Venezuela, and Nigeria.

**Figure 6: Geographical focus of just transition articles**




Out of the 33 articles reviewed here, 5 articles attempted to offer theoretical or conceptual advancements concerning just transition (**Table 2**). Pollin & Callaci (2019) is a more policy-focused conceptual framework applicable in the context of the US, while the rest are theoretical or conceptual. The latter four articles proposed just transition frameworks (Heffron & McCauley, 2018; McCauley & Heffron, 2018) or just transition management frameworks (Goddard & Farrelly, 2018), and one article focused on creating a heuristic scheme defining varieties of just transition (Stevis & Felli, 2015). Fifteen of the 33 articles conduct empirical

analysis deploying methods ranging from semi-structured interviews, qualitative document analysis to spatial regression approach using Geographical Information Systems. The remaining articles are normative and/or descriptive in nature and highlight the importance of just transition for furthering energy transitions.

**Table 2: Description of theoretical/conceptual advancements**

| Sources | Theoretical/conceptual advancement |
|---|---|
| **Stevis, D., & Felli, R. (2015)** | The authors created a heuristic scheme called "varieties of just transition." Using this scheme, global trade unions' approaches are broadly divided between "affirmative" and "transformative" forms of just transition |
| **Goddard, G., & Farrelly, M. A. (2018)** | The authors created a new framework called "Just Transition Management" |
| **McCauley, D., & Heffron, R. (2018)** | Uniting the Climate, Energy, and Environmental (CEE) justice concepts, the authors created a new just transition analytical framework focusing on: (i) distributive, (ii) procedural and (iii) restorative justice |
| **Heffron, R. J., & McCauley, D. (2018)** | The authors provide a legal geography 'JUST' framework. This framework entails elements of justice, universal, space & time |
| **Pollin, R., & Callaci, B. (2019)** | The authors created an economic policy-focused just transition framework for all fossil fuel workers and their communities in the United States |

| | |
|---|---|
| | |

### 3.2 Results synthesizing just transition elements

Overall, the articles we reviewed collectively identify 17 key elements of just transition. Apart from the elements identified during the review of the academic literature, we also reviewed a few reports published in the non-peer reviewed literature as this is a highly policy relevant topic with growing non-academic literature. We have also included these articles here but have clearly highlighted them. After identifying these 17 elements, based on Heffron & McCauley's (2018) legal geography 'JUST' framework, we classified each element in terms of justice forms, space and time (**Figure 7**).

**Figure 7: Elements classified according to justice forms, space and time**

| Elements identified | Justice forms | Space | Time | Sources |
|---|---|---|---|---|
| Long-term planning | R2 | National & state/provincial level | Long-term | (Snell, 2018), (Snyder, 2018), (Weller, 2019), (Rosemberg, 2010), (Eisenberg, 2019) |
| The role of unions | P | National & state/provincial & local level | Long-term | (Cha, 2016), (Abraham, 2017), (Stevis & Felli, 2015) |
| Community engagement | P | Local level | Long-term | (Eisenberg, 2019), (Goddard & Farrelly, 2018), (Rosemberg, 2010), (Snell, 2018), (Weller, 2019) |
| Local jobs and diversified economies | D, R2 | Local level | Long-term | (Carley et al., 2018), (Olson-Hazboun, 2018), (Prinz & Pegels, 2018), (Rosemberg, 2010), (Snell, 2018), (Snyder, |

| | | | | |
|---|---|---|---|---|
| | | | | 2018), (Lobao, Zhou, Partridge, & Betz, 2016) |
| Coal as an identity | R2 | Local level | Long-term | (Carley et al., 2018), (Bosca & Gillespie, 2018), (Haggerty et al., 2018), (Lewin, 2019) |
| The gender gap in energy sector jobs | R1, R2 | National, state/provincial & local governments | Long-term | (Rosemberg, 2010) |
| Education/ research institutions | D | National & state/provincial level | Long-term | (Herpich, Brauers, & Oei, 2018), (Witajewski-Baltvilks, 2018) |
| Worker pensions | R2, D | Local level | Long-term | (Abraham, 2017), (Cha, 2017), (Mayer, 2018), (Pollin & Callaci, 2019) |
| Just transition principles and the planning, legislative and regulatory processes | D, P, R2, | National, state/provincial & local level | Long-term | (Task force on Just Transition. 2018) |
| Job quality | R2 | National & state/provincial level | Long-term | (Cha, 2016), (Cha, 2017), (Healy & Barry, 2017), (Newell & Mulvaney, 2013), (Rosemberg, 2010) |
| Job guarantees and compensation | R1 | National, state/provincial & local level | Medium-term | (Pollin & Callaci, 2019), (Cha, 2016), (Cha, 2017) |
| Worker transition service | R2 | Local level | Medium-term | (Snell, 2019) |
| Local infrastructure development | R1, R2 | Local level | Medium-term | (Olson-Hazboun, 2018), (Cha, 2017), (Haggerty et al., 2018), (Olson-Hazboun, 2018), (Pollin & Callaci, 2019) |
| Local government revenue streams | R1, R2 | Local level | Medium-term | (Carley, Evans, & Konisky, 2018), (Johnstone & Hielscher, 2017), (Haggerty et al., 2018) |
| Communication of phase-out plans | P | National & state/provincial & local level | Short-term | (Herpich, Brauers, & Oei, 2018) |
| Environmental remediation | R1 | Local level | Short-term | (Greenberg, 2018), (Haggerty et al., 2018), (Pollin & Callaci, 2019) |

| | | | | |
|---|---|---|---|---|
| Retraining workers | R2 | Local level | Short-term | (Cha, 2017), (Mayer, 2018), (Olson-Hazboun, 2018), (Pollin & Callaci, 2019), (Rosemberg, 2010), (Vona, 2019) |

**Distributional justice - D, Procedural justice - P, Restorative justice - R1, Recognition justice - R2**

### *1. Long-term planning*

Many scholars emphasized the importance of long-term and strategic planning at the national or state/provincial level as a key to just transition (Snell, 2018; Snyder, 2018; Weller, 2019). Snyder (2018) points out that governments will have to pay for energy transitions—either they would pay now for just transition or pay later when these regions suffer (e.g. for nutrition programs, health care programs, and law enforcement schemes). The first step in long term strategic planning is to identify areas that might be most impacted by decarbonization well before the plans for decarbonization are implemented. Currently, there is a considerable lack of research on areas most vulnerable to decarbonisation and about the social and employment implications of climate policies. This kind of research need to happen even before the just transition policies are created and implemented (Rosemberg, 2010). Next, Weller (2019) argues that targeted efforts would need to be made to ensure that impacted communities are helped through policy interventions. Any long-term planning should also be coordinated between national and provincial/state levels and must consult all stakeholders who might be impacted as a result of transition (Weller, 2019). Eisenberg (2019) states that federal and state governments in several countries might already have some policies in place that may be incorporated as part of the just transition (e.g. employment insurance). It is pertinent to consider these existing policies for planning the new policies.

Overall, the literature highlights the fact that there is a need to recognize regions that might be most impacted by decarbonization (recognition justice) **(Figure 7)**. Moreover, the literature is also clear about the need for long-term planning and coordination between the national and state/provincial levels.

### *2. The Role of Unions*

Globally, fossil fuel industries have higher rates of unionization compared to other industries (Cha, 2016). One reason is that the majority of fossil fuel production at a global scale is done by state owned companies, who have traditionally encouraged unionization (Natural Resource Governance Institute, 2019). For example, the Indian federal government-owned Coal India Limited (CIL), the world's largest coal mining company, accounts for nearly 85% of coal production in India and has a nearly 100% unionization rate (Pai and Carr-Wilson, 2018). Thus, job losses in the fossil fuel industries might increase tension between unions and pro-environment stakeholders as unions attempt to save the jobs of their members. To make sure that powerful unions don't impede transitions, it is seen as important to have them be part of any just transition plans (Cha, 2016). Several scholars view dialogue with unions as vital for creating just transition plans (Abraham, 2017; Stevis & Felli, 2015) as unions can play an important role in implementing just transition programs and can act as partners in programs such as retraining (Cha, 2016).

Overall, the literature states that policymakers should engage with unions in an equitable manner (procedural justice) in the just transition process **(Figure 7)**. By necessity, the process of engagement needs to be long-term if unions are to be made partners in just transition plans. This needs to happen at different scales—national, state/provincial, and local levels because

unions are not a homogenous group operating only at one level. For example, Unifor, Canada's largest union operates throughout the country but has many local branches representing different types of oil sands workers, such as construction workers and trades people among others (Pai and Carr-Wilson, 2018).

### *3. Community engagement*

Several scholars emphasized that dialogue with the local community is key to a successful just transition (Eisenberg, 2019; Goddard & Farrelly, 2018; Rosemberg, 2010; Snell, 2018; Weller, 2019). Olson-Hazboun (2018, p. 372) writes "...marginalized energy communities are likely to continue to align with fossil fuels industries unless they are genuinely engaged in the decision-making and benefit-sharing processes of the low carbon transition." Goddard & Farrelly (2018) argue that not engaging extensively with affected communities usually results in the politicization of energy transition in the name of "jobs vs the environment." Goddard & Farrelly (2018) emphasize that the niche actor networks could be established between workers, communities and niche industries and such networks could be aided by national governments. For example, current niche sectors such as renewable energy companies could form networks with the community members and unions in fossil fuel producing regions to counter the "jobs vs the environment" claims.

Since just transition frameworks or policies apply to local communities including workers, and any meaningful community engagement would require incorporating procedural justice principles **(Figure 7)**. This implies that all relevant stakeholders should get a fair chance to participate in the just transition planning process. Providing evidence in the case of just transition policy making in Victoria, Australia, Weller (2019) states that there is currently a

tendency among policymakers to take a top-down approach in making just transition plans and not engage with affected communities. Moreover, the above literature also highlights that the community engagement must be with the affected local community and should be throughout the transition process (long-term).

### *4. Local jobs & diversified economies*

The importance of local jobs and creating a diversified economy was highlighted by many scholars (Carley et al., 2018; Olson-Hazboun, 2018; Prinz & Pegels, 2018; Rosemberg, 2010; Snell, 2018; Snyder, 2018). Creating local jobs and diversified economy may be particularly important for the coal industry as there is historical evidence that when coal mining industries decline, most workers don't migrate when they lose their jobs due to a strong sense of belonging, and the fact that most are older and less skilled (Beatty & Fothergill, 1996; Danson, 2005; Fothergill, 2001). Scholars suggest that local analysis should be conducted and an economic diversification plan should be made based on the outcome (Lobao, Zhou, Partridge, & Betz, 2016). Snyder (2018) highlights the example of the Appalachian Regional Commission in the US that provides business development grants to private enterprises to invest in different industries in the region and help create more diversified employment. Prinz & Pegels (2018) advocates that clean energy jobs should be created in structurally weak regions as these jobs can be a driver of clean energy policies.

The literature highlights the fact that any low carbon transition will result in both job creation and job destruction. Policymakers and other concerned stakeholders operating within a just transition framework will have to both recognize the differential social and economic impacts of having winners and losers of this transition (recognition justice) and develop policies to

ensure equitable distribution of burdens and benefits of energy-related decisions (distributional justice) **(Figure 7)**. For example, as noted above, coal workers have been less mobile compared to other workers and a just transition approach could recognize their unique situation and seek to create local jobs by diversifying the economy (distributional justice) in terms of post-transition employment. By necessity, this would then require long-term plans as different fossil fuel industries might decline/close down at different times depending on national policies and market conditions.

### *5. Coal as an Identity*

Scholars focusing on coal workers, particularly coal miners, highlight that miners have a strong sense of belonging to the place where they live and work (Carley et al., 2018; Bosca & Gillespie, 2018; Haggerty et al., 2018; Lewin, 2019). Coal is an identity issue in these communities, which is amplified by attachment to location, landscape, and personal networks (Carley et al., 2018). In just transition policies and planning, it would be essential to acknowledge people-place attachment of global coal mining communities (GCMC) (Bosca & Gillespie, 2018). Coal communities often use generational identity as a legitimating factor to support the coal industry. For example, Bosca & Gillespie (2018) analyzed written public submissions regarding the development of a coal mining project in Lithgow, New South Wales, Australia and found that coal miners supporting the coal mine development often wrote emotionally about how coal has supported their families for several generations (Bosca & Gillespie, 2018).

Given the fact that coal is also an identity issue for workers and their communities, scholars suggest that just transition plans should acknowledge (recognition justice) this local identity **(Figure 7)**. So far, no study has conveyed how this can be done. However, since this local

identity is strongly embedded in coal communities, it might be necessary to recognize this throughout the transition planning process (long-term). While no scholarly work has highlighted the identity issue with respect to other fossil fuel workers such as oil workers, it might also be relevant to other fossil fuel workers.

### *6. The gender gap in energy sector jobs*

Fossil fuel industries' jobs historically have been dominated by men. According to the International Renewable Energy Agency (IRENA), the share of women in the oil & gas industry is merely 22% (IRENA, 2019). Rosemberg (2010) fears that there is a risk that women will not enjoy the fruits of the clean energy transition. There is very little discussion about this element within academia or in just transition policies, which highlights the need to recognize this historical injustice (recognition justice) and ensure that future just transition work focuses on restoring this gender gap (restorative justice) **(Figure 7)**. This kind of gender gap in energy sector employment exist all levels (national, state/provincial, local) (IRENA, 2019), thus by necessity it should addressed at all levels. Moreover, given the long historic injustice, (Rosenberg, 2010) states that addressing gender gap in new jobs must be part of a long-term agenda.

### *7. Education/ research institutions*

Herpich, Brauers, & Oei (2018) argue that Governments could encourage the creation of educational and research institutions in fossil fuel regions as they can play an important role in shifting a fossil fuel/ mining region towards a knowledge-based economy. For example, in the 1960s the Ruhr region in Germany (historically a hard coal mining region) did not have a single university. However, the German government supported and financed the creation of several

universities. By 2014, the region hosted 22 universities that attracted 250,000 students. “The deployment of the universities enabled a shift from the mining economy towards an economy based on high-value adding sectors (such as the lead markets in the Ruhr area) with increased demand for highly skilled workers and research-based innovation” (Herpich et al., 2018, p. 24). Apart from the universities and research institutions, Witajewski-Baltvilks, Lewandowski, Szpor, Baran, & Antosiewicz (2018) in their report for the *Instytut Badań Strukturalnych* state that education at secondary and tertiary levels must be updated keeping the future labor requirements in mind.

Given the key role educational and research institutions could play in shifting a fossil fuel/ mining region towards a knowledge-based economy, the national & state/provincial level governments could develop policies and provide funding (where feasible) for creating such institutions in areas affected by decarbonization (Herpich, Brauers, & Oei, 2018). This will ensure equitable distribution of burdens and benefits of energy transitions (distributional Justice) **(Figure 7)**. Moreover, creating such institutions would require long-term support from these governments.

### *8. Worker Pensions*

Generally, just transitions work tend to focus on current workers and fail to recognize the large number of pensioners who will be negatively affected as a result of energy transitions away from fossil fuels. In the US, the number of pensioners is almost equal to the number of coal workers (Pai & Zerriffi, 2018). Many leading coal companies, like Murray Energy, are claiming bankruptcy and putting the pensions of thousands of workers in jeopardy (Randles, 2019).

In India, the current number of coal mining related pensioners (0.5 million) is nearly same as the number of coal miners in the country (Sengupta, 2018). As a result, several scholars advocate for pension protection of forced and naturally retired workers (Abraham, 2017; Cha, 2017; Mayer, 2018; Pollin & Callaci, 2019). Mayer (2018), who studied local policymakers' perspectives on just transition policies in the Mountain West region in the US, found that over 70% of surveyed local government policymakers support pension protection. There is also evidence that this kind of pension protection is hailed by fossil fuel communities in some countries (Abraham, 2017). For example, Abraham (2017) found that a deal between The IG Bergbau, Chemie, Energie (IGBCE) trade union and the German government guaranteeing pension for early retiring coal workers was lauded by the local workers as a good just transition measure (Abraham, 2017).

In many countries, the fossil fuel companies pay money into a pension fund that supports workers after retirement. In such places, government regulations could ensure that fossil fuel employers honor their pension commitments and, where these companies are in genuine crisis, the federal government may have to consider taking over the obligation for workers' pensions (Pollin & Callaci, 2019). Future work on just transition should assess pensioners (recognition justice) as a key group directly affected by energy transitions in terms of distributional justice **(Figure 7)**. Such work would also have to take into account both the spatial differences between pensioners given differences between fossil fuel regions within a country and the long time-frame of pension protection as any just transition policy in this area would need to be in place until the death of pensioners, and potentially surviving spouses.

### *9. Just transition principles and the planning, legislative and regulatory processes*

Among the ten recommendations of the Task force on Just Transition (2018, p. ix) for Coal Power Workers and Communities in Canada was the need to embed just transition principles in the planning, legislative and regulatory process. While considered important enough by the task force to include in its recommendation list, it is not a topic that has been included in the academic literature on just transition. The task force recommends that the government incorporate "…just transition in federal environmental and labour legislation and regulations, as well as relevant intergovernmental agreements." Integrating just transition into policy, planning and regulation would require consideration of multiple forms of justice. Legislation, policy and regulation will always have differential impacts across affected parties raising questions around equitable distribution of burdens and benefits of energy-related decisions (distributional justice). Correspondingly, those costs and benefits may accrue differently across regions and would raise questions about how particularly vulnerable regions and communities are being recognized (recognition justice). Finally, engagement with communities (procedural justice) on a long-term basis at every level may be necessary for successful implementation **(Figure 7)**.

### *10. Job Quality*

A number of scholars argue that it is important to create "decent" jobs for fossil fuel workers be they in the clean energy or any other industries (Cha, 2016, 2017; Healy & Barry, 2017; Newell & Mulvaney, 2013; Rosemberg, 2010). Decent jobs are generally defined as those that are high-quality, attractive to people who lose employment in traditional industries, and maintain prevailing wage standards and labor agreements (Cha, 2016). Furthermore, Newell & Mulvaney (2013) suggest that the new jobs should be made accessible to people from a variety of

backgrounds and skill sets and provide future career progression. Healy & Barry (2017, p. 455) states that mere "job creation is clearly a poor proxy for a just transition—what matters more is the kinds of jobs, how secure they are, how long they last, and related forms of community resilience and innovation in the face of dynamic energy markets."

Within academia and outside, the main focus has been on transitioning fossil fuel workers to clean energy jobs. Numerous media reports and research by international organisations and scholarly work have highlighted that fossil fuel workers could be transitioned to the growing renewable energy industry jobs (Cardwell, 2017; ILO, 2018; Louie & Pearce, 2016). Recent studies have also claimed that in the long run renewable energy jobs such as solar and wind jobs could offset fossil fuel industry job losses (ILO, 2018; IRENA, 2018). However, no study has focused on whether these new renewable jobs or any new jobs are secure or long-term or whether they pay comparable salaries. This kind of analysis is particularly important as historically it has been seen that after any industrial decline/closure, workers who found new jobs earned less and were forced to do part-time jobs (Minchin, 2009; Danson, 2005). In the UK, across industries, for workers who lost employment in old industrial regions, "the route out of non-employment for those without work may well be through insecure, low-paid and dead-end jobs" (Danson, 2005, p. 455).

Thus, understanding the nature of new jobs (renewables or otherwise) at national and state/provincial would be crucial for any just transition plans geared towards transitioning fossil fuel workers (recognition justice) **(Figure 7)**. Moreover, in the current energy transition, different kinds of jobs will be created as new climate mitigation technologies are deployed in

the future. Hence, understanding the nature of new jobs is considered by scholars a long-term goal.

### *11. Job guarantees and compensation*

Though some scholars highlighted that job guarantees and compensation plans must be created for workers losing employment due to decarbonization (Cha, 2016, 2017), only one scholar provided specifics on a possible plan. For the US, Pollin & Callaci (2019) recommend a 'job guarantee program' that provides guaranteed jobs for all laid-off fossil fuel workers in clean energy industries. Pollin & Callaci (2019) further say that such a program should provide compensation for workers for their loss of salary (restorative justice) for a period of five years (medium-term). During this period, the worker must be guaranteed the same salary and benefits as what they used to get while working in the fossil fuel industry. So, if a worker gets a job in the clean energy industry, the gap in salary and benefits must be covered by the state. Based on the above criteria for 'job guarantee program,' and considering a scenario where fossil fuel industries decline as a result of a 40% decline in US emissions by 2035, Pollin & Callaci (2019) estimate that $200 million per year would be required to compensate all fossil fuel workers who would be laid off during this period. While the example provided is for the US, the details of such a program would be country-specific, as would the assessment of political and economic feasibility.

### *12. Worker transition service*

When industries decline, workers usually need guidance to cope up with the loss of livelihood and for making plans for employment transition (Snell, 2018). Thus, worker transition service centers in fossil fuel regions could provide one-on-one service to all workers in need.

The officers involved in the worker transition service centers could cater to the "needs, challenges, and interests of workers and advocate for them by negotiating with training providers to offer training courses and introducing them to other employment service providers" (Snell, 2018, p. 557). There is evidence that such centers have been successful in some jurisdictions. For example, Snell (2018) states that worker transition service centers were created in Latrobe Valley, a coal region in Victoria, Australia and of the 430 displaced workers who registered at these service centers, nearly 60% were employed again within 6 months. Each worker transition service would have to identify individuals and groups who might be impacted (recognition justice) and provide assistance to them **(Figure 7)**. These centers would need to be easily accessible to workers, meaning they be local and run for a few years to ensure that all affected worked are helped.

### *13. Local infrastructure development*

Some scholars emphasized the importance of funding local infrastructure development (Cha, 2017; Haggerty et al., 2018; Olson-Hazboun, 2018; Pollin & Callaci, 2019) that might have been so far supported by taxes and revenues from fossil fuel industries. Such funding would have to be based on local contexts as different local regions have different dynamics that makes each regions' needs unique (Eisenberg, 2019). From the literature, it is clear that recognizing local contexts (recognition justice) and restoring local infrastructure (restorative justice) is considered crucial for a just transition **(Figure 7)**. Olson-Hazboun (2018) said that such funding should come from federal or state/provincial governments and must be for a reasonable time period (medium-term).

### *14. Local government revenue streams*

Many fossil fuel regions, especially coal-dependent regions, are dominated by that single sector economically (Carley, Evans, & Konisky, 2018; Johnstone & Hielscher, 2017). In these regions, if coal mines and power plants close, local governments fear losing their largest source of revenue. Thus, transition plans could entail a fiscal strategy to address any loss of revenue (fully or partially) due to fossil fuel industry closures. One way to negate the shortcomings in revenue is by creating a transition revenue and investment strategy that includes "local revenue strategies, state and federal assistance, and a spending strategy linked directly to economic development goals" (Haggerty et al., 2018, p. 77). Haggerty et al. (2018) suggested that since local governments play a significant role in providing a variety of services to rural communities, just transition plans should replace the portion of a local government's revenue stream that derived from coal mining and coal power plants.

For replacing and stabilizing local government revenue streams, the recognition and restorative forms of justice are applicable as it is pertinent to first recognize which local government are vulnerable to revenue losses and adopt the right strategies to restore the loss in these revenues **(Figure 7)**. This kind of assessment and implementation may vary across countries and different regions within countries, thus, such strategies would need to be local and locally implementable. Moreover, the funding or support from federal or state/provincial governments needs to consider the fact that stabilizing local government revenues might sometimes take more than short-term intervention especially in cases where fossil fuel industries provide the bulk of a local government's revenues.

### *15. Communication of phase-out plans*

Herpich, Brauers, & Oei (2018, p. 22) recommend that communication about the fossil fuel industry phase-out should be made as early as possible to "ease the disruptiveness of upcoming changes, by helping former coal miners [or fossil fuel industry workers] to stay in the labor market..." As not much has been written about this element, it is not clear what should be the mode of communication or what are the best practices for effective communications for fossil fuel phase-out plans. However, the manner in which phase-out decisions are made and communicated is likely critical to ensuring procedural justice. This would include a fair process for including different stakeholders to take part equitably in the decision-making process even at the idea stage of phase-out (**Figure 7)**. It is also obvious that this kind of engagement about fossil fuel phase-out needs to happen at all levels in the short-term.

### *16. Environmental remediation*

Fossil fuel extraction often negatively impacts landscapes and waterbodies, with potential effects on both human health and ecosystems. Remediation of those landscapes and systems can be seen as a form of restorative justice **(Figure 7)**. The required remediation would be specific to each local site, such as specific coal mining areas, and could be expected to take a couple of years (Pai & Carr-Wilson, 2018). Three scholars suggested that decommissioning of fossil fuel infrastructure and environmental remediation in fossil fuel areas could provide several benefits (Greenberg, 2018; Haggerty et al., 2018; Pollin & Callaci, 2019). In the short-term, decommissioning fossil fuel infrastructure or reclaiming old coal mining sites would provide economic opportunities in the form of investments and job creation (Haggerty et al., 2018; Pollin & Callaci, 2019). Later, remediation would help create access to recreational activities that can help combat negative economic consequences of legacy contamination

(Haggerty et al., 2018). Greenberg (2018) recommends that a fund be created for environmental remediation and priority for remediation jobs could go to former miners and local community members in the area.

### *17. Retraining workers*

Many scholars emphasized the importance of retraining (Cha, 2017; Mayer, 2018; Olson-Hazboun, 2018; Pollin & Callaci, 2019; Rosemberg, 2010; Vona, 2019) and one scholar who studied local policymakers' perspectives on just transition policies in the Mountain West region in the US found that nearly four-fifths of local government policymakers surveyed expressed support for retraining (Mayer, 2018). Pollin & Callaci (2019) claim that while some jobs in the clean energy industry are similar to jobs in the fossil fuel industry, others are different and retraining fossil fuel workers and preparing them for jobs in the clean energy industry is a critical element of a just transition. The authors calculated that $65 million per year would be required in the US to retrain all laid-off fossil fuel workers to clean energy jobs. This assumes the fossil fuel industry declines as a result of a 40% decline in the US emissions by 2035. Recognition justice would require that retraining programs aimed at helping fossil fuel workers appropriately identify the workers affected by energy transitions, the skills they possess, and the skills required for them to be working in clean energy industries or other industries. Moreover, as suggested by some scholars, workers would need to be provided easy access to such short-term skill-specific programs.

## 4. Discussion & Conclusion

Scholars in academic fields such as labor, economics, geography, law, energy transitions and policy have sought to identify and explain different elements (or strategies) of a just transition

for fossil fuel workers and communities. While individually these studies make important contributions, no systematic review has been conducted in the past synthesizing all these just transition elements. Using a systematic search and review strategy, we analyzed 33 articles that focused on just transition for fossil fuel workers and their communities in the context of climate change. In addition, we also analyzed key reports by national commissions on just transition and reports by select think tanks.

Our review points to three main findings. Firstly, the field is still new, and most studies focus on a few industrialized countries (although some have a global focus). Given the fact that millions work in the fossil fuel industries in countries such as India, China, Brazil and Middle-eastern countries (all major fossil fuel producers), future just transition work must focus on expanding the geographic scope to better understand similarities and differences in the transition process. Moreover, so far, just transition studies have largely focused on coal workers. That is partly justified given the carbon footprint of coal, but future studies could focus on enhancing the field and understanding of just transition by focusing on oil and gas workers and comparing across fossil fuels and across fossil fuel-intensive sectors. In addition to differences in industry structure, workers in other sectors may have different attributes than coal workers in terms of their working conditions, skill sets, salary structure, and mobility. Thus, depending on these attributes and the needs of workers, the just transition plans might look very different. Future work could also pay attention to lessens that can also be learnt from other non-fossil fuel sectors also experiencing transition.

Secondly, we found that the literature so far contains both quantitative and qualitative studies, as well as theoretical studies, but is largely normative and/or descriptive. Future research could

focus on contributing to the empirical literature including conducting more qualitative and quantitative studies of just transition options, and by creating actionable just transition frameworks for various jurisdictions.

Thirdly, our review collectively generated 17 key elements of just transition (**Figure 7**), which range from the requirement of long-term planning to importance of retraining. In this review, we explain these elements further by using Heffron & McCauley's (2018) legal geography 'JUST' framework to characterize each of these elements based on justice forms, spatial and time scales. For justice forms, for each element we identify "what justice is needed and/or expected." Moreover, we also characterized each element on the basis of spatial scales (national, provincial/state and/or local level) and time (long-term, medium-term and short-term). By characterizing each element, we show that for designing various just transition strategies policymakers should pay attention to different justice forms. These elements also vary spatially suggesting the involvement of different stakeholders at different levels of government in the transition process. Moreover, given the timelines of interventions (long-term to short-term) involved, our findings emphasize the need to undertake holistic planning to meet the goals of just transition. Here, by characterizing these elements, we make a first attempt to further scholarly and policy focused understanding of each of these elements and showing how theoretical concepts (such as justice forms) need be used while designing specifics of just transition plans involving each identified element. However, our characterization of the elements should not be considered as the only way to characterize these elements and must be taken as a starting point for deeper future analysis into each element.

Our first two major findings highlight major gaps in the literature and points to areas where future research is required. Moreover, by identifying just transition elements and characterizing each element on the basis of justice forms, space & time, we also contribute to the scholarly understanding of the emerging field of just transitions for fossil fuel workers and their communities. The elements we identify here are a good starting point for scholars in the field to conduct future research. Moreover, these elements can also provide policymakers insights into where to target their efforts in creating just transition strategies. However, it must be noted that the elements highlighted in this paper are not an exhaustive list and many of these elements are poorly defined in the literature. For example, many scholars identify retraining workers as critically important for helping fossil fuel workers transition to new jobs. However, the articles about this element are either descriptive or have focused on costs associated with retraining fossil fuel workers to jobs in clean energy industries. So far, no study has focused on the kinds of skills required for working in clean energy industries or, for that matter, whether emerging jobs in a given economy are more likely to be found in non-energy industries. Future studies could focus on identifying how to make retraining programs more effective and in line with new job requirements whether in clean energy or other industries. Future work could also focus on assessing whether existing institutions currently running retraining programs are equipped to provide desired retraining for new kinds of jobs.

Overall, future work in this area needs to provide more evidence and clarity on each of these just transition elements. There is also a need for greater realism in future scholarly work, particularly focusing on remote fossil fuel-based communities where creation of equally well-paid jobs on a similar scale may prove challenging. Lastly, while many scholars are examining

just transition strategies, none of the scientific articles so far has systematically incorporated the views of fossil fuel workers such as coal workers and their communities into the key features and elements of a just transition. This is a major gap and remains an area of future research.

For the political feasibility of energy transitions required to meet the global climate targets, scholars believe that implementation of just transition strategies for fossil fuel workers and their communities could be important. Others argue that there is an ethical obligation to provide for the well-being of fossil fuel workers and their communities as the world transitions to low carbon sources. This paper identifies elements that are considered vital to just transition strategies, but scholars, citizens, and policymakers need to critically assess and implement these elements to ameliorate opposition from fossil fuel workers and their communities to the much-need low carbon transitions.

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