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First published 2019

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Funding: This work was supported by the ESRC and The Panalpina Group

Keywords: governance, circular economy, sustainability transition, China, UK, standards

1.0 Introduction

Sustainability transitions are well established as multi-level heuristics (Kemp, 1994, Geels, 2002) and there is growing interest in the ways in which different modes of governance are enabling and/or constraining potential transitions (Manning and Reinecke, 2016). Such approaches to governance also provide normative guidance to shape transitions (Svedin et al., 2010). With regard to improving sustainability, the global wastes and resources sector has traditionally been viewed as a laggard. More recently, though, the sector has been perceived as playing a key role in sustainability transitions: it is central to practices on the Circular Economy (CE) where wastes are characterised as resources. There is now a burgeoning literature in the West and China on rethinking the waste economy. Much of the literature is practice-led as it seeks to document changes in materials, processes and markets. Meanwhile, important contributions in the academic literature are seeking to describe the changes in the sector, particularly relating to concepts of the CE, and what those might mean for the nature of sustainable resource management (Merli et al., 2018). Typically, innovations have been small scale and niche (De Jesus and Mendonça, 2018).

The next stage in progressing a sustainability transition in resource use is to more consistently scale up and diffuse such activities. In doing so, a range of governance tools, like regulations, market-based incentives and standards, are being examined as ways to help steer change (Manning and Reinecke, 2016, Wijen and Chiroleu-Assouline, 2019). These tools are deployed in a variety of ways across time and space as governments and private sectors, and to a lesser extent citizens and Non-governmental Organisations (NGOs), interact to actively manage current politico-economic arrangements and shape future ones (Lieder and Rashid, 2016).

In this article, we examine the nature of moves towards a sustainability transition in the wastes and resources sector via a focus on voluntary standards. In doing so, we highlight how governing arrangements, particularly moves from a government-managed wastes sector to a more private-led resources sector, are shaping the ways in which a transition occurs and the nature of that transition. This matters greatly because the contestation that surrounds the CE is rarely connected to forms of governance. Yet it is the governance arrangements and the intertwining of meanings linked to the CE that will be critical in shaping the direction and pace of change. Ultimately, a better understanding is needed of how different sustainability transitions may be opening or are being closed by rival actors and their differing interpretations of the governance of the CE.

2.0 Theoretical Overview

In the sub-sections below, waste and resources management are examined in relation to sustainability transitions. This sets up, in section 3.0, a critical framework on the ways in which governance in China and the UK can be compared to identify alternative pathways towards CE activities at a range of scales.

2.1 Sustainability Transitions

There are three main types of heuristics based on innovations designed to effect sustainability transitions, each of which has different implications for the CE: Innovation Systems (IS), Systems Innovation (SI) and Sociology of Expectations (SOE). Each strand of theorizing provides insights into how and why transitional change may occur.

An IS approach assumes a structural/functional underpinning to change caused by external shocks to the system (Dosi et al., 1988, Geels, 2010). Radical change can only come about as a result of external events such as a global economic recession or an oil crisis which dramatically affect the market prices of materials. Such price hikes in turn can change public and private attitudes towards the recycling and reuse of materials (e.g. Ackerman and Gallagher, 2002, Angus et al., 2012). Moves towards a CE, require a significant change in the volume of *global* flows of materials and this would only likely happen in the wake of highly disruptive international events. Some indication of the direction of change arises from the decision of the Chinese government in 2017 to raise the standards of imported recycled materials which effectively closed a major market to Western exporters (see 3.3 below) (Ross, 2017a; Ross, 2017b).

SI heuristics emerged in the 1990s in reaction to IS thinking. These models focus on the ability of niche activities to supplant a regime of rules and regulations about business and social practices (Kemp, 1994, Geels, 2002). As such, this multi-level approach to sustainable change through the diffusion of innovation foregrounds the ways in which institutions align (or misalign) over time. Radical change is more likely to occur from internal organisational shifts among key actors where the adoption of new innovation is facilitated by the removal of institutional barriers to change (Geels, 2010). In terms of the CE, the SI perspective focuses on the mechanisms needed to scale up niche-level innovative activity to supplant prior institutional arrangements at the regime level, further permitting significant flows of materials to occur. Here, the role of creating new and revised standards to facilitate trade in materials at a *range of scales* is of significance.

Social constructivist SOE heuristics emerged in the 1990s also in reaction to IS thinking (e.g. van Lente, 1993, van Lente and Rip, 1998, Borup et al., 2006). Advocates suggest that the agency of actors and the structure they face derive from learning, creativity and dynamic inter-subjective sense-making (Geels, 2010). Radical change is made possible through endogenous second-order learning activities (i.e. changes in cognitive frames) (cf. Callon, 1998, MacKenzie et al., 2007, Callon et al., 2009). In terms of the development of more sustainable technologies, varying promises (or expectations) are made by *entrepreneurs* in the face of quasi-evolutionary processes like path dependence (Garud and Ahlstrom, 1997), approaches to power and thus strategy, contestation and access to resources. These promises intersect with the different levels of risk aversion held by decision-makers who may or may not choose to fund further development of the technology. Expectations can be critical in holding together a group of actors, including officials, industry representatives, NGOs and citizens, around a shared vision, such as CE practice, which collectively they are pledged to work towards in order to achieve a range of sustainable outcomes. Kirchherr et al. (2017) analyse how key actors coalesce around shared CE meanings that can determine a programme of action. This planned direction of travel is even more important at a time of intense debate about the meaning(s) of CE practice.

While persuasive and helpful in any analysis of the CE, drawing on these strands of sustainability transition heuristics is, however, problematic. IS approaches can be critiqued for their aggregation of micro-level data to the meso-level (Coenen and Díaz López, 2010, Coenen et al., 2012, Hacking, 2017). Given the current CE policy flux, this risks missing important perceptions that individual actors hold that help shape approaches to a transition (cf. Coenen and Truffer, 2012). Similarly, it has been suggested that SI approaches, such as Strategic Niche Management, ignore the importance of individual actors' agency in determining strategy (cf. Markard and Truffer, 2008) and downplay the everyday politics of the contestation between networked groups. As with earlier technology push/pull approaches to innovation, SI approaches ignore the need for policy makers to acquire legitimacy for normative visions of socio-technical change. At the same time, positivists find the social constructivist ontology of SOE heuristics problematic because of the lack of a fixed point of objective reference (Collins and Yearley, 1992, Bijker, 1993).

One way around these challenges is to recognise the value of a sustainability transitions approach. By drawing upon a cognate perspective, micro-level details are examined when researching contested CE viewpoints. We opt for a Sociology of Knowledge (SOK) approach to our analysis (see sub-section 3.1 below). SOK has similar social constructivist underpinnings to SOE thinking. We regard analysis of contestation as critical because moves

towards CE practice are normative and open to debate. The nature of CE transitions will, in important aspects, be shaped by modes of governance and the policy instruments that are utilised. Consequently, we pay attention to the ways in which standards operate within systems of governance in order to better understand how a CE transition may be enabled or constrained (Flynn and Hacking, 2019). In other, words, policy instruments are being utilised to open and close transition opportunities. How key actors conceptualise the CE and seek to use policy instruments to pursue their goals therefore becomes an ever more important aspect of critical analyses of the CE.

2.2 Wastes, Resources and Standards

To facilitate the trade in waste and resources, there have been both public policy initiatives - such as that on the CE - and private, voluntary efforts particularly around standards (European Parliament, 2017). Standards have been identified by a number of researchers as a key tool in the governance of a sustainability transition in waste and resources (Gregson and Crang, 2019). China has been a pioneer of standards at all levels: from national, to enterprise standards (for individual companies), and the country contributes multi-laterally to the development of international standards (Guttman et al., 2018). While standards elsewhere are voluntary and nearly always led by business interests, in China, they can both underpin economic activity and be a more explicit part of the government's political leverage over other actors whether internal or external. This has led to some restructuring of the waste and resource trade in recent years. China decided to reduce and then to curb much of its imported waste paper and plastics from the West based upon the introduction of a new national standard for waste quality (Date, 2017). Reducing imports of waste materials by raising their quality is just one aspect of China's approach to the CE which will help improve the local environment in China by trying to prevent weakly regulated and polluting recycling activities. However, promoting a broader industrial transformation is the priority (McDowall et al., 2017). Any secondary benefits to CE practices may be limited (Interview CH1, 2018). Therefore, in the Chinese context, the central state's promotion of standards has been used overtly as part of a governmental approach to managing economic and social change, e.g. realising public policy goals such as curbing pollution, environmental improvement and the advancement of domestic recycling industries (Chan and Flynn, 2018).

Standards are open to several interpretations. For example, suppliers to major companies may be expected to work to a quality standard, such as ISO9001[1], or face the prospect of

[1] This standard is designated 'ISO' to reflect its status as one of a number from the International Organization for Standardization (ISO). ISO9001 involves having a quality management system (QMS) where companies use the

losing future contracts. The power relations that exist between a major manufacturer and a number of small suppliers are such that the latter feel compelled to fall into line regarding any change in standards being set by the former (Gibbon and Henriksen, 2012). Standards perform an essential but often unseen role in helping trade. For waste, where there is considerable risk of contamination or variability in the quality of a material which would reduce its value, standards help materials to flow by reassuring purchasers of what they are buying. This can be particularly important where the distance and speed with which materials flow and their sheer scale mean that regular inspections along the supply chain are regarded as impractical.

Debates on materials trade between China and the West reveal the challenges that Neoliberal Environmental Governance (NEG) is facing, of differing interpretations of the CE, and of how the CE might be realised (McDowall et al., 2017). To better understand the nature of these relationships, the UK is selected as an exemplar of NEG (e.g. quality BS5750[2], environmental management BS7750 and Circular Economy BS8001)[3]. This approach is compared with how standards are shaping the conceptualisation of the CE in China. We build on the work of McDowall et al (2017) who established that normative shifts towards CE arrangements appear more likely to occur over time in China than in Europe because of the latter's lack of consistent steering by state bodies. Our advance is to highlight how neoliberal economic relations in the UK actively undermine environmental protection because of the monetization of environmental assets and the largely voluntary nature of governance (Brenner and Theodore, 2007). As a result, it is much more problematic to promote a CE than McDowall et al (2017) suggest. To illustrate the tensions within NEG we focus on a key neoliberal policy instrument – standards – that have increasingly been moving to the fore on CE activity. By linking together policy content with a policy tool, in this case standards, we can develop a much more nuanced understanding of nationally specific conceptions of the CE and what they may mean for a sustainability transition.

Our contribution to ongoing environmental governance debates is, therefore, three-fold. First, is a critical assessment and evaluation of the contrasting social constructions of the CE in neoliberal and authoritarian countries. Second, central to this endeavour, is an analysis of the way that standards provide key insights into the unfolding nature of novel thinking on waste

standard to demonstrate their ability to consistently provide products and services which meet customer and regulatory requirements.

[2] The 'BS' standard refers to one produced by the national British Standards Institute (BSI), which is a member of the ISO.

[3] Although we are focused on the UK, we can only make our analysis with reference to the European Union (EU) because of its role in informing waste, resources and CE policy in member states. We have also drawn on primary data from individuals in the EU where it reflects on the UK context.

and resources. Third, this allows us to identify the implications of the continuing use of standards within differing governmental contexts in the development of the sustainability transition associated with the CE in both the UK and China.

2.3 Resource Management

From the 1960s and 1970s, there has been greater interest in wastes and resources management with a concomitant rise in efforts at supranational governance. As trade in wastes has grown, it has been accompanied by a set of shifting narratives, including waste dumping in Africa and Asia (Clapp, 2002, Schmidt, 2006) as well as the search for material value to help drive economies (Velis, 2014, Velis, 2017). More recently, the key narrative linked to trade in wastes has been that of the CE, a normative vision based on a multi-level sustainability transition (Loiseau et al., 2016). CE activity requires flows of materials between those countries/regions which produce waste (now conceptualised as a resource input) and those countries along a supply chain who can add further value to that material by making use of it within their processes. Within the CE, these material flows will take place at multiple levels as market operation weave between the local and the global. China has long been associated as a key trading partner for the West's waste materials. However, having spent several decades processing the West's wastes into new resources, China has rethought the viability of this business model and decided to raise the quality of imported recyclable materials. This shift has "triggered a crisis in the governance of global waste flows" (Gregson and Crang, 2019, 1). Disruptions to trade throw into sharp relief the importance of governance arrangements. There is a need for better understanding of material flows. Novel ways of examining how materials may be circulating draws attention to the role of standard setting activity such as China's 'National Sword' programme which in 2017 significantly raised the bar for minimum quality standards for the importing of wastes. In the context of the hoped-for sustainability transition via a CE approach, this improved understanding of the governance of material flows becomes ever more critical.

3.0 Governance of Standards

In this section, theoretical approaches to standards in neoliberal and authoritarian states are compared regarding environmental governance. A SOK analytical framework allows for an examination of the values, societal structures, cultures, power relations, underlying world-views and the paradigmatic potential of actors involved in the governance of waste and resources (Korhonen et al., 2018). Here we use standards to critically examine what happens when key waste and resources actors operationalise their perceptions of what the CE means. This marks an advance on earlier work because we can begin to judge the likely future resilience of the term 'circular economy' based upon an improved understanding of how and

why certain groups advocate alternative meanings. In terms of the evolution of social constructions of standards, the empirical evidence and its meaning is contested. We explain the nature of this debate conceptually later in this section and empirically in Section 5.0. Overall, in terms of the drive towards a sustainability transition in waste and resources, a SOK perspective permits a better understanding of the nature of such a transition and which actors are enabled and/or constrained in a time of distinct normative change.

From the outset, we want to be clear on the use of terminology, chiefly ‘standards’ and ‘neoliberalism’. According to Brunsson and Jacobsson (2000), a standard is a specific type of rule with three intended purposes. Firstly, they are: "Important tools for regulating individual as well as collective behaviour and achieving social order". Secondly, these policy instruments are voluntary for those who wish to use them. Though throughout our article we recognise that there are degrees of voluntariness. If a standard is to be effective it must be seen to be legitimate by those who use it and further accentuate the legitimacy of an action. Thirdly, standards are meant to be widely used (Brunsson and Jacobsson, 2000, 2). These points matter because they draw attention to the way in which a collective governance process can help to steer a sustainability transition. It is for this reason that there is increasing attention given to standards at both an analytical and normative level as a tool for promoting system change (Manning and Reinecke, 2016, 621, Wijen and Chiroleu-Assouline, 2019, 99).

For Bowker and Star (1999, 319), governance becomes more complex, because, as they point out, it is built on an "incredible, interlocking set of categories, standards, and means for interoperating infrastructural technologies". The material flows that underpin markets and international trade are, therefore, constructed on intricate relationships. Hence studying standards offers an understanding of the repercussions, arising from interactions with a growth fixated global economy that is based on neoliberal themes of trade, deregulation and a limited state. Meanwhile, we follow McCarthy and Prudham (2004, 10), who argue that neoliberal environmental governance is concerned with the ways in which relations between the state, markets and civil society become ever wider and deeper. Standards contribute to sustaining neoliberalism in ways that are more than coincident, because they help to extend and maintain markets by structuring exchanges along supply chains, whilst offering state bodies the opportunity to realise public policy objectives with less direct involvement. As Gibbon and Henriksen (2011, 130) argue, “Governing through standards is a central neoliberal technology of government.” This suggests that as the state is reconstructed in the image of the market, standards bring together expert knowledge, public-private activity and give a key role to the private sector in maintaining order, norms and quality levels across time and territories.

Standards compliment other technologies of governance such as certification and auditing and promote new spatially distantiated relations of control between political centres of decision-making and governed territory (Rose, 1993, Miller and Rose, 1990, Foucault, 1991, Barry, 1996, Dean, 1999). Political centres include sites such as London, Brussels and Beijing. While the notion of governing through standards operates at a high level with a persuasive analysis of state restructuring, it nevertheless is typically found wanting when outcomes are assessed. It is unclear how standards come to play the role that they do or how they differ between countries (Gibbon and Henriksen, 2011, Gibbon and Henriksen, 2012). These shortcomings are the focus of this article.

3.1 Sociology of Knowledge Approach

A Sociology of Knowledge (SOK) approach allows an analysis of how and why key waste and resource actors use a range of supporting evidence to justify and legitimate their perspectives. Typically, knowledge will be contested. Actors are therefore likely to seek a mutually agreed and politically sanctioned structure to the knowledge divisions upon which practice is based. These actors are considered to be continuously engaged in inter-subjective sense-making and learning around the adoption and use of standards within the context of normative moves towards the CE (cf. Vygotsky, 1934/1987).

At present, debates on the CE are marked by competing constructions of the concept rather than mutual agreement (see Section 5.1. below). An SOK approach also reveals how emergent strands of knowledge appear, are contested and evolve (cf. Berger and Luckmann, 1966, Cetina and Mulkay, 1983). In the case of the CE, a wide range of publications, from professional trade journals to academic publications, have a major role to play in meaning making and thus how waste and resources actors position themselves in relation to the use of standards (including in a future CE). Primary and secondary source data also shows these actors' broader perceptions about the nature of the relationship between industry and the state in terms of environmental regulation. An SOK approach therefore highlights how the creation of concepts leads to reciprocal roles for actors. In time, these roles become institutionalised and meanings are embedded in society. New routines (or ‘ways of doing things’) are agreed via a politics of knowledge that reduces uncertainty. New realities in different places and at different scales thus become ‘socially constructed’ (Scheurich and McKenzie, 2008; see also Manning and Reinicke, 2016). Such studies emphasise how understandings are constructed (and co-constructed) by members of specific communities of practice. In order to legitimate their world-views, individuals use particular mutually-agreed concepts and theoretical perspectives (cf. Latour and Woolgar, 2013, Cetina, 2013). Typically, this will involve researchers analysing narratives that appear in secondary source material such as policy

documents, professional publications, the media and academic articles (see, for example, the policy analysis of McDowall et al, 2017). Ultimately, a SOK approach will help us to understand how meanings of the CE and standards are constructed (and co-constructed) by members of specific communities of research and practice using mutually-agreed concepts and theoretical perspectives in order to legitimate their world-views (cf. Knorr, 1977, Cetina, 2009, Latour and Woolgar, 2013, Cetina, 2013). This approach to knowledge will then help us to identify how, where and when there is potential for transitional change.

In the literature, there is an absence of comparative research on how authoritarian or neoliberal governance approaches may utilise standards or how they may contribute to a CE (Lieder and Rashid, 2016, Su et al., 2013). To help close this gap, actors – waste and resource stakeholders - need to be identified via the SOK approach who are continuously engaged in inter-subjective sense-making and learning around the adoption and use of the CE and standards. It is essential to draw out these differing and overlapping social constructions of the concepts 'circular economy' and 'standards' which are maintained by key actors and institutions. This is because, in the context of a sustainability transition in resource management, 'buying-in' to a framework will shape how the CE unfolds over time. Standards matter in the West for the CE because they help to coordinate the timely flows of materials for customers and suppliers. Related work in other sectors, especially medicine, is suggestive of the ways in which the framing of knowledge by institutions takes place (Abraham and Ballinger, 2012). In China, as shown by its implementation of its Green Sword policy, standards are a much more explicit part of the central government's regulatory apparatus and can be utilised, for example, to curb trade. An SOK perspective on this activity can provide "[a] basis from which to conceptualise the nature of governing" (Bulkeley et al., 2007, 2736).

3.2 UK Governance

Western neoliberal states use a mix of top-down and market-led networks in their planning for the CE. Political centres, such as Brussels and London, determine the attainment of policy objectives which help to 'steer' actors and individuals in more distant territorial spaces (Bulkeley et al., 2005, Bulkeley et al., 2007). At the same time, though, market actors are increasingly prominent in seeking to shape their notion of a CE and how it should be delivered. In many cases, actors' interests are aligned, and this helps neoliberal states legitimate the use of private actors in the delivery of public policy. In Europe, the UK is often perceived as being at the forefront of neoliberalism (Gibbon and Henriksen, 2011, 151) and this is reflected in its trading relations for waste and resources management and increasing use of voluntary standards to boost trade (Higgins and Hallström, 2007).

Environmental policy has traditionally been dominated by governmental activities, and the private sector and NGOs have played a lesser role in delivering public policy (but see, for example, the support of the World Wide Fund for Nature – WWF - for the Forest Stewardship Council). Increasingly, though, standards, like other neoliberal practices, such as auditing and certification (Power, 2009), are becoming more important policy instruments and a means to provide reassurance on quality when trading takes place (Bloomfield, 2012, Cashore, 2002). Market and non-market actors, "rely increasingly on standards to manage reputations, make claims credible, and rationalise competition, especially when traditional forms of regulation (e.g. governmental) have been politically delegitimised" (Timmermans and Epstein, 2010, 77). Standards have come to the fore in food and agricultural policy (Busch, 2000, Henson and Humphrey, 2009) where corporate interests have a key role in securing food safety (Marsden et al., 2009).

Within neoliberal economies such as the UK standards are largely voluntary and private-sector-led, though supply chain pressures may well make that much less voluntary than would be expected by independent businesses. Higgins and Hallström (2007) have undertaken a detailed analysis of the historical growth of standards in the West. They point out how the UK was early to set up a national standards organisation (British Standards Institute) in 1901, followed by those for the USA and Germany (both in 1917). The standards organisations reflected a close link between industry, with engineers – at the heart of contemporary manufacturing and processing industries – and national governments. The UK government was keen to explore the potential that standards offered to encourage trade Higgins and Hallström (2007, 692). From the late 1980s onwards, there were efforts to harmonise standards among EU member states as part of the drive to removing barriers to trade. Once again, the UK government was leading in efforts to liberalise markets.

Originally standards in the West related to production and processing, but over time have moved into ever more diverse areas to engage with quality of life issues such as product design, safety and reliability of products, and environmental management. Higgins and Hallström (2007, 693) argue that “As standardizers spread themselves over new fields, governments became more and more dependent on incorporating standards into their regulatory regimes and purchasing routines,” and this is most especially the case for those countries, like the UK, where neoliberal thinking and practices have been well advanced.

3.3 Chinese Governance

Once China liberalised economically in the 1980s, some of the elements of neoliberal reasoning became more visible, but, crucially, the Communist Party of China remains

important and necessary as the ruling party in this one-party state (cf. Dean, 2010). The "prevailing discourse on government in China continues to approach the task of government in a distinctly Chinese … and … 'socialist' manner." (Sigley, 2006, 495). The state is intervening in different ways, combining both neoliberal and socialist, facilitative and authoritarian strategies (Bray, 2006, Jeffreys and Sigley, 2009). Since the 1980s, Beijing has pursued ambitious plans for social engineering involving economic rationalization and marketization programmes in employment, education, sustainability, and health, among others. (Dutton, 1992, Bray, 2005, Greenhalgh and Winckler, 2005, Dutton, 2008). The neoliberal rollback of the central state is *not* being pursued in China as in the West. Instead, a socialist market economy requires a powerful government that continues to intervene but often in different, and sometimes more subtle ways, for example, arising from the close relationship between political and economic actors. One approach is the use of standards (Guttman et al., 2018), which are attracting greater attention from Western and Chinese academic researchers (Yu et al., 2015, Ranta et al., 2017).

The contrasts between the UK and China over the role of government and the part that standards may play in the (self-) regulation of business are considerable. In the UK, long-standing shifts away from significant state involvement in market and regulatory coordination from the 1980s onwards suggest a greater role for the private sector in helping to achieve public policy goals. In a neoliberal framework which seeks to use standards to underpin the flow of materials central to the CE, they are framed using neoliberal terms such as reducing 'red tape', 'voluntarism and 'light-touch' regulation. In contrast, as we shall see below, standards are usually employed by the Chinese government as an important policy measure to increase industrial competitiveness and to promote industrial development. Accordingly, standardization is deemed as an important basis for CE development (Li et al., 2012), as it is a vital means for the normalized development of a CE (Xiao et al, 2013; Ge and Guo, 2017). Standards are also the main basis by which the Chinese government evaluates CE development (Li et al., 2012). The establishment of standards in China, are led by the government and reflect the government's needs and interests.

As in the West, approaches to governance, or more specifically, standardization, rely on a body of technical expertise whose growth has been sponsored by the state. In China, non-governmental actors play a much less significant role than in the West. There are four levels of Standards in the Chinese standard system, namely, National Standards, Professional Standards (Industry or Sector Standards), Local Standards and Enterprise Standards. National standards refer to standards that are approved by the national standardization

authority, namely the Standardization Administration of China (SAC), and are of great significance to the nation's economic and technological development. They take precedence over all other types of standards. Professional Standards complement national standards and are set by industry technical committees. These Technical Committees (TCs) are comprised of members from government agencies, private industry associations, companies (sometimes local branches of foreign companies but often with limited voting rights), and academia. However, all Professional Standards are authorised by government. Local Standards are set by local technical committees, which are authorized by local government's administrative departments in charge of standardization. The Chinese standardization reform of 2017 has emphasized the need for streamlining the bureaucracy surrounding standard making and their regulation and delegating power, specifically by lessening the authority of government to drive market relations (Hui and Cargill, 2017). Some commentators have argued that China has begun the shift from standards made wholly by government to the coexistence of government and non-governmental standards making (Wang and Liang, 2013). However, such reforms should not be over emphasised as organizations that contribute to standards making are mostly industry associations or Government-organised Non-governmental Organisation (GONGOs) (Wang and Liang, 2016), and the creation of these organizations is mainly encouraged by the government (Martens, 2006). Therefore, government still plays a significant and decisive role in the Chinese standardization system.

China's environmental protection standards coincided with moves towards environmental management. In 1973, the Preparatory Group Office of the National Environmental Protection Conference organized various national, provincial and municipal governmental sectors to jointly prepare China's first environmental protection standard – the "Trial Standards for Industrial 'Three Wastes' Emissions". In 1973, the standard was promulgated by the National Planning Commission, the National Infrastructure Construction Committee, and the Ministry of Health (Standard Code: GBJ4-73), which was implemented in 1974. Along with the gradual institutionalization of environmental protection and governance, environmental protection standards have been slowly developed. By the end of 2018, the number of national environmental protection standards exceeded 1,000 (NDRC, 2019) and typically regulate the measurement of environmental quality, pollutant discharge (control), and other factors that apply for the enforcement and management of environmental protection law. Local standards are regarded as supplements or enhancements to national standards and draw on higher authority.

The concept of a CE was formally accepted in 2002 by the central government as a new development strategy. Following this, the Circular Economy Promotion Law was enacted in

2009, serving as the main national-level framework for pursuing the CE (National People's Congress, 2008). Since then, various action plans have followed (e.g., State Council, 2013; NDRC, 2016), which offer further details for specific sectors and provide clarity on the implementation of the provisions of the CE Promotion Law (for an extended account see Jiao et al, 2018). The emphasis on pollution and industrial park experimentation in China's CE is evident from the comprehensive indicators listed in the national Circular Economy Development Evaluation Index System (CEDEIS). With no specific standard for CE, the CEDEIS serves as the action guideline and assessment criteria for CE development at various level of governance in China.

The initial version of CEDEIS was jointly issued by the National Development and Reform Commission (NDRC), the former Ministry of Environmental Protection (now Ministry of Ecology and Environment) and the National Bureau of Statistics (NBS) in June 2007. It divided measurements in two dimensions, namely the macro level (focusing on overall society) and the industrial park level. There was a total of 22 indicators for measurement at the macro-level and 14 indictors for the industrial park-level. In 2017, an updated version of CEDEIS was issued (Government of China 2017). One significant change is that the new CEDEIS applies to national and provincial levels, leaving the municipal and county level, as well as the industrial park level to local authorities and enterprises (and further information on CEDEIS indicators can be found in Appendix B). The decision was made due to local variations in the utilization of resources development levels, and industrial structure. This variability also helps to explain the lack of a specific national CE standard in China.

4.0 Methodology

A qualitative approach was pursued with this research. The study begins in 2001 with the first English-language academic article mentioning the 'CE' concept. Similar conceptual terms - such as 'Industrial Ecology' - were in use earlier in the 20th Century, but the specific focus of this study is the competing social constructions of the CE concept through standards and standard setting. The difficulties of undertaking research in China are well recognised (Lang and Xu, 2013). It is inevitable that such difficulties produce an asymmetric approach to primary source material from both countries. In the case of China, data is weighted in favour of contributions from secondary sources (Li and Wu, 2012). In this context, because of the significant role of government, we have made extensive use of key government policy statements. These documents provide insights into the ways in which government perceives public policy challenges and how this will shape the practices and expectations of all relevant actors.

Our research design shows a recognition that we cannot expect to collect similar types of data in both the UK and China. By paying particular attention to the internal validity of the case studies, we have minimised the inevitably asymmetric nature of the source material by using multiple sources of evidence, having key informants test out our ideas as we develop them, and maintaining a chain of evidence as shown in our empirical material later on (Yin, 2009, Başkarada, 2014). We used the feedback from our key informants to iteratively refine our interpretations of governance, standards and the CE. Initially, we drew on qualitative interviews with key stakeholders and analysis of quantitative and qualitative data from secondary sources for case studies in both countries. Primary source interview data was then collected in 2017 and early 2018 from 30 individuals, of which three key informants were in China[4]. Interviews were with standard setters, standardisers, key private sector companies involved in the resource management/waste sector, researchers and an expert environmental activist (Table 1). Each was selected based on their representativeness in terms of the total range of public and private actors involved in CE developments (as identified from a mix of snowballing and a review of secondary sources). These interviews were necessary to explore in greater depth how the CE concept is developing, the role of standards in enabling flows of materials, the challenges in the use of standards, and the obstacles to the development of standards. These telephone interviews were conducted using a semi-structured question list, typically lasting between 30 and 40 minutes and were transcribed, coded in terms of the emergent themes and responses and anonymised. Most of the interviews were undertaken with very senior figures in the sector.

[4] Note that the Chinese interviewees are identified by number only but the UK respondents also have their organisational designation included. This is because, with far fewer Chinese interviewees, identifying their institutional role could have meant breaching their anonymity.

Table 1: Summary of Interviewee Themes and Responses

Actor	Core interview themes	Popular responses
Standard setters	• Standard setting Policy challenges • Barriers/enablers to change • Who to cooperate with • Political will • China • Markets and quality • Trade • Governance • Circular Economy	• Policy context • Governance • Networks • Intergovernmental relations • Professional associations • Trade and tariffs • Circular Economy
Standardisers	• Policy challenges • Standard setting • Barriers/enablers to change • Political will • Who to cooperate with • China • Markets and quality • Circular Economy	• Policy context • Materials & quality • Governance • Networks • Professional associations • Trade and tariffs • Circular Economy
Private sector companies / NGOs / Public researchers	• Policy challenges • Standard setting • Barriers/enablers to change • Markets and quality • Use of standards • China • Circular Economy	• Limited nature of standards • Innovation • Materials & quality • Trade and tariffs • Regulation/red tape • Supply chains • Circular Economy

A wide range of secondary source publications from professional trade journals to academic publications have a major role in meaning making and therefore how policy and industry stakeholders position themselves in relation to the use of standards (including in a future CE). Primary and secondary source data also reveals stakeholders' broader perceptions about the nature of the relationship between industry and the state in terms of environmental regulation. The study period finishes at the end of 2018, the last full year of publication data.

Secondary source material included:

1) an examination of key professional websites (e.g. BSI, ISO, and the European Committee for Standardization, the European Committee for Electrotechnical Standardization, trade associations and professional institutes) was undertaken for information on standards for material flows in the CE. These searches allowed reviews of the content of tabular data

on individual and groups of standards. This analysis offers an understanding of the materials for which standards have been developed, as well as insights into those materials where standards are being called for. This examination of standards also helped in the identification of key person interviewees.

2) An exploration of specialist waste trade outputs - grey literature (e.g. from the Chartered Institute of Wastes Management and the Recycling Association) - on standards and the CE was undertaken. This search and textual examination helped draw out and contextualize the key issues for the CE as perceived by a range of specialist commentators and experts including *BusinessGreen, EDIE.net, ENDS Report, Letsrecycle.com, Materials Recycling World, Recycling International, Recycling Waste World, Resource* and *Waste360.* This material also helped to identify key person interviewees.

3) Government department web sites dealing with standards and the CE were searched in the UK and China. This provided information on policy-related material.

4) Web sites of non-governmental bodies and charities involved in promoting the CE were examined for written material on standards.

5) CE and standards articles were also searched for in more general, popular press coverage including *China Dialogue*, *Xinhua News Agency, China Daily*, the *BBC,* the *Guardian* and *Sky News*.

Data from these secondary sources were combined with the primary source interviews to inform our analysis.

5.0 Governance of the Circular Economy via Standards

This section covers the analysis of our conceptual perspective on governance and standards. The four subsections draw on the emergent responses in our interviews (see above).

There are important parallels in the structure of the waste and resources industries in the UK and China (Gregson and Crang, 2019). Historically, many small companies in the UK have not worked particularly well in terms of the application of standards or of securing environmental improvements. The consolidation of firms in the UK since the economic downturn in 2008, whilst unwelcome to the sector, may well be aiding the setting and adoption of standards and improving environmental management. In China too, waste enterprises are

mostly small scale and with low levels of pollution control. While the environmental violations of enterprises have become increasingly prominent, some local governments have neglected the supervision and control on these enterprises in pursuit of economic benefits, and even allowed the illegal processing and utilization of foreign waste, which has caused serious environmental pollution (Xu, 2018).

However, the markedly different economic structures of the two countries have led to different approaches to waste and resource use. With its dramatic economic growth since the 1980s to alleviate resource shortages, China began the large-scale import of solid waste that could be used as raw materials (Su et al., 2013). However, with the continuous increase in waste imports, problems began to emerge, especially from the pollution arising from weakly regulated recycling and reprocessing firms. With a shift in national policy to emphasise more ecologically-friendly economic growth, China began to both more stringently regulate polluting companies (Wang et al., 2011) and to address its reputation as a world 'dustbin'. China's efforts to rectify foreign waste imports began as early as 2013. In February of that year, Chinese Customs launched a 10-month Green Fence ("*lvli*") operation. The operation cracked down on smuggling activities of foreign waste. In 2017, the General Administration of Customs convened the National Customs Anti-Smuggling Work Conference to deploy a one-year National Sword ("*Guomen Lijian 2017*") operation, focusing on smuggling and illegal activities in key areas such as foreign waste and agricultural products. Following this, the Ministry of Environmental Protection (now Ministry of Ecology and Environment) launched a special campaign to curb environmental violations in the import waste processing industry (see Appendix A for a full list). However, although various efforts have been made, the problem of illegal entry of foreign wastes has not been effectively addressed, which has caused grave threats to people's health and environmental safety. Therefore, in 2017 and 2018 the Chinese government decided to strengthen the supervision of solid waste from source by lifting further the quality standards for the importing of waste and applying them to a wider range of materials (Moore, 2017).

Our review of key Chinese and Western literature on standards and the CE has drawn out at a general level that we should anticipate differences between neoliberal and authoritarian systems of governance. Nevertheless, there is a significant gap in understanding what those differences may mean in practice. It is our contention that through a thematic comparative analysis we can better understand the operation of neoliberal and more authoritarian styles of environmental governance and what this means for a sustainability transition. We therefore need to compare the perceptions of key actors of the CE and standards (cf. Cetina, 2009, Cetina, 2013, Latour and Woolgar, 2013). To do this we have organised the empirical material

around four themes which emerged from the interplay of our conceptual framework and reflection on our empirical material (see 4.0 above). These are:

1) Circular Economy Meanings – how CE meanings are subverted to promote a framing of economic opportunity in the UK and China.
2) Standards' Meanings – the CE and standards are shown to work in a mutually supportive way, but the Chinese state has gone further and used standards strategically to direct external markets and so achieve public policy goals.
3) Trade and China: UK Perspectives - UK views matter because the CE is shown to operate at a global scale and standards are there to help smooth trade.
4) China and Trade: Chinese Perspectives – Chinese views matter because of the links between CE thinking and wider links to resource use and pollution regulation. This is particularly evident when China began introducing restrictions on waste imports.

The transition to a CE has so far involved high-level ambitions from national and supranational governmental bodies. This action has come at a time of increased promotion of knowledge about the CE from think tanks, NGOs, charities, academics and private companies. There are therefore a large number of highly contested approaches to CE activity (Kirchherr et al., 2017, Homrich et al., 2017, Velte et al., 2018). These meanings are explored below.

5.1 Circular Economy Meanings

In their review of the literature on circular economy themes, Lieder and Rashid (2016) draw out nine research fields none of which explicitly deals with governance or of CE activity in the context of sustainability transitions. Instead, what their work highlights, is that despite calls for multi-disciplinary working (Lieder and Rashid 2016, 42), there is a dearth of social science contributions (see Lieder and Rashid 2016 Figure 3 and Figure 4, 43). This situation applies to several key contributions. For example, Prendeville et al (2018) offer an insightful account of scalar notions of the CE by relating it to city-level activity. However, although Prendeville et al. (2018) reveal a series of city-scale meanings of the CE, and helpfully point to the ways in which systems of governance may help to steer change, there remains much to be done to develop our understanding of how urban transitions may occur. Lieder and Rashid's (2016) review reveals that social science contributions to the CE literature are largely relegated to informing policy debates. The limited coverage of social science contributions means that when thinking does occur on CE development, it tends to underplay the significance of governance arrangements. There is clearly a need to draw together the work that is taking place on standards and transitions (e.g. Wijen and Chiroleu-Assouline, 2019, Manning and

Reinecke, 2016) and CE governance to assess how standards may facilitate (or constrain) a sustainability transition.

Korhonen et al. (2018) identify the most influential background concepts of CE as practitioners' cradle-to-cradle notion of 'eco-effectiveness' and industrial ecology (both being linked to a 100% reliance on renewable energy and recycling all materials). Several leading actors have presented other key meanings of the CE. These include, the Ellen MacArthur Foundation (EMF) which states that "A circular economy is an industrial system that is restorative or regenerative by intention and design" (EMF, 2012, 7). The European Commission (EC) picked up on the work of the EMF and went on to define a CE as "[one] where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimised" (European Commission, 2015). Both the EMF and EC's activities have in turn informed the CE definition proposed by the British Standards Institute in 2017 with the world's first CE standard (BS8001) which states that "A more circular approach seeks to decouple economic growth from resource consumption" (BSI, 2018).

Kirchherr et al. (2017) have undertaken a comprehensive review of CE definitions. Kirchherr et al. (2017) found that frequently CE is depicted as a combination of terms associated with the waste hierarchy, namely reduce, reuse and recycle. Rather less attention is given to recognising that CE demands a systemic shift from a linear (waste) economy. Even less effort is made to link the CE to wider policy and academic debates such as that of sustainable development. For that reason, Kirchherr et al (2017, 229) advocate a CE approach involving an economic system that seeks to reduce, reuse and recycle materials at different scales, ranging from that of individual consumers to nation states.

The concept of the CE was introduced in China in the 1990s. It had its origins in cleaner production, industrial ecology, and ecological modernization thinking and was inspired by examples of implementation in Europe, the United States, and Japan (Yuan et al., 2006, Su et al., 2013, Jiao and Boons, 2017, Jiao et al, 2018). China's approach to the CE places greater attention to scale (through a multilevel system of experimentation under hierarchy) and place (through incorporation of CE ideas into land-use planning) (McDowall et al, 2017), as exemplified in the designation and construction of an array of CE pilot/demonstration industrial parks, cities, and provinces (NDRC, 2005, 2019). Within the literature, McDowall et al (2017) have drawn out the competing perspectives on the CE in China and Europe. The Chinese approach to the CE is framed as a response to the environmental challenges created by rapid growth and industrialisation. CE debates are concerned with ways to reduce waste and encourage resource efficiency. Within Europe, the CE is promoted from a narrower

environmental agenda and is promoted as a way of businesses achieving a double dividend of improved efficiency through more economic use of resources. This view of environment and economy relations shows considerably continuity with perspectives on growth such as ecological modernisation (Mol and Spaargaren, 2000).

What these evolving definitions of the CE have in common is a systematic approach to the flows of materials, the suggestion of positive economic benefits for organisations engaging in CE activities and the coordination and design of new markets. However, it would be a mistake to assume that convergent understandings of CE at an elite, policy level are playing out in a straightforward fashion within the waste and resources sectors in the UK and China. Indeed, an exploration of how the CE is understood by different standard users, particularly those operating in materials markets, gives a more nuanced indication of the broader shifts in environmental governance in recent decades, and the difficulties that may arise with evolving a CE in the future in a neoliberal context. The competing knowledge claims that contribute to thinking on the CE are framed by actors operating in significantly different 'epistemic worlds'. It is important to recognise that, despite potentially profound differences in interpretations, there are typically also mutual points of shared understandings between epistemes. These points, or so-called 'boundary objects' (Star, 2010) can be used to hold different knowledge frameworks at least loosely in place. Amongst the boundary objects for a CE are those key themes identified by Kirchherr et al. (2017) and include an alternative and more equitable economy that takes responsibility for its materials management. Some boundary objects can also be 'anchoring devices' that can guide policy development (Van der Sluijs et al., 1998, 312) as they bring together ideas and thinking where there is a high degree of consensus among actors. An anchoring device might include the use of standards to manage material flows as this brings together governments, private sector actors and NGOs.

Ongoing analysis of the CE therefore requires that we recognise that a wide range of actors and individuals can be brought together under the CE umbrella. This occurs because these strategic actors have a common interest in successful CE outcomes despite a range of reservations and alternative meanings ascribed to the central concept. In interviews, some actors have indicated their scepticism of the CE and the activities it requires.

From the UK, industry actors point to a lack of understanding as to what the CE might mean, highlighting a gulf between the thinking of larger companies and policy makers and much of the industry. One interviewee noted that: "the circular economy, is ... essentially all things to all people" (Interviewee B1 - UK professional waste body, 2017). Whilst for another:

> "[R]elatively few people in the waste management industry can honestly say they could even articulate what the circular economy [is]. I think people in the waste sector tend to use it as a euphemism for the waste hierarchy." (Interviewee A3 – London Waste Policy manager, 2017)

In China, the Circular Economy Promotion Law issued in 2008 refers to a circular economy as reduction, reuse, and recycling (3R) activities in the production, circulation, and consumption of products. However, the academic and practical interpretation of a Chinese CE differs substantially from the legal perspective. In academia, there is a consensus that the focus of promoting a CE in China, rather than being an incrementally improved environmental management policy as in the West, should be a broad efficiency-oriented approach that secures the closed-loop flows of materials at all stages of production, distribution and consumption (Su et al., 2013). CE is regarded as a new development model to help the country leapfrog into a more sustainable economic structure to deal with the current environmental problems and resource shortages (Zhu, 2008, Geng and Doberstein, 2008).

Drawing on the academic perspective, one key person interviewee argued there is not a single version of the CE:

> “There are three versions of the CE, or what we called, three circulations. Version 1.0 is waste disposal, which is about the circulation of waste; Version 2.0 is about remanufacturing of the production process, which refers to the circulation of products; the version 3.0, which is the most high-end version, is the platform economy, or sharing economy, which refers to the circulation of services. Take sharing a bike as an example, one does not need to purchase or own a bike for biking. The service provided by one bike can be enjoyed by many people. From the circulation of wastes to products, and to services, we seek to recycle the products through services, to reduce waste, or the recycling of waste.” (Interviewee CH1, 2018)

Our interviewees were keen to distinguish between the normative and aspirational tone of a CE in academic debates and its current delivery:

> “However, in non-academic sectors, in actual practices, people still regard the waste economy as a circular economy.” (Interviewee CH1, 2018)

> “The state is promoting circular economy, but what is a circular economy? Most of the circular economy [activity] is the waste economy.” (Interviewee CH2, 2018)

So, in China, as in the UK, there is considerable discussion over the meaning of the CE. Like the UK, the debate over the content of a CE may hamper efforts to transition towards more sustainable materials management. However, over time, such negative viewpoints can be progressively marginalised by the narrative shaping of more powerful actors. Key to the successful rolling out of state-backed CE policies would appear to be the ability of a range of actors at various levels from the central state down to individual projects to work together with a common vision. Such visions, and the different CE meanings that they are composed of, are held together by shared understandings and chains of meanings. However, outcomes on the ground will differ from the UK, where a neoliberal economic framework has produced a relatively disengaged central state, to China, where the role of a dirigiste centrally planned economy is rarely challenged. These differences in governance, and the ways in which standards are operationalised in practice, means that in China the nature of authoritarian governance produces a much more muted public debate between government and the waste and resources sector. This national difference means that alternative perspectives on the CE in China are being played out among the research community which has strong links to policy actors. A fuller insight into the nature of these differences becomes clearer in the following sections.

5.2 Standards' Meanings

Standards for a CE, per se, are only just emerging (e.g. BSI, 2018). However, standards themselves play a critical role in the movement of materials that underpin the CE (Flynn and Hacking, 2019). Standards are central to the activity of markets in terms of trust-building and quality control (Gibbon and Henriksen, 2012). Yet the way in which those standards work in practice – how they enrol or marginalise actors, and how they help shape understandings of key terms, like the CE, remains under researched. To help remedy this lacuna we first examine how standards are understood, and then in Section 5.3 how they are used in debates on trade, a key component in the (re)scaling of narratives on the CE.

In the UK, trade in resources has long been occurring on a pan-European and global basis. It therefore makes sense to consider the UK's activity in the context of both European and national governance via standards. From a UK policy perspective, the role of standards in the CE is very clear for those working on circular practices in Europe:

> "[Standards] facilitate trade ... When you adopt European standards ... it means that these standards are going across the trade routes ... and that helps to remove the trade barriers

> in Europe. If these standards are adopted abroad ... then they will have more of a relevance, which helps the European industry." (Interviewee F2, Standards Body, 2017)

Facilitating the growth of markets in Europe requires borderless movements and the development of new secondary markets in recycled materials. A European civil servant suggests that standards are central to growing secondary raw materials markets in a CE:

> "[Y]ou cannot have a secondary market for raw materials if you do not have a set of interlinking standards. You need a quality standard for recycled material, which is linked to very clear quality standards for the products that incorporate those materials, which is linked to quality standards for virgin materials." (Interviewee A2, European Commission, 2017)

Companies therefore are prepared to regard standards as part of the currency of trade. However, striking an agreed balance between regulatory and voluntary activity within market development in an evolving CE is a moot point. Where that line between voluntarism and regulation should be drawn is disputed and depends upon how market actors perceive their sector, their strength within it and their position in relation to related sectors. For example, as we were told: "[T]he paper industry continues to believe that it should be the arbiter of the quality of the material it receives, and not other elements of the supply chain" (Interviewee C2 - UK Paper Industry trade body, 2017). A typical way for different actors to agree on the quality of materials is via standards.

In the neoliberal UK, standards are widely accepted and moreover are acting as a tool (technology) of governance (Gibbon and Henriksen, 2011, Gibbon and Henriksen, 2012). The development of standards for a CE and for material flows is sympathetic to the larger corporate actors and the trade associations that they participate in because it encourages the extension and deepening of markets for materials. For a neoliberal government such as the UK, governing via standards legitimates the actions, power and privileges of private sector actors. Even here, though, there is a selectivity at work: those business and organisations that lack the capacity to participate in thinking on standards development or in meeting quality standards find themselves becoming increasingly marginalised. As standards and a CE become increasingly entangled so they are engaged in mutually supportive arrangements. In this context, standards help to facilitate trade and are sympathetic to notions of a CE transition based on market relations, and that can occur at multiple scales (i.e. where those who sell and purchase materials find the most favourable opportunities) and as a market-based CE transition becomes common currency so key actors look to standards to help deliver it.

In the context of increasingly neoliberal environmental governance, the BSI have tried to use a new CE standard to facilitate a realignment of waste management practices which includes the creation of new markets for materials. The initiative was supported in part by the Department for Business Energy and Industrial Strategy and a BSI-led group of stakeholders including, for example, the EMF and the Chartered Institute of Wastes Management. Unlike previous product and process standards, this new framework was intended to encourage broad industrial participation in a principles-based standard. BS8001 appeared in July 2017 and it claimed to be:

> "[the] first practical framework and guidance of its kind for organizations to implement the principles of the circular economy ... It is intended to apply to any organization ... It provides practical ways to secure smaller 'quick-wins', right through to helping organizations re-think holistically how their resources are managed to enhance financial, environmental and social benefits." (BSI, 2018)

China does not have a similar CE standard, but its standards do shape CE activity. For instance, China's standard on the importing of waste materials is to promote environmental protection rather than the CE. It is, perhaps, rather surprising that despite its longstanding interest in a CE, China has not yet produced a comprehensive standard for a CE. The closest that government has come to a CE standard is an evaluation index system that was jointly published by the NDRC, the Ministry of Finance, and the Ministry of Environmental Protection (now Ministry of Ecology and Environment) in 2017, namely the "Circular Economy Development Evaluation Index System" (see 3.3 above). Although the significance of the standardization of CE has been widely recognized and discussed in China (Li et al., 2012, Wang, 2017, Zhang, 2004), it is argued that the premise of setting a standard for a CE requires an understanding of what a CE should be:

> "What will be the theoretical basis of the standard is the key. If we do not figure out whether it will be based on the circulation of waste or the Product Lifecycle Management … to design the standard, the standard produced will be unclear and indistinct." (Interviewee CH1, 2018)

So, what we see is that the nature of standards is intimately linked to types of governance and understandings of the CE. Indeed, our Chinese interviewees were keen to draw a distinction between the role of waste standards in China and the West:

> "The starting points and the methods of setting standards for waste in the West are different from China. The foreign standards are normally set by the industry association, which is essentially a standard for the classification of solid waste. The formulation of such standards is mainly for facilitating the trade in the market, since the trade is based on the quality of the waste. However, the standard set by the Chinese Ministry of Environmental Protection [now MEE] is not a classification standard, but a standard for pollution control." (Interviewee CH2, 2018)

In China, debates over the meaning of a CE hamper the development of a CE standard. Like the neoliberal UK, in China standards are a tool used by government to manage economic and social relations but take a rather different form. Given the nexus between state and businesses, such as state-owned enterprises (government-owned legal entities which perform commercial activities), and interconnections between political and economic actors, standards become a more direct means for government to deliver on its politico-economic agenda. Moreover, standards are used as part of a wider set of policy instruments (e.g. rule and regulations) to help deliver policy (see Appendix A). For instance, it is commonly believed that the effective ban of foreign waste will help meet a policy goal of limiting pollution caused by importing poor quality materials. The ban will also play a key part in China's development of model of sustainable growth of which the circular economy strategy is part (Hao, 2018). In this sense, while the Chinese framing of the CE rests in large part on links to an 'ecological civilization' narrative (McDowall et al., 2017), the economic imperatives are equally visible. The ban on imported waste poses an immediate challenge to recyclers and manufacturers who rely on the supply of foreign plastic and paper. Consequently, the demand for domestic raw materials will increase, which will then promote the recycling rate of domestic waste. Moreover, it was recognised that China's ban of foreign waste would have a profound impact on the ability of its trade partners to meet their recycling targets, and thus effects on promoting a global circular economy (Preston and Lehne, 2017; Xu and Zhang, 2018) and it is to this that we now turn.

5.3 Trade and China: UK Perspectives

In this section, we review emerging perspectives on materials and trade from the point of view of the UK and of China. These perspectives matter because they give clues as to how key actors are conceptualising the scale and nature of a CE: is it a national CE for China and an international one for the West? It indicates whether the waste and resources industry intend to continue with a linear economy in which materials quickly become valueless or if there is to be a switch to the quality of materials so that they can be inputs for others in a CE. Moreover,

the analysis here provides further evidence on the way in which standards are conceptualised in the UK and China, and thus how they matter for governance.

A key role of standards in the West has been to facilitate trade (Higgins and Hallström, 2007). In the context of materials, this has encouraged ever greater international trade. As one observer informed us: "[The UK is] ... massively dependent on China as our major customer for taking a load of our waste" (Interviewee E1, Plastics Recycler, 2017). Whilst another interviewee went further in their critique of the way in which the materials trade with China had developed:

> "China …, that's the lazy option. You've effectively got resource in this country [UK] and you are effectively exporting that resource, that waste to another country because effectively it's too difficult at the present time for you to do something with it. [A]nd these are fundamental issues for the circular economy. … [I]f you've got a waste, you can pick out the nice bits of paper, the card, the cans, you know, the easy bits, then it gets a bit too difficult. We either burn it or ship it overseas. We have to say these are resources and shipping them overseas is giving China an advantage. We need to clean up that whole [waste] stream" (Interviewee E2, Engineer, 2017).

So, whilst trade can be linked to moves to promote a CE by finding markets that most value those resources, the overwhelming sense from our UK interviewees was that trade was to find the most economic disposal option.

Our interviewees were well used to developing standards or working with standards. There was widespread recognition that standards could be used to give a market message:

> "[S]tandards are sort of like the ... formalisation of the market supply chain message. So rather than China saying, I don't want rubbish, China can say, I'll only take stuff that meets this standard." (Interviewee B1, Professional body, 2017)

For this interviewee, it was about all about 'market rules':

> "So, if China's saying, here's my standard, meet it, you will look at the cost of meeting that standard. And if you reckon the numbers add up, then you'll do that. And if the numbers don't add up, you won't do that!" (Interviewee B1, Professional body, 2017)

So, for our Western interviewees there is a common belief that standards can help provide reassurance about the quality of materials that are being traded and can be used to enhance quality further. However, standards work within market rules. If waste and resources businesses perceive that markets operate to sufficiently value quality, then quality can be improved and moves towards a CE become more realistic. In the UK, where efforts to promote a CE rely so heavily on the private sector moves towards a CE may be slow and disjointed.

5.4 China and Trade: Chinese Perspectives

Within China, debates on the consequences of raising the quality threshold of imported waste and applying more stringent standards to an ever-larger number of materials, are framed in a rather different way to that of the UK. As argued above in Sections 3.3 and 5.1, it is important to distinguish the way that governance of imported waste falls under environmental protection, while promoting the CE is seen as an economic development issue. In China, the key themes are about controlling illegal waste imports, and the prospects for a CE.

The imposition of stricter standards for Chinese waste imports was a political decision to help industrial restructuring by withdrawing inputs from low value, polluting and poorly regulated waste companies (see Section 5.1). One interviewee explained:

> "As environmental problems become increasingly prominent in China and the government is extensively promoting ecological modernization, tightening the control of foreign waste that could bring environmental pollution is an inevitable trend" (Interviewee CH3, 2018).

Whilst another interviewee noted that over the years:

> "The Chinese Customs have seized a large amount of illegal foreign waste that does not meet the standards, but the situation is still very severe. Earlier governmental actions are not as systematic as the recent moves. Sooner or later, China will get to this stage and more stringent rules on importing foreign waste or materials will be enforced. It is simply because those Western countries has not yet prepared for this, and thus moan about Chinese action" (Interviewee CH2, 2018).

For our Chinese interviewees there was an optimism that raising waste import quality standards would be beneficial for the CE. Interestingly, though, they tended to believe that the most beneficial impacts would be in the West. According to one interviewee who is involved in standard setting:

> "When the Chinese raised the quality standards it would surely affect other countries' [standards and waste] systems. Why do foreign countries complain a lot about Chinese standards raising? It is because they need to adjust their standards and waste systems to the new demands of the new Chinese standards. Their recycling facilities, mainly the packaging and recycling facilities would have to be upgraded to fit the new 0.5% quality threshold. But this can surely be achieved." (Interviewee CH2, 2018)

Another interviewee also thought that positive change could emerge:

> "The Chinese move on raising the quality standards of the imported waste produced heated discussion on the CE. People mainly talk about when China stops importing, the US and the Europe start getting nervous. Although it still treats CE as the waste disposal, it is also good. CE is about tightening the head and the end and see if we can achieve circulation in the middle. Now, as the Western countries can no longer count on China to deal with their waste, they have to seek for other solutions: either go back to the old ways of landfill or incineration, or develop the product lifecycle management system, in which the manufacturer will bear the whole production responsibility and reduce the end-of-pipe treatment in the product design. In this vein, it will force both China and western countries to accelerate the development of a circular economy." (Interviewee CH1, 2018)

Whilst interviewees were keen to be positive about the reform of Chinese import standards, the same interviewee also recognised the interlocking nature of the global materials economy and how entrenched interests would make the promotion of a CE difficult:

> "It can be said that a real CE has not yet formed in the world. It is basically still within the old linear economy. This has not been changed. It deals with a little bit of waste recycling, which we do not refer to as real CE. The current situation is a world-wide, ocean-crossed distribution – the United States transported its waste to China, and China reprocesses the waste into product, and then it flows to Europe. This is a global supply chain. But this is still the circulation of waste, which is a waste economy rather than a CE". (Interviewee CH1, 2018)

While standards and the CE matter to both the UK and China as tools for governing, they do so in different ways that reflect their governance systems. If standards are used to continually ratchet up material quality and extend still further materials markets, they provide a means to legitimate a neoliberal approach to a CE transition. For China, meanwhile, standards are a

very direct tool for governing; a means to help in the delivery of state objectives. As Higgins and Hallström (2007, 693) argue, for more authoritarian governments, standards and standard setters are "unashamedly arms of national government". Rather than utilising standards to deepen the trade in materials, China is using them to help regulate pollution and the activities of domestic waste and resources companies. Standards are being utilised by government to manage material flows (i.e. regulate the market) and assist in economic restructuring. There is less overt emphasis on using standards to manage a transition to a CE. More stringent standards may facilitate trade, but as Chinese commentators recognise is more likely to curb it because Western exporters will struggle to meet revised quality thresholds. Given the significance of China as an export destination, there are knock-on effects as, for instance, exporters of waste may rethink their markets by seeking to access cheap disposal options that undermine efforts to promote an international CE.

In terms of standards and neoliberal environmental governance, we see a paradox. On the one hand, many businesses and other stakeholders claim they are committed to an economic environment where the activities of the state are rolled back. They would like to avoid the authoritarian imposition of standards, as seen in China, for example. However, the seemingly weaker bonds of voluntary-led standard setting and observance, in fact disguises a relatively strict conformism with standards for formally autonomous agents in large part for fear of loss of reputation and trade (Higgins and Hallström, 2007).

6.0 Conclusions

In this article, we throw light upon the nature of governance and potential CE transitions by linking together policy content with a policy instrument: standards. We show how it is important to focus on the central role played by key actors and their expectations for CE practices. These expectations play an important role in shaping future CE activity in ways aligned with SOE analysis. However, when we analyse the ways in which actors work together to develop more sustainable resource activities, the foreclosure of options that takes place at the behest of the more powerful does not affect the essentially contested nature of what we have observed. Contestation is taking place around the CE concept, around forms of governance (e.g. standards) and around the transition process itself. We reflect further on each of these three themes and draw out the interrelations among them below.

The UK and China both promote notions of a CE that are based around positive economic benefits and the creation of new markets. In the UK, a neoliberal approach to standards means that they are associated with providing reassurance along supply chains about the quality of materials. Standards help to support market relations and spread further the area over which

materials can travel. Businesses and trade associations play a key role in formulating standards and ensuring their legitimacy through their use. At a practical level there is much more contestation than the high-level statements about the CE would suggest (cf. Cetina, 2013). In China, by contrast, notions of the CE are constructed around material reduction and recycling. This equates to incremental improvements in environmental management rather than a system-level transition. The Chinese model for a CE is principally concerned with waste reduction and efficiency because it seeks to regulate pollution in a domestic setting. Moves toward a more inclusive notion of the CE can only work if state actors reconceptualise what is meant by a CE and then impart that vision to industry, regulators and citizens. The challenge for Beijing in trying to achieve this reconceptualization whilst remaining sympathetic to its more conservative notion of environmental reform encapsulated in the term 'ecological progresses, a weak form of ecological modernization.

In the UK, networks can bring together shared thinking on the nature of a CE at an elite policy level. For practitioners involved in waste and resource management the situation is more confusing with a wider variety of views emerging. For these actors operating in a market environment, a neoliberal approach to the CE means that there is constant search to maintain existing markets and to seek out new markets for materials. In remaking the geography of material flows, actors show at least as much interest in locations for disposal as they do for material reuse and recycling. So, a NEG approach assumes that a CE can occur at multiple levels from local markets to those operating at a global level. However, this market-led sustainability transition can only arise if we have considerable faith in market actors achieving consensus over the meaning of a 'circular economy' and being able to align on achieving public policy goals. There is a further set of assumptions about state actors. The first of these is that they can develop the policy tools to help support and deploy niche CE innovations. The second is to develop the policy and tools to continue with the long-term alignment between public and private actors. In short, neoliberal economic relations in the UK make efforts to promote a CE more problematic than may have been anticipated (McDowall et al, 2017).

Commentators have recognised the key role of standards in neoliberalism (Higgins and Hallström, 2007, Gibbon and Henriksen, 2012). Foucauldian analyses of standards and standard setting suggest that networks of actors are held tightly together using standards either via self-disciplining or through the formation of an epistemic community. What these interpretations have lacked is an analysis of how actors coalesce around standards to give them meaning in practice. Schröder et al (2019, 190) have pointed to the need for further analysis of how "the emergence of the circular economy is constrained by the context of neoliberal economic growth". Analysing how thinking and practices on standards and the CE

come together within a NEG setting enabled us to draw out the challenges arising from differing interpretations of CE activity, and of rival conceptions of how the CE might be realised (Kirchherr et al, 2018). On the surface, these competing perspectives might appear to be an insurmountable challenge to neoliberalism and of efforts to promote a sustainability transition in materials. However, a SOK approach enables us to unpack the inter-subjective sense-making and learning witnessed with the CE and standards. Rival perceptions of the CE and standards reveal considerable flexibility in the interpretation of these terms. This ambiguity is particularly helpful in holding together an ever-expanding loose assemblage of actors. The progressive growth of networks of CE actors in the UK can, in large part, be explained by the idea of shared meanings. Such overlapping approaches can be seen to be being held in place by so-called 'boundary objects' (Star, 2010) and 'anchoring devices' (Van der Sluijs et al, 1998). With so many actors agreeing to collaborate on an effectively nebulous concept (cf. Kirchherr et al, 2018), CE activity can enrol increasing numbers of actors. As it does so, those who are associated with the CE approach will consequently gain political legitimacy and therefore benefit in terms of power among private actors and their networks but in governance terms, these actors are also influencing waste and resources management policy.

The work of Wijen and Chiroleu-Assouline (2019) and Manning and Reinecke (2016) has drawn attention to the role that standards can play in steering sustainability transitions. Our analysis highlights how, when a transition is at a formative stage - as is the case of the CE - actors coalesce around and seek to shape meanings for key terms and their use in practice. In both the UK and China, the agenda for a CE is not driven by a central actor. This is because in the UK, government is not playing a strategic role in constructing a transition pathway, while in China a highly centralised state apparatus is associated with inter-ministerial rivalries. Instead, the CE agenda arises from the (inter)actions of a relatively small number of key actors operating within and across diverse governance settings. Standards are a means to help realise those agendas: market development and liberal trade relations in the UK, and national resource security in China. Standards, therefore, also help realise alternative sustainability transition pathways.

To find a variety of understandings of the CE among the array of actors in the waste and resources community in China and the UK is, perhaps, to be expected, especially given the relative novelty of the term. More importantly, the diversity of views on the CE matters for how a transition may occur. The greater the consensus around the meaning of a CE and of the expectations of actor behaviour, the more straightforward the process of steering. However, with contestation and ambiguity surrounding the understanding of a CE, then how market and

political actors perceive and seek to shape market signals becomes more critical since these will be a key driver to a CE transition.

CE sustainability transition can take multiple forms, as our work on China and the UK shows. Change will occur at a range of levels. As any transition gains traction so we need to turn our attention to the ways in which policy instruments may provide opportunities to quicken and strengthen those pathways to change. This requires that we shift our focus to the detail of how transitions occur in order to better understand how policy instruments work in practice. Our analysis of China and the UK shows the importance of understanding standards within their governance settings because this shapes their meaning and practice, and in turn shapes sustainability transition pathways.

Acknowledgements

We wish to thank the referees and the Associate Editor, Professor M. J. Cohen, for their positive and insightful feedback on earlier drafts of this article.

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Appendix A: Key documents on the governance of imported waste in China

Relevant documents	Level of Authority	Date issued	Effective Date	Issuing authority	Commentary
Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Wastes (2004 Revision) [Revised]	Laws	29.12.2004	1.4.2005	Chairman of the People's Republic of China: Hu Jintao	Revised by Legislative Affairs office under the Department of State in June 29, 2013.
Administrative Measures for the Import of Solid Waste **[Effective]**	Departmental Rules	4.8.2011	1.8.2011	Ministry of Environmental Protection (MEP), Ministry of Commerce (MoC), National Development and Reform Commission (NDRC), General Administration of Customs (GAC), State Administration of Quality Supervision, Inspection & Quarantine (SAQSIQ).	To regulate the environmental administration of the import of solid waste and prevent environmental pollution caused by imported solid waste
Implementation Plan for Prohibiting the Entry of Foreign Garbage and Advancing the Reform of the Solid Waste Import Administration System	Regulatory Documents of the State Council	18.7.2017	18.7.201	General Office of the State Council	To completely ban the entry of foreign garbage, improve the management system for imported solid waste, and effectively strengthen the management of domestic solid waste recycling. Following the Plan, a series of regulatory systems and environmental control standards will be revised or newly introduced.
Identification standards for solid wastes General rules	Standards	27.5.2017	1.10.2017	MEP	- The **first** identification standard for solid waste in China.

					- Important basis for law enforcement at Port. The standards further refine and clarify the principles, procedures and methods for identifying and classifying solid wastes, which serve as reference to the identification of hazardous wastes and help to strengthen the management of imported wastes.
Environmental protection control standard for imported solid wastes as raw materials – - Smelt slag (GB 16487.2—2017) - Wood and wood articles wastes (GB 16487.3—2017) - Waste and scrap of paper or paperboard (GB 16487.4—2017) - Waste and scrap of iron and steel (GB 16487.6—2017) - Nonferrous metal scraps (GB 1648.7—2017) - Waste electric motors (GB 16487.8—2017) - Waste wires and cables (GB 16487.9—2017) - Metal and electrical appliance scraps (GB 16487.10—2017) - Vessels and other floating structures for breaking up (GB 16487.11—2017) - Waste and scrap of plastics (GB 16487.12—2017) - compressed piece of scrap automobile (GB 16487.13—2017)	Standards	29.12.2017	1.3.2018	MEP and SAQSIQ	- Firstly published: 1996; 1st revised: 2005; 2nd revised: 2017 (current version). - Setting new standards for the quality control of imported wastes: except waste plastics and Vessels and other floating structures for breaking up, new standards stipulate that the impurity threshold for nonferrous metal scraps falls to 1 percent, and 0.5 percent for other types of waste. - Tightening the control of radioactive pollution of imported waste and the quantity of hazardous waste - Clarifying the inspection process and inspection methods.

Announcement on the adjustment of “Import Waste Management Catalogue”	Standards adjustment	19.4.2018	31.12.2018 & 31.12.2019	Ministry of Ecology and Environment (MEE), MoC, NDRC, GAC	Effective 31 December 2018, 16 types of solid waste including scrap metal, scrap vessels, scrap automobile, smelt slag and industrial waste plastics listed in the "Catalogue of Solid Waste Used as Raw Materials under Restricted Import", shall be transferred to the "Catalogue of Banned Import Solid Waste"; and another 16 types will be banned from 31 December 2019.

Notes: Ministry of Environment Protection (MEP), Ministry of Ecology and Environment (MEE), Ministry of Commerce (MoC), National Development and Reform Commission (NDRC), General Administration of Customs (GAC), State Administration of Quality Supervision, Inspection & Quarantine (SAQSIQ)

Appendix B: Key Indicators for Circular Economy Development Evaluation Index System (CEDEIS, 2017)

Categories	Indicators	Unit
Comprehensive indicators	Major resource output rate	Yuan/Ton
	Major waste recycling rate	%
Special indicators	Energy output rate	Ten-thousand-yuan/ton standard coal
	Water resource output rate	Yuan/ton
	Construction land output rate	Ten-thousand-yuan/ha.
	Crop straw comprehensive utilization rate	%
	General industrial solid waste comprehensive utilization rate	%
	Repeated water use rate of industrial enterprises above designated size	%
	Recycling rate of main renewable resource	%
	Urban kitchen waste recycling rate	%
	Urban construction waste recycling rate	%
	Urban regeneration water utilization rate	%
	Resource recycling industry total output value	100 million yuan
Reference indicators	Industrial solid waste disposal amount	100 million tons
	Industrial wastewater discharge	100 million tons
	Urban domestic waste landfill treatment	100 million tons
	Key pollutant emissions (calculated separately	100 million tons