

RESEARCH

In the Name of Circularity: Environmental Improvement and Business Slowdown in a Chinese Recycling Hub

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This article examines the concept of ‘circular economy’ by looking at its effects on recycling activities in China, in particular through the lens of e-waste or DEEE (discarded electrical and electronic equipment). It focuses on a case study of the recent changes in the globally notorious DEEE recycling hub of Guiyu since plans for the construction of a ‘circular economy industrial park’ unfolded. Drawing on fieldwork carried out by the authors annually since 2012, the article points to the highly disruptive character of changes operated by the Chinese state in the name of increased circularity. After more than two decades of severe pollution, environmental betterment in Guiyu was long overdue. But it came at a high price: a marked business slowdown that forced the majority of workshops to close down. As activities and discards started concentrating in the park, so did profits in the hands of the local elite. This leads us to argue that the circular economy in China, which is ostensibly about improving resource efficiency, can in practice have more to do with controlling who benefits economically from recycling activities.

Keywords: circular economy; industrial park; recycling; e-waste; sociotechnical imaginary; China

Introduction

The concept of a ‘circular economy’ (*xunhuan jingji*) plays a crucial role in contemporary China. It was enshrined in a national law in 2008 and has repeatedly been reaffirmed by the government thereafter. Among the ‘pilot projects’ set up to turn the concept into reality, large industrial parks have drawn particular attention and earned China a reputation as a leading country in the effort to move away from an unsustainable, ‘linear’ economic model (defined as a sequence beginning with resource extraction and ending with waste disposal). However, in China, much like in the rest of the world, the idea of a circular economy tends to be framed in deceptively simple terms. What exactly makes an economy ‘circular’? How can linear processes be transformed into circular ones: through what measures, taken by whom, at what level? Too often, the circular economy is approached as a matter of technological progress and industrial reorganisation, which leaves aside a multitude of political and moral issues.

This article examines China’s state project of a circular economy by exploring the tensions between top-down visions and on-the-ground realities. It focuses on the mobilisation of the concept in a field often referred to as ‘e-waste management and treatment.’ We present the case study of a rural recycling hub called Guiyu that is located in eastern Guangdong Province and specialises in ‘discarded electrical and electronic equipment’ (DEEE).

We pay particular attention to the emergence and realisation of plans to build a ‘circular economy industrial park’ there for local companies. Having visited Guiyu every year since 2012, we were able to observe the park’s evolution, from mere architectural drawing to vast complex of multi-storied buildings, and to track its effects on the local economy and society.

Our interviews and observations indicate that, while the advent of the industrial park has certainly improved the environmental impact of recycling activities in Guiyu, it has also caused, or at least contributed to, a significant slowdown of these activities. Indeed, thousands of small, typically family-run workshops were forced to close down around that time. Moving into the park and adapting to the new requirements there was difficult for socioeconomic entities of that kind, for the park was designed, built and managed in a thoroughly top-down manner, not reflective of local practices, business models and modes of organisation. A few family workshops nevertheless succeeded, but many of them failed, and most did not even try. In addition, all small workshops operating outside the park faced intense pressure from environmental inspections conducted by local officials. The local elite, on the other hand, has not been nearly as affected. One powerful clan, in particular, caught the wave by positioning its interests in line with the project of an industrial park at the right time, thereby ensuring that it would continue to benefit from the trade in DEEE.

These findings lead us to question the Chinese Party-state’s embrace of the circular economy and its expected positive repercussions. Judging from the way this national, state-led project has been implemented thus far on the ground

in Guiyu, it seems to be parachuted from above, oblivious of local reality and at least as capable of disrupting existing circular material flows as it is of promoting new ones (see also Tong et al. 2018). Most crucially, the reorganisation of material flows it requires creates opportunities for accumulation by dispossession (see Inverardi-Ferri 2017a), especially by those benefitting from a privileged access to land, goods and state power. This leads us to argue that the circular economy, although ostensibly about improving resource efficiency, can actually be more about controlling who benefits economically from recycling activities.

The Circular Economy as a Sociotechnical Imaginary

Our exploration of the Chinese circular economy is informed by the concept of 'sociotechnical imaginary,' devised by STS scholars Sheila Jasanoff and Sang-Hyun Kim (2015). Jasanoff defines sociotechnical imaginaries as: 'collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of life and social order attainable through, and supportive of, advances in science and technologies' (Jasanoff 2015a: 4). This concept builds on the theory of 'co-production' previously developed by Jasanoff (2004), dependent upon which political world views and culture are constructed alongside scientific technological systems, and vice versa.

In our view, the project of establishing a circular economy in China qualifies as a sociotechnical imaginary in that it constitutes a largely supported—at least by state actors—and positive vision of social progress to be attained through a revamping of industrial processes and networks (more on this below). We find the concept of sociotechnical imaginary useful, because it helps us map the relationship between technology and politics that lies at the heart of the Chinese circular economy, and see how material and social resources are mobilised to enact this imagined future. In that sense, approaching the circular economy as a sociotechnical imaginary brings us further than approaching it as a discourse would. As Jasanoff argues: '*Discourse* shares with imaginaries the properties of being collective and systemic (e.g., Hajer 1995), but it usually focuses on language and is less directly associated with action and performance or with materialization through technology' (Jasanoff 2015a: 20, italics in original).

Sociotechnical imaginaries can be explored from four different perspectives, which Jasanoff refers to as (1) origins, (2) embedding, (3) resistance and (4) extension (Jasanoff 2015b: 322). Our study mainly sheds light on points (2) and (3) in that it concentrates on processes 'whereby the merely imagined is converted into the solidity of identities and the durability of routines and things,' and 'when new conceptions of how to change the world bump up against the old' (ibid.). In other words, we omit questions related to the birth of the idea of a circular economy and its spread on the global stage.

The Promotion of a Circular Economy in China

Waste management and other experts throughout the world recommend making material flows more circular so as to solve many of the problems faced by contemporary

societies, from growing resource needs to pollution (see, e.g., Sheldon 2018 and, on China, Ellen MacArthur Foundation et al. 2018). Many governments, including the Chinese government, have already adopted policies and regulations that promote a more 'circular' economy (see Geng & Doberstein 2008). Concepts borrowed from the field of industrial ecology, such as 'closed loop' and 'zero waste', have become global buzzwords that signal declaredly ambitious attempts at increasing resource efficiency to thereby both protect the environment and boost the economy (on China, see Mathews & Tan 2011). Yet, in practice, the circular economy suffers serious limitations, which even some of its proponents acknowledge (see, e.g., Cullen 2017 and, on China, Someno and Miao 2016). Scholars who have critically interrogated the circular economy and its implementation in Europe note, for instance, that it promotes the circulation of resources within national or regional boundaries and restricts out-bound flows. In practice, the models chosen in that part of the world have foreclosed the use of global recycling networks for recovering wastes as resources, despite the fact that these networks are actually achieving circular economies, and they have done so for reasons that have a strong moral and political dimension (Gregson et al. 2015, Kama 2015).

In order to understand the meaning and significance of the concept of 'circular economy' in China, we must situate it within a broader context. Around the turn of the twenty-first century, when it became increasingly obvious that China was facing an environmental crisis, the Chinese Party-state started using environmental concepts and theories that had originally been coined abroad. In particular, it adopted many of those that rested on the idea that the protection of the environment is compatible with the promotion of the economy, or that both are even mutually beneficial. This process started as early as the late 1990s, with the adoption of 'sustainable development' (*kechixu fazhan*), and intensified from the late 2000s onwards with the addition of 'ecological modernization' (*shengtai xiandaihua*), 'circular economy' (*xunhuan jingji*), 'clean production' (*qingjie shengchan*) and 'green growth' (*lüse fazhan*). All of these concepts and theories made their way into official plans, policies and propaganda (Si 2012). The Chinese Party-state clearly joined the international community in embracing and advocating the notion that 'the greening of economies is not generally a drag on growth but rather a new engine of growth' (UNEP 2011, see also Hajer 1995).

In recent years, the language in which Chinese leaders formulate their intention of achieving both a stronger economy and a cleaner environment crystallised around the term of 'ecological civilization' (*shengtai wenming*) (Pan 2015). According to observers (Oswald 2014, Geall 2015, Geally & Ely 2018), the call for an ecological civilization is not mere rhetoric; it has been accompanied by a series of concrete measures, including environmental education programs for party cadres, amendments to China's Environmental Protection Law and greater powers to environmental authorities (for a comprehensive list, see UNEP 2016). Whether these measures have been effective in bringing improvements to the quality of the environment is a

difficult question and a matter of debate. What is certain is that they couched a program of increasing state power and control in the language of environmentalism (Goron 2018).

State-led environmentalism has had a great impact in the field of waste collection and recycling. For much of the reform era, the sector remained virtually unregulated and dominated by a multitude of small actors such as self-employed workers, family businesses and small and micro enterprises, which are usually referred to in China as *getihu*. This changed progressively around the turn of the century. If we look more particularly at DEEE, state intervention dates back to the early 2000s and intensified in the late 2000s and early 2010s.

With regards to DEEE imports, the central government imposed a ban on various categories of devices and appliances as recently as 2000. For several years, enforcement remained weak, so flows of DEEE into China continued more or less unabated. But from 2013 onwards, Beijing launched a series of nationwide operations (including Green Fence and National Sword) to crack down on smuggling and other illegal activities, which led to a significant decrease in incoming volumes. Since then, scrap imports from abroad are routinely referred to in China as 'foreign rubbish' (*yang laji*), decried as dirty and dangerous, and depicted as a threat for the country. In 2018, the central government's policy on transnational trade in recyclable waste became particularly restrictive. A long list of categories of scrap are now banned from import into China, including almost all plastics and papers. This ban applies to DEEE as well, since plastics make up a large proportion of the materials used in electrical and electronic equipment. Recent official rhetoric on DEEE imports in China clearly draws on the dominant and, to some extent, crystallised framing of 'e-waste' as a public problem centred on environmental dumping (for a critique of this framing, see Davis et al. 2018 and Lepawsky 2018).

With regards to DEEE generated within the Chinese territory, the central government adopted a system known as extended producer responsibility (EPR), which attributes responsibility for the management of products' having reached their 'end of life' to those who sold them in the first place. The principle of EPR first appeared in Chinese legislation in the *Circular Economy Promotion Law* in 2008. It was applied to the field of DEEE a year later through the adoption of the *Regulations Regarding the Administration of the Recovery and Disposal of Waste Electronic and Electrical Products* in 2009 (Guowuyuan 2009, see Schulz & Steuer 2017). The Chinese version of EPR in this field basically amounts to a financing mechanism, which only became effective in 2013: producers (i.e. both manufacturers and importers) have an obligation to pay a tax for recycling on each item they put on the Chinese market while licensed recycling companies are entitled to receive a subsidy for each item they dismantle; the money paid by the producers goes into a national fund managed by the central government and is later distributed to the recyclers. Thanks to the EPR financing mechanism, Beijing has managed to create a new subsector composed of slightly more than a hundred large, capital-intensive recycling operations located throughout the country (see Schulz 2015, Inverardi-Ferri 2017b).

The new regulatory system for 'e-waste management and treatment' (*dianzi feiqiwu guanli chuli*) devised and controlled by the Chinese central government is touted as 'green' (*lüse*) or 'environmentally friendly' (*huanbao*), and apt to make circular economy a reality. Its proponents regularly emphasise the contrast between 'large companies' (*da qiye*) and 'small workshops' (*xiao zuofang*), insisting on the fact that the former achieve better 'pollution control' (*wuran kongzhi*) and 'resource recovery' (*zaisheng ziyuan*) than the latter (Schulz 2015). It should be noted, however, that China's regulatory system promotes exclusively material recovery, namely the destruction of objects with a view to salvage materials, whereas many of the actors and entities that operate outside or at the margin of this system also practice component and product reuse. In that sense, the so-called 'informal sector' does a better job at respecting the 3Rs principle (aka 'waste hierarchy': reduce, reuse, recycle) than the 'formal' one (Schulz 2015; Tong et al. 2015; see also Huang et al. 2016b).

The central government's main aim in taking the measures described above (i.e. imposing strict restrictions on waste imports and creating high barriers to entry in domestic waste collection and recycling) was to raise the sector's industrial concentration. Beijing sought to redirect material and financial flows towards large companies, which it can control more easily. This involved both cracking down on *getihu* to push them out of business and ultimately replace them with large companies, and creating specialised industrial parks to group *getihu* together and subject them to monitoring and control by larger companies—a strategy devised in the mid-2000s and officially referred to as 'enclosed management' (*quanqu guanli*) (see Schulz 2019 on Guiyu and Qingyuan in Guangdong Province and Goldstein 2017 on Wen'an in Hebei Province). Official discourse justifies such measures by the need to move towards a 'circular economy'—itself a crucial part of the leadership's plan to bring about an 'ecological civilization' (see Geall & Ely 2018). At a more fundamental level, however, such measures have deeper roots in the push towards zoning (setting aside different areas for industry, agriculture, residences) that characterises the production of territory in contemporary China (see Shue 2017).

From the outset, Chinese authorities faced various problems in implementing 'enclosed management'. High investment and operational costs within industrial parks made them highly unattractive to owners of small workshops, many of whom preferred to continue operating outside. This in turn affected larger companies within the parks, which often lacked material input and operated much below full capacity (Jingji Cankao Bao 2015). Given the scarcity of domestic 'secondary raw materials', some of the larger parks, such as Ziya outside of the city of Tianjin, were initially designed to rely entirely on imports. Eventually, this reliance on sources located outside the country proved problematic, since, as described above, importing 'foreign rubbish' into China became increasingly difficult from the mid-2010s onwards and especially since July 2017.

The marginalisation of self-employed workers, family businesses and micro enterprises, who have been central

to waste recycling during the reform era and had almost complete monopoly of the sector until recently, has been described in depth by other China scholars (see Inverardi-Ferri 2017a). The misrepresentation of these actors as always polluting is what makes the so-called formal sector and 'system' look greener and more circular (Goldstein 2006; Schulz 2018; see also Pickren 2014 and Reddy 2016). Such discursive interventions legitimise the drive to reorganise DEEE processing through formal parks and large plants. This is a gross misrepresentation of the much broader set of activities that small informal actors engage with when it comes to dealing with DEEE. Indeed, the work of the informal sector has been central to extending the lifespan of electrical and electronic equipment through practices of reuse, refurbishment and repair, which in fact contribute to circularity (Schulz 2018). The promotion of formalisation as the core principle of circular economy then wilfully neglects DEEE's complex materiality (see Lawhon & Salehabadi 2013) and the ways in which it may benefit from a wider range of processing techniques. Only on the basis of these omissions can formalisation and its focus on material extraction be presented as environmentally desirable (Schulz 2018).

Similar dynamics are at play in forms of certification of recycling activities and the negative portrayals of the North-South trade in DEEE (Lawhon & Salehabadi 2013; Pickren 2014). They are also fundamental to the 'Best of two Worlds' (Bo2W) model, which promotes a global redistribution of tasks whereby 'low-income' countries engage exclusively in manual disassembly of DEEE and send sorted material fractions to 'high-income' countries for further processing through extraction and refining (Manhart 2010, Wang et al. 2012). The rationale behind the Bo2W model is to exploit the respective competitive advantages of these categories of countries, namely cheap labour and advanced technology, to better protect the environment and human health. But it simultaneously takes for granted and reinforces global inequality by factoring out practices leading to reuse, which play a major role in the Global South (Lepawsky et al. 2017), as well as by attributing complex, high value-added know-how and processes to regions and actors located in the Global North (Reddy 2016).

In sum, our analysis of the ways in which DEEE has been regarded, treated and governed within the wider top-down drive to improve environmental protection in China indicates that the promotion of formalisation is the key characteristics of the current e-waste regime imposed by the state. It is one of the ways in which the sociotechnical imaginary of a circular economy has been implemented thus far in China. However, we do not wish to suggest that formalisation has materialised in precisely the way it was envisioned by the state. Powerful as the state may be, circular economy plans encounter complex local realities and conflicting interests (see, e.g., Tong et al. 2018). In our research, we also aimed to identify some of the obstacles that top-down attempts to reconfigure material engagements with DEEE run into—an emphasis Jasanoff refers to as 'resistance.' The following sections contain more on this topic.

Addressing the Challenges of Access

Anna Lora-Wainwright and Yvan Schulz both took several research trips to Guiyu. Lora-Wainwright carried out fieldwork in Guiyu for short periods in 2012 and 2013 in collaboration with Professor Li Liping from Shantou University. Schulz has visited Guiyu four times since 2014, most recently in May 2018, staying in town for three days to a week each time. The notoriety of the site created considerable obstacles to accessing it and spending significant amounts of time there. Lora-Wainwright worked closely with Professor Li to devise strategies for data collection to complement short-term participant observation. Together, they trained students at Shantou University who undertook roughly 60 in-depth interviews in 2012–3 (see Huang et al. 2016a; Lora-Wainwright 2017). Schulz spent over a year and a half living in Guangzhou and researching DEEE between 2014 and 2016 for his PhD thesis (Schulz 2018). He was able to visit the park during the early stages of its realisation in 2015 and 2016, when it was still mostly empty. By the time he returned in April 2018, the park had become a thriving site, but also a closely guarded one. Schulz asked the park management to be allowed to enter again, but permission was denied. It was therefore impossible for him to carry out fieldwork officially within the boundaries of the park.

Despite his inability to spend time inside the park, Schulz was still able to gather useful insights by taking a driving tour of the park, interviewing one recycler who works there, walking along nearby roads, and observing flows of workers and materials from his hotel room, located in close proximity to the park. He also spent a week living with a plastic recycling family just outside of Guiyu and interviewed key informants in Guiyu and neighbouring towns. These locals include people who: were still involved in DEEE (and plastic) processing and trading; had been involved in that line of business in the past but had been forced to abandon it; or had never been directly involved in it (e.g. a hotel manager). Interviewees were recruited through existing contacts or introduced by such contacts.

The Emergence of Rural Recycling Hubs

Rural recycling hubs are areas located in the Chinese countryside where the main source of livelihood has shifted in the late twentieth century from agriculture to scrap recycling. These hubs emerged in close connection with China's fast-paced economic growth during the reform era. Industrialization, urbanization and the advent of consumerism boosted demand for raw materials and caused a proliferation of waste, some of which could be recycled. At that time, China turned into the world's largest scrap importer. For instance, the largest share of imports from the United States in both weight and value in the mid-2000s consisted of recyclable waste (Minter 2013; Goldstein 2012). Self-made entrepreneurs with origins in the Chinese countryside figured prominently among those who sourced scrap from abroad. Several towns, among which Guiyu in Guangdong Province, Taizhou in Zhejiang Province (see Tong & Wang 2004) and Wen'an in Hebei Province (see Goldstein 2017), morphed into specialised dismantling and processing centres that

thrived on a mixture of foreign and domestic scrap (in varying proportions depending on the place and period), and catered for many of the needs of the local manufacturing industry. In most cases, these recycling hubs were located in poor rural areas, but close to both the sea and large industrialised regions, which made them ideal spots in terms of labour, land and transportation costs.

Guiyu, a town located in eastern Guangdong Province, is arguably China's most famous rural recycling hub. Since the early 2000s, it epitomises the 'e-waste tragedy' (Dannoritzer 2014), according to which 'every year, up to 50 million tons of electronic waste [...] are discarded in the developed world. 75% of this waste disappears from the legal recycling circuits, with much of it being dumped illegally in the Third World, where it destroys landscapes and harms lives' (film description). For many years, dismantling and processing were done in Guiyu using artisanal methods, which resulted in severe pollution. To this day, the town stands for what recycling should not look like: streets clogged with debris, black rivers devoid of life, and human bodies contaminated with toxic substances such as heavy metals and flame retardants. As it happens, Guiyu has experienced a radical transformation in recent years, whose positive impact on the environment was already obvious when Schulz visited in April 2018 (more on this below). Nevertheless, its sulphurous reputation lingers on.

Guiyu played a predominant role in the social construction of e-waste as a public problem (Schulz 2018: 61). For more than a decade and a half, the town received considerable attention, especially from NGOs and the media, and not only within China but also abroad. Due to its fame, it largely eclipsed other relevant sites, at least in China. This strong focus on Guiyu and what it stands for both reflects and results in an image of what e-waste is and how

it should be dealt with that is partial and biased. It exaggerates the importance of certain approaches to and types of material engagements with DEEE, and simultaneously obfuscates others—an instance of what Zsuzsa Gille calls a 'misperception of waste's materiality' (Gille 2007: 34). In Chinese and international public discourse, Guiyu is usually associated with crude or primitive recycling, that is, inefficient and harmful efforts to recover materials from used and used up electronics. In fact, for many years, the local population was involved not only in dismantling and processing, but also in salvaging reusable components and reselling them as functional products—an activity that generated the largest share of profits by far, according to several of our interviewees (see also Minter 2013: 196 and 201)—but this dimension rarely gets mentioned. As a result, Guiyu usually comes across as some kind of alchemical dream turned into a nightmare. In our view, the strong albeit simplistic association between DEEE, Guiyu and crude recycling goes a long way toward explaining why, in public discussions on 'e-waste', reuse practices tend to be ignored, even though they take place on a large scale throughout China, especially if we look at large household appliances (Schulz 2018: 296) and valuable, high-end electronics (Schulz 2018: 346).

Guiyu's Circular Economy Park

In 2005, China's central government selected Guiyu as the first circular economy experimentation point and in 2010 Guangdong province made the construction of a demonstration park for comprehensive recycling a priority (Schulz 2015) (see **Figure 1**). Yet, based on our visits since 2012, it remained mostly empty until recently. Indeed, the fact that locals in 2018 still referred to the park as '500 mu' (1 mu = 0.667 acres), the surface of the land it occupies, rather than by its official name, may be



Figure 1: The plan of Guiyu's circular economy park, displayed at the park entrance in 2015. Photo credit: Yvan Schulz.

an outcome of such protracted planning. During Lora-Wainwright's visits in 2012 and 2013, there was abundant scepticism and sarcasm about the park ever coming into being. It remained merely a plan, ridiculed by locals and described in many conversations as 'impossible' to realise. The pressure to move businesses into the park was widely regarded as an effort by the township government to collect more revenue by charging rent and levying taxes on businesses, not an effort to control pollution.

When Schulz visited in 2015 and 2016, a few workshops had moved into the park, but they used methods, such as manual dismantling, which bore little difference to those they had used when operating as a cottage industry (see **Figure 2**). None of those he spoke to inside the park had anything positive to say about it. One sarcastically remarked: 'It's great that you've come. Now, you can tell the world how environmentally friendly we've all become!' Resentment about the high rents remained fierce.

By 2018, the park was in full operation, brimming with goods, vehicles and people. Uniformed security guards were posted at crossroads and in other key locations, such as the loading/unloading station. It was organised into different sections devoted to particular activities (e.g. dismantling, roasting of circuit boards) and goods (plastics). These sections were not completely self-contained, though, just as was the case for businesses outside the park. Beside a very wide area dedicated to dismantling workshops, the park contained a water treatment plant and a new smelting complex. All spaces available to workshops for dismantling, sorting and storing were filled, even in the upper floors of buildings, which was not yet the case in 2016. Most actors in the park clearly concentrated on electronics: in workshops, Schulz saw all kinds of electronic devices (hard disks, CD and DVD

players, printers, photocopiers, printed circuit boards (PCBs), and so on) in all stages of deconstruction. By contrast, TCL, a Chinese state-owned company that runs a large plant in the park, visibly dismantled only two types of electronics, namely television sets and desktop computers (besides large household appliances such as washing machines, refrigerators and air conditioners—these five categories of products being until recently the only ones for which a subsidy could be obtained from the central government). The processing methods used in the park did not seem to have changed much, and they involved mostly manual dismantling. Workers used simple tools or machines, such as a grinder, to remove surface-mounted components from PCBs.

The steady flow of traffic was a positive sign that the park was a thriving centre for business. Every day in the early morning and late afternoon, Schulz observed an uninterrupted flow of two-wheeled vehicles on the road located below his hotel, which is linked to the park's main access road and leads nowhere else (see **Figure 3**). In the morning traffic flowed from the town centre towards the park, whereas in the afternoon it flowed from the park towards the town centre. Vehicles inside the park ranged from bicycles to large articulated lorries capable of carrying sea containers and everything in between: electrical scooters, motorbikes, motorised tricycles, vans, cars, and small lorries. According to interviews, most of those working in the park were locals.

Before the park was established, Guiyu and some of the surrounding towns (like Nanyang) relied heavily on DEEE processing and trading. One interviewee (a wealthy middle-aged hotel owner who had never been involved in this line of business) explained that Guiyu's 'pattern' (*geju*) is reliant on waste: 'the lifeline of the industry that



Figure 2: Manual dismantling inside Guiyu's circular economy park in 2016. Photo credit: Yvan Schulz.



Figure 3: A steady flow of workers heading to Guiyu's circular economy park in the morning (video excerpt). Video credit: Yvan Schulz.

has led the development of this place is waste, right? Well, waste is pollution [*feipin jiu shi wuran*], and the government is currently cutting [*qie*] pollution [he made a lateral movement with his hand flat as if he was slicing the air], cutting it until there's none left [*dao dou qiediao le*]. Indeed, Guiyu's economic configuration changed rather dramatically in recent years, resulting in what some called 'economic depression'. Lindi, a young man who used to dismantle CD drives, reflected that 'Two to three years ago, walking down my street [in central Nanyang], you would have seen workshops and electrical appliances [*dianqi*] everywhere. So many people were doing this.' Now, as Lindi stressed, hardly anyone was involved in that line of business anymore. Lindi and others could easily list several friends and acquaintances who had given up this professional activity and 'switched to another one' (*gaihang*). Most of them had turned to knitting, embroidery, textiles or underwear manufacturing, or e-commerce. As a consequence, Lindi estimated that 70 to 80 percent of migrant workers employed in DEEE dismantling and processing workshops in Guiyu had recently left the town. The reason, he said, was that there just wasn't enough work for them anymore. Some of these migrant workers returned home, while others moved elsewhere to look for employment. Their departure certainly contributed to a sense of emptiness, especially for those who remembered Guiyu in the early 2000s, when migrant workers numbered an estimated 100,000 (or twice the local population).

How can we make sense of such mixed messages: on the one hand reports of a significant economic slowdown, on the other the establishment of a large and seemingly thriving park? This seeming paradox can be addressed by disaggregating the broad category of local actors. It would be difficult to measure the scale of the transformation that took place in Guiyu in recent years, especially without any reliable sources on the size of the trade and workforce before and after the establishment of the park. But it

seems clear that those most adversely affected by the park were small actors who were relatively new to the DEEE business, like Lindi and his friends, and therefore had limited capital to invest in joining the park, limited networks to join forces with others and limited capacity (in terms of both capital and connections) to survive crackdowns. Conversely, workshops that moved into the park were likely to be larger or small but well-connected workshops whose owners would typically be (or have been) residents of the core villages in Guiyu that became involved in DEEE processing and trading early on (e.g. Beilin and Huamei) and members of more powerful kinship clans. According to the official story, many of the almost 5,000 small workshops that used to operate throughout town have merged to form a total of 49 companies that now operate within the park. But our impression, based on interviews with people who either are involved in this line of business or used to be, suggest that the vast majority of these workshops have simply vanished.

According to Lindi, only the largest workshops managed to enter the park. This is because operational costs in the park were too high for small workshops. He estimated that it cost about 100,000 RMB per year to run a workshop inside the park, in large part due to rent and taxes. 'Goods are taxed on their way both in and out of the park', he explained. All interviewees agreed that moving into the park incurred a decrease in revenue. Probably for this reason, workshop managers were less able to employ as many workers as they had done before. Owners of smaller workshops that entered the park joined forces with others in order to face the costs, but many of them later went bankrupt and were forced to leave the park.

A complementary factor conspired to put further pressure on any remaining small workshops outside the park: increasingly severe environmental inspections. These were typically carried out by the township Environmental Protection Bureau (Huanbaosuo),

sometimes in conjunction with other town-level entities, such as the Administrative Bureau for Industry and Commerce (Gongshangsu) and, on occasion, their higher-level counterparts. Lindi's case can serve as an illustration. He was forced to quit in 2015, following an environmental inspection of his CD dismantling workshop. Lindi recalled that four people from the environmental protection bureau arrived at his workshop and told him, without inspecting his workshop in any depth, that his activities were polluting, and the workshop would have to close. Lindi appealed the decision, arguing that he was only doing dismantling, which, unlike acid-stripping or open burning, is not particularly polluting. He also borrowed from the state's own green vocabulary—in an act of rightful resistance of sorts (O'Brien & Li 2006)—and argued that he was contributing to 'recycling' (*xunhuan liyong*, literally 'circular use'), which is good for the environment. His appeal was unsuccessful, however, and Lindi was sentenced to one and a half years in prison with a one-year probation. He is now engaged in retailing bras and corsets online, an obvious choice given the proximity of factories in a neighbouring town that specialises in manufacturing women's underwear. His experience and narrative reflect the effects of the recent pressure to concentrate activities inside the park on smaller actors and widespread doubts over whether inspections were indeed about environmental protection or part of a long-standing practice of rent-seeking among local officials (more on this below). Indeed, Lindi's personal story suggests that small DEEE dismantling or processing businesses need not pollute to any significant degree to be criminalised and shut down on account of violations of environmental protection law, and their owners sentenced to prison. It suffices that they operate outside the park, and therefore beyond the newly created structures and mechanisms of capital accumulation.

Business in Guiyu also suffered from the restrictive stance that characterised central government policy on waste imports from the early 2010s onwards. 'Smuggling' (*zousi*), on which Guiyu had relied almost entirely in its heyday, became increasingly difficult and risky as several state agencies, including the Customs, Ministry of Environmental Protection (now Ministry of Environment and Ecology) and General Administration of Quality Supervision, Inspection and Quarantine, started to join forces and step up efforts to monitor incoming flows of waste material and crack down on trafficking and other unauthorised activities. As for the wide-ranging ban on scrap imports implemented nationwide since January 2018, our interviews indicate that it aggravated further what was already a dire situation for recyclers in Guiyu. However, it arguably had a less significant impact there than in other recycling hubs, for Guiyu specialises in types of goods (DEEE) whose import had been forbidden—at least on paper—since the early 2000s. In fact, a process of switching to domestic supplies had already started in Guiyu many years before the ban and was well under way by the time the ban was adopted, as we were able to document and other sources (e.g. Minter 2013) confirm.

Ambivalent Perspectives on the Park

Local attitudes towards the park in 2018 were characterised by ambivalence. Everyone agreed that the obligation to join the park and the frequent environmental inspections had caused a severe economic slowdown, affecting small businesses in particular and compounding the pressure they were under as a result of Beijing's policy on waste imports. At the same time, everyone also agreed that the park had brought a marked improvement in Guiyu's environment (see Nanfang Zazhi 2018). Locals viewed this evolution positively and noted it with satisfaction. The young man who drove Schulz through the park spontaneously pointed to environmental protection equipment there (e.g. filters on smokestacks), arguing that it had contributed to putting an end to the omnipresent stench of burned plastic that had characterised Guiyu in the past. He also stressed that fish had come back to the town's once lifeless waterways, and that plants grew again on their banks. Walking through the streets of Guiyu, Schulz noticed a marked reduction in, among other things, dust, noise, fumes and traffic, which made his sensory experience in 2018 very different from those of his previous stays. Schulz was also struck by the fact that public squares, which long served as market places for buying and selling DEEE, had regained their role as traditional public meeting places for children, the elderly and the unemployed.

Several interviewees argued that concentrating businesses in one area was the best way to tackle the challenge of pollution. This does not mean however, that they regarded the park as entirely green. For a start, the processing techniques inside the park were largely similar to those which were employed before the park was established, such as manual dismantling and roasting of circuit boards. Although some environmental protection equipment was visible, we could not verify whether it was employed adequately—and several of Schulz's previous interviews with industrial equipment specialists in China suggest that it is not rare for such equipment to be standing idle (Schulz 2018: 257).

The comments by a local hotel owner clearly highlight some inadequacies in the park as it stands. 'There's a plan [*jihua*]: to make all these companies formal (*zhenggui*). [But] it will take time to carry out [*hui manman wancheng*].' He elaborated: 'They haven't equipped the park well enough; it's still lacking [*bu wanshan*]. Now that you've been here [in this hotel] for a while, have you not noticed the smell [*weidao*]?' The hotel owner proceeded to show Schulz a picture of a chimney he had taken with his smartphone, from one of the hotel rooms. A thick, coloured smoke came out of the chimney, which was part of a copper smelter. Schulz had noticed the chimney but told the hotel owner he had assumed it did not belong to the park, since it was located just outside of the park's walls and did not appear on any of the official maps. The hotel owner gave him a knowing look, with raised eyebrows. 'Outside, it would be even less permitted [*waimian jiu geng bu yunxu*],' he explained. Later in the day Schulz walked by the smelter and saw its official name (Park Project for

Pyrometallurgy or *Yuanqu Huofa Gaizao Xiangmu*), which confirmed that, although located outside the walls, the smelter was indeed part of the park infrastructure. Two days later, while sitting in his hotel room and looking out the window, Schulz noticed fumes coming out the smelter's smokestack that looked very similar to those he had seen on the hotel manager's picture.

Interestingly, the official description of this smelter indicated that it served as a 'testing facility' (*zhongshi chejian*) rather than a fully operational one. This makes the fact that it was still being used, possibly even daily, all the more surprising, because Guiyu now also possesses a large, brand-new smelter dedicated to the recovery of valuable metals from PCBs, which features unique, state-of-the-art technology (see Liu 2018). The initial purpose of this new 'demonstration project' (*shifan xiangmu*) was to conduct research on various pyrometallurgical processes with the aim of developing industrial applications. It was built by, and now belongs to, China Energy Conservation and Environmental Protection Group (CECEP or *Zhongguo Jieneng*), a state-owned enterprise reporting directly to the central government that describes itself as a 'flagship company' (*qijian qiye*), owns 563 subsidiaries, and employs close to 50,000 people nationwide. According to its website, this new facility has a yearly treatment capacity of 20,000 tons of PCBs and a yearly production capacity of 4,000 tons of copper blister. But there are indications that it may have been operating at a much lower level in April 2018, even though production had already begun, at least officially. A presentation by the new smelter's chief engineer during a conference in May 2018 (*ibid.*) was suspiciously devoid of any figure regarding actual volumes (output, not capacity) and Schulz's interviewee who worked in the industrial park said he thought the facility still remained idle. It is therefore likely that Guiyu's new smelter, which claimed to 'implement the circular economy', did so by virtue of its existence rather than performance.

The hotel owner's comment above suggests that the park is not necessarily less of a pollutant, but rather that pollution is only permitted inside the park. These inadequacies in environmental performance inside the park and the fact that processing techniques employed largely resembled those used previously outside the park are likely to be important reasons why, when Schulz attempted to gain permission from the park manager to visit the park, he was told that visitors would not be accepted for another two years. This reality stands in contrast with the official rationale of the park, that is, of promoting circular economy and protecting the environment in ways that were not possible without concentrating businesses in the park.

Such accusations of inadequate environmental standards in the park—like Lindi's allegation that environmental inspections are driven by the imperative to collect revenue rather than protect the environment—are rooted in and continue to nourish residents' attitudes to local officials and the most powerful local clan, the Chens from Huamei (see Kirby & Lora-Wainwright 2015). Indeed, two

members of this clan served as party secretaries of Guiyu in the past and played instrumental roles in establishing and running the industrial park. The first party secretary and his brothers, who also occupied leading positions in the town government, founded the company that would run the park and applied for the permission to build it. The second party secretary joined them as a major shareholder of this company and subsequently took the role of head of the park's Administration Committee (*guanweihui*). The names of several of the plants operating in the park suggest that they are in fact joint ventures involving the Chens from Huamei. In particular, the Chens seem to have interests in metal extraction, which is where the largest profits can be made.

Interviewees who spoke to Lora-Wainwright in 2013 and those who spoke to Schulz in 2018 displayed a mixture of awe and spite towards these leaders-turned-entrepreneurs. One of them remarked: 'Their ability is not inferior to that of the provincial government. They are bold and resolute; they really know how to handle affairs.' Another reflected on the clever business move by these elites: 'Not only did they not spend a cent [because they invested government money], but they quickly reaped large benefits.' The enduring reference to the park as '500 mu' may also, by implication, serve as a comment on how much land was appropriated by the town government for this project and on the huge potential revenues for those in charge of the park. For all these reasons, the park was regarded largely as a rent-seeking venture by the local elite—and therefore not seen as a total and final solution to Guiyu's environmental problems.

Contested Circularity

The realisation of the circular economy park in Guiyu stalled for several years (see Kirby & Lora-Wainwright 2015) and only finally materialised after strong top-down intervention and growing emphasis on environmental protection among the very top leadership in China. More frequent and severe environmental inspections forced small workshops to close, even when, like Lindi's workshop, they may not have been polluting. More thorough checks at customs and a clampdown on license fraud have resulted in less foreign waste entering China and unlicensed operators (usually the smaller ones) losing access to imports. Some interviewees regarded this as an important factor in the current slowdown of informal recycling and the closure of many small workshops in Guiyu. But the realisation of the park is not only a consequence of top-down pressures. Indeed, the fact that the local elite—members of the Chen clan who already wielded powerful networks through their previous posts as town party secretaries—made the park effectively their project contributed to its establishment. Goldstein (2017) similarly pointed to the centrality of the county party secretary in making the circular economy park in the plastic recycling hub of Wen'an a reality. When members of local elites realised that informal DEEE recycling would soon no longer be tolerated, given growing pressure from above, they took advantage of a new opportunity for revenue through the circular

economy park. They were able to do so thanks to the particularly powerful position of township leaders, who can both requisition land and set its price, and thereby also create opportunities for themselves and other members of their clan to buy or lease land at beneficial rates. From this perspective, the fact that the park became reality roughly at the same time as Beijing's restrictive policies started to produce results does not look like a coincidence.

The premise of the park was to promote a more circular economy. But to what extent has it done so? Given that the flows of goods and materials circulate well beyond the park, the park is by no means a closed, self-contained system. The vision of industrial symbiosis that underpins circular economy parks (see Mathews & Tan 2011), is only very partially realised, if at all, through the Guiyu park by itself. Partly processed goods flow into the park, but many fractions (e.g. aluminium, iron and steel) must leave the park (and, in some cases, be sent several hundreds of kilometres away, to the Pearl River Delta), given the lack of specialised smelters and other facilities to process and refine them there. Schulz also observed a significant flow of small vehicles transporting goods (materials, including plastics, and components) out of the park, possibly for further processing in Guiyu's vicinity, though we were unable to confirm where. In other words, the park contributes to circularity only if we include wider flows. Equally, goods do not just flow out of the park for further processing, but they flow into it after partial processing in larger, licensed plants. Our interviewee who worked in the park commented: 'They [the licensed, DEEE-dismantling plants] make money through the subsidy, and then they make money again by selling [goods] to us.' This statement confirms that Guiyu workshops are part of a wider national (and possibly, to some extent, still international) circular economy by which 'lower end', manual work is at once despised but also needed.

These dynamics resemble a version of the Bo2W model, which Reddy (2016) has rightly critiqued as constituting a form of resource grab whereby larger actors draw the biggest proportion of the profit through material recovery while they capitalise on the labour-intensive processes of manual dismantling without rewarding those workers adequately. In the case of Guiyu highlighted above, flows are mostly national (China's own recycling companies accomplish the first part of the process, and pass goods on to smaller workshops reliant on manual work for finer processing), but the largest share of the profit remains unequally distributed. Ultimately, the economic reconfigurations required by the park marginalised small actors who had previously been able to earn a living from DEEE processing and trade. The value derived from extraction of the most valuable materials (i.e. non-ferrous and precious metals) is no longer in the hands of small workshops but rather rests with several companies owned either by the local elite or by large, state-owned groups such as TCL and CECEP. In this sense, then, the reconfiguration of previously existing circuits occurs at the cost of marginalising weaker actors and brings little in terms of additional circularity.

Conclusion

In this article, we mobilised Jasanoff's concept of sociotechnical imaginary to explore the implementation of Chinese circular economy and the resistance it gives rise to. Our aim was to dive into 'a deep meditation on the basis of a technological society's particular forms of sightedness and blindness, and the trade-offs that inevitably accompany attempts to build a shared normative order' (Jasanoff 2015b: 339). We have done so in connection with Guiyu, the poster child of e-waste pollution and a town that has received considerable attention since the turn of the century. This has enabled us to highlight some of the unacknowledged aspects, unexpected developments and unwanted consequences of the Chinese central government's policy on environmental protection.

China's current e-waste regime, although focused on state-led standardisation and formalisation of dismantling and processing in large plants and circular economy parks, is far from realising the ideal of greenness and circularity it purports to embody. In Guiyu, as we have seen, some forms of pollution inside the park are intentionally overlooked, some may even say sanctioned. The fact that the park concentrates potentially polluting activities in one place, located separately from residential areas, means that pollution is less likely to affect the population as it did when DEEE processing was inseparable from locals' homes. But this is better described as zoning than circularity. In addition, the ideal of self-containment typically associated with the circular economy was only realised to a very limited degree. Considerable flows of fractions out of the park suggest that it relied heavily on other sites beyond its control. Finally, if one of the rationales behind the park was to do away with 'primitive' methods for processing DEEE as they were developed by informal workshops in previous decades, it is clear that the park did not deliver, since it provided a new space for many of those practices to carry on.

But mitigating pollution does not seem to be the main aim of the exercise. This is evident in Lindi's story, among others. Diverting gains to the local government and local elite, who practically own and run the park, appears as a much more significant outcome so far. The top-down imposition of a model of circular economy that requires concentrating businesses inside a park has resulted in some environmental improvements in Guiyu, but also in a marked redistribution of the economic gains from DEEE processing and trade. It has exposed workshop owners to higher costs through tax and rent and forced many of the smaller enterprises to shift to alternative livelihood strategies with very mixed degrees of success. In sum, China's e-waste regime may promote circularity, and present formalisation as a key mechanism for achieving it, but our fieldwork suggests that such top-down interventions have disrupted pre-existing forms of circularity and resulted in an even more unequal distribution of economic gains. Seen from this angle, China's circular economy appears to be less about increasing the circulation of industrial inputs and outputs, and more about controlling the generation of revenue and profit related to such circulation.

To conclude, three main insights can be derived from our study. Firstly, the alleged improved circularity and reduced environmental impact of projects that bear the label 'circular economy' needs to be tested on a case-by-case basis and cannot be taken for granted. In Guiyu, it is anything but obvious and indisputable. And this is not unique to this region of China. The same can be said about the country's capital Beijing, for instance, where 'CEIP' (circular economy industrial park) is all but synonymous with 'incinerator complex', perhaps with the occasional ash-to-brick factory or experimental attempt at composting food waste as an attractive accessory' (Goldstein forthcoming).

Secondly, researchers need to pay close attention to who invokes the term 'circular economy'—or any other term taken from the panoply of Chinese green propaganda, for that matter. There are significant power differentials between those who are able to use this kind of vocabulary and those who are not. In Guiyu, recyclers not belonging to well-established families and clans struggled to make claims of greenness and have them recognised, whereas elites managed to do so when it became necessary.

Thirdly and lastly, researchers need to ask who stands to benefit from the pursuit of a circular economy and who stands to lose from it. In Guiyu, the success of the park was accompanied by a more uneven distribution of economic gains and the dispossession of the majority for the protection of the interests of a minority. It contributed to the more general marginalisation of what many refer to as the 'informal sector'.

This should prompt researchers to approach the environmental imaginary of a circular economy with a healthy dose of scepticism, whether in connection with China or any other country.

Ethics and Consent

Fieldwork for this article was approved by University of Oxford Social Science Division Research Ethics Committee (SIAS_CHINA_C1A_18_061).

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Competing Interests

The authors have no competing interests to declare.

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