

Top-Down, Bottom-Up and Beyond: Governance Perspectives on Urban Resilience and Environmental Justice in the People's Republic of China

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2.1 INTRODUCTION

The challenges facing cities in the developing world are becoming increasingly complex, as traditional socioeconomic concerns become intertwined with new, unpredictable environmental problems like climate change. The complexity and uncertainty of these new sustainability issues make them difficult both to forecast and to manage (Walker et al. 2002; Newig et al. 2007). New technologies, consumer behaviour and practices are introduced into society by innovation in different sectors, often in an unplanned fashion and led by different actors. At the same time, new governance approaches to manage sustainability issues are emerging across the globe, through new political organizations, policy instruments and initiatives that transcend traditional public-private borders (Bulkeley and Newell 2010). For example, many urban climate change initiatives

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are led by non-state actors, and many are realized through cooperation between public authorities, private organizations and civil society. Understanding how sustainable practices emerge, and how they are managed and up-scaled, is of key importance to explain new environmental trends in the urban scale in the global South. More specifically, this is a question of understanding who is involved in creating new solutions to emerging environmental issues, and recognizing the role of innovation and cooperation that extends beyond traditional top-down interventions.

The connections between governance approaches and environmental trends have been previously explored, for example, with reference to the role of cross-level governance in ecosystem protection, or the level of participation and deliberation in creating urban resilience (Brondizio et al. 2009; Lebel et al. 2006). Such connections have, however, been explored to only a limited extent in the context of the political system of China. The aim of this chapter is to contribute to this area of knowledge by explaining what forms of governance approaches are involved in managing environmental risks in an industrializing city in China. In doing so, the chapter illustrates different forms of management of environmental issues that exist in a centralized, highly authoritative political system. The chapter shows the consequences these governance approaches produce in terms of building urban resilience and effects on environmental justice. The key argument is that different forms of management of environmental issues create different outcomes in terms of creating resilience and addressing perspectives of justice. In prioritizing between these outcomes, there are also tensions between socioeconomic concerns and environmental issues. The chapter also discusses the relationship between urban resilience and environmental justice in this context.

Governance is a concept frequently discussed academia and policy documents, often in terms of ‘good governance’ or used simply as a collective description for government structures and activities. The varied use of the term means that different definitions are applied in different fields of literature, but the concept ultimately concerns ways of ‘creating the conditions for ordered rule and collective action’, normally with reference to the activities and structures of governments (Stoker 1998: 17). Processes through which local government authorities creates conditions for ordered rule with reference to environmental issues are studied in this chapter by focusing on decision-making processes, including policy-making and planning. Decision-making is studied here by considering the key organizations and actors involved and key sources of influence on decisions.

Processes of collective action and cooperation with reference to environmental issues are studied primarily in terms of the approaches and interactions involved in realization of environmental policies. This chapter thus takes a linear approach to policy processes, assuming that decision-making and enforcement occur along a traditional, state-centred governance model. Such a model is applied in order to capture key dynamics taking place in China's comparatively top-down system; however, multiple forms of interactions between sectors in both stages of the process are considered.

As noted in the Introduction to this book, the concept of resilience was originally adopted from the literature of ecology, where it describes the degree to which a system can tolerate alteration before rearranging in accordance with new structures (Holling 1973). This chapter builds on the definition used in the literature on urban socioecological resilience, which is based on three system aspects: the amount of change a system can undergo and maintain the same configuration, the capacity of a system to self-organize, and the capacity of a system to learn and adapt (Carpenter et al. 2001: 766; Walker et al. 2002; Alberti and Marzluff 2004). This definition has previously been interpreted as the degree of change a system can undergo whilst retaining its functions, capacity of self-organization, and capacity of adaptation in the face of external stresses (Walker et al. 2002). With reference to environmental issues in a city, this can be understood as the degree to which an urban system that is under pressure of environmental stresses is able to continue to function and to adapt in response. This chapter primarily considers two forms of environmental stresses on an urban system: resource shortages and environmental deterioration (mainly land fragmentation and pollution). Capacity of adaptation is studied by considering ability to learn, self-organize and adopt new practices in response to these stresses.

Also as discussed in the Introduction of this book, the concept of environmental justice has been used to address various aspects of environmental fairness, including post-colonial, international and gender dimensions (Walker and Bulkeley 2006). This chapter applies a twofold understanding of the concept, which includes a procedural aspect (influence over environment-related decision-making) and a substantive aspect (distribution of environmental risks and resources).

The case study of this chapter is the city of Rizhao in China's Shandong Province. The city is chosen for displaying development patterns typical of cities in this region, such as rapid population growth, economic and industrial expansion and a large increase in infrastructure

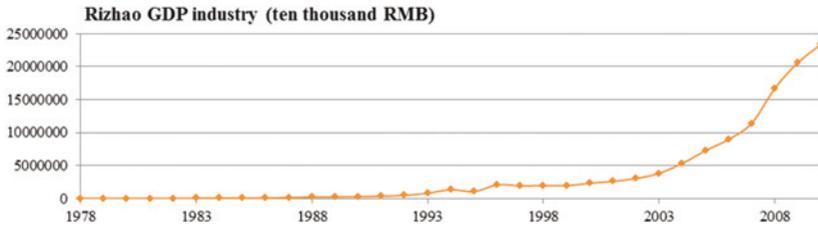


Fig. 2.1 Rizhao economic growth, 1978–2010. *Source* Rizhao Municipal Yearbooks

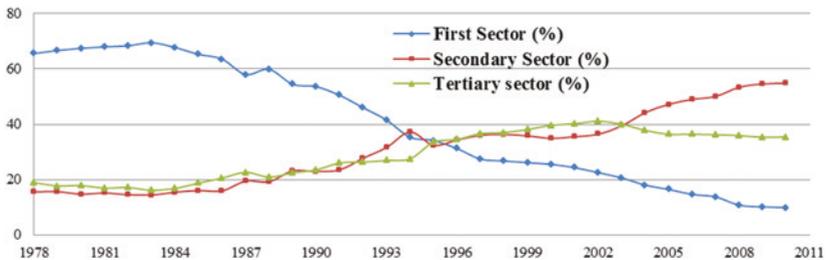


Fig. 2.2 Rizhao economic structure, 1978–2010. *Source* Rizhao Municipal Yearbooks

and built-up land. Figures 2.1 and 2.2 illustrate growth in industrial GDP and increase in the size of the secondary sector. Rizhao is also a medium-income, average-size city, making it a potentially representative case of development trends of China's East-Coast industrializing cities.

Rizhao has, at the same time, distinguished itself as a forerunner within environmental development, by raising control of polluting enterprises, improving protection of ecological zones, increasing green space and adopting energy-saving technologies in the construction and industrial sectors. This makes the case study relevant as the use of different policy instruments and enforcement strategies in different sectors can be expected to reflect different governance approaches. The chapter focuses on the city's spatial planning processes and the industrial and construction sectors, as activities in these sectors have the largest environmental impact. Industry and construction use the most water and energy resources and create the most pollution. Urban spatial planning determines the size of industrial and built-up areas with reference to protected green space.¹

The study is based on research carried out in Rizhao over a six-month period in 2013. The data collection is based on interviews with key informants in the city of Rizhao: local officials, central and local planners, company representatives and academics. The interviewees were selected with the aim of maximizing the variation of viewpoints by selecting several respondents from each sector, and by choosing individuals with long work experience and insights into the mechanisms explored in the study. The interviews were complemented with policy and document review and collection of secondary quantitative data from Rizhao Municipal Yearbooks (1989–2010).

2.2 DYNAMICS OF ENVIRONMENTAL POLICY-MAKING AND ENFORCEMENT IN RIZHAO

2.2.1 *Processes of Environmental Planning and Policy-Making*

The strongest influence on decision-making in cities in China is the top-down transfer of guidelines from higher levels of government, which occurs mainly through adoption of goals and targets delegated to municipal departments by the provincial government. This transfer is most obvious in key policy documents, such as the municipal Five-Year Plans (FYPs), which outline development strategies and targets for each economic sector. The municipal Development and Reform Commission (DRC) drafts the FYPs in accordance with provincial standards, in turn delegated by the central government. Within environmental policy, the FYP includes guidelines on resource conservation, pollution targets and ecological protection. Targets set by Shandong Provincial Government, including industrial energy conservation and resource conservation in the construction sector, similarly guide resource use in other sectors.

Another mechanism creating a top-down transfer of ideas is the involvement of national institutes in planning processes. The central planning institute, China Academy for Urban Planning (CAUPD) in cooperation with the Municipal Construction Committee drafted Rizhao's two most recent Master Plans. Similarly, the Environmental Protection Bureau (EPB) delegated the drafting of the 'Rizhao Eco-City Construction Plan 2001–2020' to the central-level China Academy of Science (CAS). Another significant influence on municipal policy is the priorities of leaders in high positions in the municipal government, for example, the mayor and party secretary.

The above top-down mechanisms are integrated with demands from local stakeholders through the city's standard planning procedures, in which the municipal government convenes meetings to solicit opinions of local organizations. This mainly includes relevant departments and business interests, but also research institutions and ordinary citizens (through surveys). These discussions aim to resolve conflicting agendas and avoid planning overlaps, such as in the drafting of Rizhao's eco-city construction plan:

We spoke with the agricultural department, the urban planning department, industrial representatives and the fisheries. After the plan came out, we asked many times for their comments and tried to work out amendments according to their ideas.²

In these negotiations, some stakeholders, primarily economically powerful industries and developers, appear to have a larger influence than others on decision-making outcomes. This tendency is expressed as decisions more often being made in favour of industrial enterprises and private land developers, allegedly due to their larger capacity to generate GDP, tax income and employment (this point is further explored in the sections below).

As described by one of Rizhao's urban planners:

We had an idea that they begin to develop tourism projects in the inland, to allow the tourist industry to spread from the coast to the less developed areas. Instead, this area was developed for industries related to the port zone. The income from the industrial activities would be much bigger than that from tourism so it was hard to push this point. In the planning process, this decision was made by the government, but it might have been suggested by industrial interests.³

Figure 2.3 maps the key organizations involved in drafting Rizhao's key planning documents, as well as some key influences on planning negotiations. The diagram illustrates that the influence on plans and key policy documents runs in both vertical and horizontal directions. Although key policy directions are provided by central and provincial government units, local stakeholders have room for manoeuvre in influencing the details of the plans through their influence on local government offices. The thicker lines show that the negotiation-based decision-making system

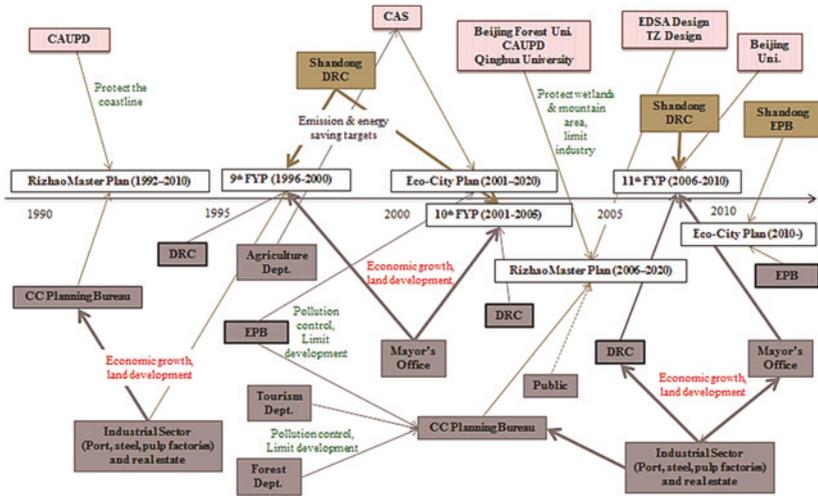


Fig. 2.3 Rizhao decision-making interactions. *Source* created by the author

allows some stakeholders, usually economically powerful industries and developers, to have a greater influence on decision-making outcomes.

Box 1.1 Decision-Making Organizations in Rizhao

CAUPD	China Academy of Urban Planning and Design
DRC	Development and Reform Commission
CAS	China Academy of Sciences
RCC	Rizhao Construction Committee
EPB	Environmental Protection Bureau

2.2.2 Enforcement of Environmental Plans and Policy

The enforcement of urban environmental plans and policy is divided between municipal departments in accordance with their areas of responsibility. Rizhao EPB supervises pollution control, preservation of protected zones and promotes environmental protection. Rizhao Development and Reform Commission (DRC) is in charge of planning

guidelines, large project approvals and promotion of economic restructuring. Rizhao Economy and Information Technology Commission (REITC) promotes industrial energy conservation and industrial recycling. Rizhao Construction Committee enforces green construction standards and promotes adoption of heat metering, thermal power and solar energy. To make sure that targets are met, city departments report results to higher levels of government. The foundation of the top-down control of the political system is performance assessments through China's cadre evaluation system, which directly influences political careers, especially for leaders in high positions, such as the mayor and party secretary.

In the realization of environmental policy, a traditional approach of issuing binding standards is still widely applied. For example, air and water pollution levels are monitored in factories and transgressing industries are fined or in severe cases shut down. Industrial energy efficiency standards and green construction standards are monitored in a similar way. However, industry and real estate often fail to live up to environmental standards because of lacking funds, and strategies to breach this gap include use of subsidies and preferential financial policies to support green practices. In many cases, green technology is still too expensive, and the authorities also use training and joint research as methods to spread knowledge about affordable ways to adopt greener practices. Examples include cooperation in R&D into solar technology and industrial recycling for production of methane-based energy. As stated by Rizhao Construction Committee:

We provide training for all the major developers for them to be aware of green construction and know how it is done... When they try to build green, they use too much money, they don't have the knowledge to do this in a cheap way yet, but we are working on it.⁴

2.3 RIZHAO: URBAN RESILIENCE AND ENVIRONMENTAL JUSTICE

2.3.1 *Influence of Governance Arrangements on Urban Resilience*

The continued prioritizing of economic growth by central and provincial government impairs effective responses to concerns about resource use and pollution. Assessment targets reward GDP expansion and industrial

progress ahead of environmental protection, and there are incentives for continued investment in industrial expansion, which places further pressure on resources and contributes to rising pollution. The central government has attempted to ameliorate this effect, for example, by adjusting the cadre evaluation system and channelling funds and political recognition in return for meeting environmental standards. So far, however, these incentives still seem to be outweighed by the emphasis on economic performance. The top-down growth directives limit local leaders' ability to respond to environmental pressures, and plans are adjusted according to central guidelines instead of local environmental issues. In terms of urban resilience, the top-down control effectively impedes management of the pressures of pollution and resource shortages, weakening the ability of the urban system to respond and adapt to environmental issues. This form of governance arrangements can thus have a negative impact on resilience.

The considerable influence of private development interests on planning exacerbates this problem. Rizhao's heavy industry is characterized by high pollution emissions, high resource consumption and low resource-use efficiency, with adverse impacts on the city-region's biodiversity and natural habitats (Wang et al. 2009). Although expansion of industry increases pollution, water scarcity and land fragmentation, it is still often permitted due to the sector's disproportionate influence on planning decisions. Urban planning is described as:

a process of 'in the day-time we research, in the night-time we vote', because even if there is pollution, the government still needs to consider GDP and economic growth, so still needs to keep the factories'.⁵

This statement illustrates that, when considering whether or not to expand urban industrial activities, environmental conditions are studied, but the decision-making is based not on pollution levels but rather on the factories' potential income levels.

It appears that the influence of external planners sometimes acts as a counterweight to this trend.

The local government originally wanted to develop the entire area, but the expert advice was to keep the coast. Now this region can be used for leisure, tourism and water sports. Otherwise, the entire city would pretty much be living in the factory area in the middle of the pollution.⁶

The industry wanted to develop the chemical industries, the power plant and manufacturing, but we thought the industry was too heavy. The agricultural sector wanted to expand, but we thought that would not be simple because of the water shortages. There are ecological areas that must be preserved for the sake of ecological sustainability, including the wetland and mountain areas, but there is a lot of pressure from developers to develop them.⁷

These comments suggest that incorporation of external ‘expert views’ into planning decisions can improve urban resilience by increasing responsiveness to local environmental pressures. The influence of individual leader priorities can sometimes have a similar effect. For example, Rizhao:

had a very educated Party Secretary who supported the eco-city plan... He was not an expert himself, but willing to learn from our advice, which made it easier to implement environmental policies.⁸

Several interviews with local academics and planners in Rizhao confirm that the education and environmental interest of the mayor has contributed to early adoption of ecological protection policies and support of the green technology sector. This suggests that a motivated top leadership can increase awareness of and responsiveness to environmental issues, which improves urban resilience by increasing ability to respond to pressures and to move away from further environmental degradation.

Regarding the authorities’ interaction with the private sector, regulatory instruments such as pollution and energy-use standards coupled with fines or the threat of factory closures create direct pressures on industrial and real-estate sectors to improve environmental performance. For example, for control of air and water pollution, the end-of-the-pipe approach appears to have been generally effective. Figure 2.4 shows that most forms of urban air pollution emissions have declined in recent years despite increasing industrial activity. The most likely reason for this trend is the enforcement of stepped up industrial pollution standards, and closure of the most polluting plants.

Similarly, industrial energy standards have been strictly implemented since they became legally binding requirements in 2008, after which transgressors could be fined and black-listed. Figure 2.5 shows that industrial energy consumption reached an inflection point in 2009 and then started to decline. A decrease in total energy consumption coupled

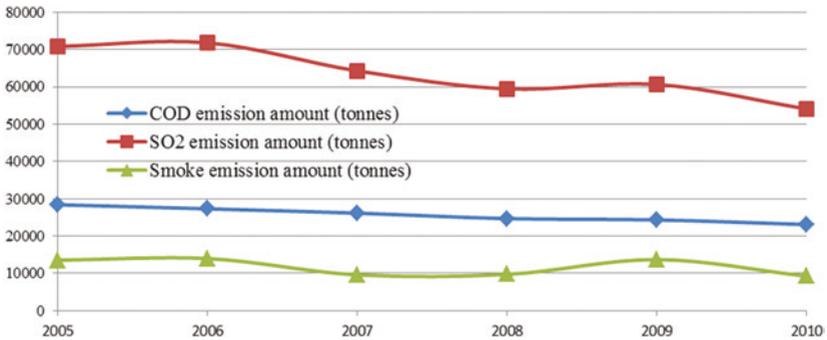


Fig. 2.4 Rizhao air pollution emissions. *Source* Rizhao Municipal Yearbooks

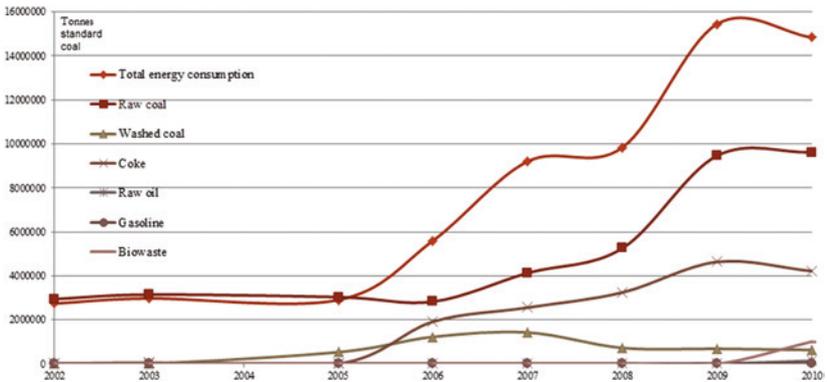


Fig. 2.5 Rizhao industrial energy use. *Source* Rizhao Municipal Yearbooks

with increasing industrial activity is a radical development. This is probably because of equipment upgrades in the city's large industrial plants (such as the steel factory), introduced largely due to pressure caused by the binding targets.

Rizhao Construction Committee has used a similar approach, combining building standards with a rigorous management system, in which projects are controlled throughout all stages of construction and building licences are denied if projects fail to meet standards. As a result, about half of Rizhao's buildings meet China's lowest-level building-efficiency standards. The approach has also been effective in encouraging

the adoption of solar water heaters; in 2007, solar water heaters were installed in 95% of the city's buildings (RMPG 2009).

Regarding urban resilience, increased environmental performance as a result of regulatory instruments can be seen as an improved response to environmental pressures. However, this is often a change only in degree of performance, created through incremental improvements of existing equipment. These instruments do not normally cause radical change of companies' technologies or practices, and are therefore less likely to contribute to transformation. Regulatory approaches appear to lead to direct responses to government pressures, but not necessarily to capacity for self-organization and renewal with reference to an external pressure, which is a limitation in terms of creating resilience.

The government's support instruments (primarily subsidies, beneficial taxes and land policies) and joint research strategies have had different effects on urban environmental performance. As a result of supportive financial policies, the city has seen an increase in the green-tech sector over the past decade. This includes a number of companies that spread greener practices through promotion of energy conservation and use of renewables in high-carbon-emission industries. The policies have also attracted high-tech firms that have transferred knowledge of industrial recycling technologies. For example, Rizhao's major pulp factory has imported advanced recycling techniques in which 1.4 billion kW of energy is produced daily, allowing the factory to dramatically reduce emissions, quit coal and sell surplus energy to the grid. Joint R&D strategies have included industrial recycling projects such as development of methane-to-gas technologies, which in 2012 were adopted by ten enterprises, further reducing emissions and resource consumption (REITC 2012).

The difference between control-demand strategies and supportive policy instruments with reference to urban resilience is that the latter allow firms rather than the government to be in charge of promoting new practices. This increases capacity for self-organization and stimulates learning in response to environmental pressures. Joint research projects and training programmes may similarly encourage enterprises to become involved in innovation and learning related to new technologies and practices. This not only improves environmental performance but also encourages response to resource shortages and pollution pressures. This is improvement in terms of urban resilience, as the private sector gains ability in innovation and renewal in response to environmental problems.

2.3.2 *Influence of Governance Arrangements on Environmental Justice*

There are two key points concerning the lack of procedural justice in environmental planning in Rizhao. The first relates to the meetings and negotiations where respondents suggest that certain stakeholders and government offices have more influence than others. The mayor's office has been identified as dominant, and departments working with economic issues (such as the DRC) as more influential than economically weaker ones (such as the EPB and the Tourist Department).

We had an idea to develop tourism projects in the inland but instead it was developed for port-related industry. The income from the industrial activities would be much bigger so it was hard to push this point—this decision was made by the Mayor's Office.⁹

Similar issues exist when the EPB or Tourist Department oppose expansion of industry on grounds of protecting ecological zones or reducing pollution-related algal blooming (which interferes with use of beaches). This imbalance of power illustrates the pro-economic growth dilemma described above, which creates uneven access to and influence over decision-making processes.

The second point with reference to procedural injustice is the limited amount of citizen participation in planning and policy-making. According to a central planner:

there are not really any citizens involved in planning. We did a survey, but it didn't really include a lot of people or affect the process much.¹⁰

Another planner explains:

In the planning process, the public participated at two key points. The first was a survey period; the second was when results were presented on the Internet and the planning department used published responses in project groups. Looking practically at these strategies, the first one did not have that much impact, because the sample was too small.¹¹

The general impression is that Rizhao's citizens have very limited influence over environmental development, and that any such influence is limited mainly to responses to existing plans.

Planning processes have led to variation in the distribution of risks and resources between different groups. For example, the amount of green space per person in Rizhao has increased considerably in the last decade, but much of this space is leisure areas targeted towards tourists. Many of the parks charge entry fees and probably contribute little to the life of the average citizen.

The most obviously uneven outcome is the distribution of environmental risk. Some areas have become far more polluted than others in the municipal region, including some that were originally suggested as protected areas. For example, Lanshan district 'used to be very pretty. It is now completely developed, and a very dirty, ugly place'.¹² The problem is especially serious for inhabitants of heavily industrialized zones:

There are people who do not want the factories, like the people (ex-villagers) who have to live right next to them. The government can deal with some pollution for the sake of the city development, but the people who live next to it don't want it. This is an inequality issue. The government will have a meeting to allow for opposing opinions, but often these voices will not be considered.¹³

There are no statistics on the number of villagers who have had to move, or have lost their livelihoods in farming and fishing due to industrialization and real-estate development. Rizhao has developed rapidly from an agricultural and fishing-based society to a heavily industrialized area marked by rapidly built-up land. There is probably a link between low levels of procedural justice and the uneven distribution of environmental 'goods' and 'bads'. That is, as citizens are not included in decision-making processes, planning is carried out according to the priorities of economic growth-oriented strategies of the mayor's office and powerful private interests, rather than the priorities of the public.

To legitimize these priorities, China's leadership authorities have adopted an 'ecological modernization' approach to development. This is based on a vision of capitalist society being able to transcend into an environmentally sustainable future by encouraging firms to profit from environmentally friendly technology (Dryzek 1997). This vision has not been thoroughly investigated from the perspective of potentially unjust outcomes, and the consequences of such an ideal could be further explored.

2.3.3 *Relationships Between Urban Resilience and Environmental Justice*

China has a saying: ‘Out of two bad things, choose the one which is less bad’. We can’t please all the industries and also protect the environment.¹⁴

Many of the examples above suggest a simple relationship in the form of a trade-off between economic strategies on the one hand and both urban resilience and environmental justice on the other. In China, this tendency is broadly legitimized through the assumption that raising welfare and standards of living through economic development is a prerequisite for dealing with environmental issues. Rizhao’s municipal government points to increasing disposable incomes and improved access to basic services in line with economic improvement, which to some extent has occurred at the expense of the environment.

However, this case study also shows trade-offs that are less straightforward. For example, increased procedural justice in the form of considering public opinion in decision-making may contribute to greater awareness of environmental issues, in turn contributing to the capacity to build resilience to pollution and resource scarcities. This is illustrated by the belief that ‘a strong citizen demand was an important factor that pushed the government to pay attention to environmental issues’.¹⁵ The municipal authorities introduced recycling economy systems because people were concerned about industrial pollution. A policy adviser similarly notes that factories were ‘letting out emissions that were polluting the seaside and people were placing major pressure on the government to solve this issue’.¹⁶ Increasing expression of public opinion via the Internet may also have contributed to increased sensitivity to citizen pressures. Despite the lack of formal democratic channels, this responsiveness to public demand can be seen as a way for the government to maintain social stability and uphold political legitimacy.

Another example of the link between procedural justice and resilience is that allowing municipal government departments a more equal influence on policy-making may allow the EPB and the Tourist Department, for example, to increase ecological protection. A potentially positive link between increased environmental justice and resilience would be to shift inputs into decision-making from national-level government guidelines towards greater reflection of local concerns, which are likely to be more responsive to local issues and may be more adept at self-organization. However, the positive impact of external expert advice suggests

the opposite: greater responsiveness to environmental pressures from inclusion of national-level units in planning procedures. A key conclusion is that the effect of governance arrangements on resilience is highly dependent on the interests of planners and stakeholders.

In some cases, improved resilience may be positively related to enhanced environmental justice. This seems to have been the case with the popularization of solar water heaters. The development and mainstreaming of this new technology has helped the city adapt its resource use, thus responding to the pressure of limited natural resources. The technology adoption in buildings has also allowed low-income households to save money and access hot water—an improved distribution of environmental ‘goods’:

previously, for washing or showering, almost all households were using cold water. Since the introduction of this cheap technology, used for free after installation, everyone can use warm water, even in the countryside.¹⁷

By contrast, some measures that increase resilience can potentially lead to less environmentally just outcomes, as seen with the advance of the city’s high-tech ‘green’ industries. In developing new responses to pollution and resource scarcities, the industrial sector has increased its responsiveness to these environmental pressures: it has raised resilience by improving capacity for renewal through semi-spontaneous emergence of new industrial practices. It has not been established whether the resulting profit—gains for one group of companies—is associated with losses elsewhere in society. This may include owners of closed-down factories, or villagers formerly living on land that has now been claimed for industrial development.

2.4 CONCLUSIONS

The use of a governance lens to analyse patterns of urban resilience and environmental justice leads to four conclusions. First, regarding decision-making arrangements, reliance on national-level government priorities and inclusion of stakeholder views based on uneven power relations may weaken a local government’s ability to manage environmental issues, in effect decreasing resilience in terms of ability to respond to environmental pressures. Decision-making arrangements based on low levels of procedural justice also seem more likely to contribute to poor outcomes in terms of distribution of environmental risks and benefits.

Second, in terms of policy enforcement, the case of Rizhao suggests that control–demand approaches can change the environmental performance of companies in the industrial and construction sectors. Financial incentives and joint research approaches may contribute towards learning and improving the ability of private-sector self-organization in response to environmental issues. In this sense, it appears that governance approaches involving more cooperation and information transfers between sectors may be more likely to contribute to building urban resilience. The impact on environmental justice in these cases, particularly where there is cooperation in association with strong economic interests, is unclear, as the impact of supporting some industrial sectors has not been investigated from the perspective of whether losses are generated elsewhere in society.

Third, regarding the relationship between environmental justice and urban resilience, the evidence from this case study is mixed. There are suggestions that greater procedural justice may enhance urban resilience by increasing sensitivity to environmental issues and thereby ability to respond to such pressures. The effects on resilience-building of environmental justice are harder to assess, partly because of the complexity of the resilience concept. For the purpose of the analysis in this chapter, the definition of resilience has been simplified to a focus on the ability to respond to environmental pressures and encourage activities that contribute to learning and re-organization in the face of these pressures. Activities that have improved the system's ability to respond to resource shortages and pollution are therefore seen as resilience-building activities. Some such activities in Rizhao have contributed to a more just distribution of environmental goods (such as mainstreaming the use of solar water heaters), and some have resulted in a potentially more unequal distribution (for example, the expansion of the high-tech industrial sector).

Finally, a broader understanding of urban resilience may be gained by systematically addressing the factors involved in, or required for, a system's ability to respond to and rebuild after shocks. Such an analysis could investigate the dynamics involved in the comprehensive change required for transitions towards more sustainable systems. This form of analysis would focus on mechanisms involved in creating system-level renewal, for example, large-scale shifts away from fossil fuel-based systems. Studying the preliminary steps that industrializing cities in China are taking to build resilience and respond to environmental challenges may constitute a first step towards understanding how innovation and sustainable practices may begin to emerge in this centralized, top-down political system.

NOTES

1. Over the past decade, industrial energy consumption has constituted around 70% of total urban energy use (Rizhao Municipal Yearbooks 2006–2012). Previous research shows that most of Rizhao city's air and water pollution has been caused by the activities of the industrial and construction sector, which are both resource-intensive and emission-intensive (Wang et al. 2009).
2. Interview with central policy adviser, CAS, who was involved in drafting Rizhao's eco-city plan, May 2013, Rizhao.
3. Interview with urban planner, May 2013, Beijing.
4. Interview with a top-level official at the municipal construction bureau, working with introduction of renewable energy technology in the construction sector and promotion of green building standards, April 2013, Rizhao.
5. Interview with a planner at the CAUPD, involved in drafting Rizhao's two most recent master plans, February 2013, Beijing. The planner expressed frustration about the way in which suggestions to increase environmental protection were ignored for the sake of continued industrial expansion.
6. Interview with another planner at the CAUPD, also involved in drafting Rizhao's two most recent master plans, April 2013, Beijing.
7. Interview with policy adviser at CAS who was involved in drafting Rizhao's eco-city plan, May 2013, Rizhao.
8. Interview with an academic at a local university, providing policy advice for the city's eco-city plan, April 2013, Rizhao.
9. Interview with central policy adviser at an institution in Beijing, February 2013, who was involved in the development of Rizhao's spatial and tourism planning.
10. Interview with a planner at the CAUPD, involved in drafting Rizhao's master plans, February 2013, Beijing.
11. Interview with another planner at the CAUPD, involved in drafting Rizhao's master plans, February 2013, Beijing.
12. Interview with an academic at a local research institution, involved in drafting Rizhao's eco-city plan, April 2013, Rizhao.
13. Interview with a planner at the CAUPD, involved in drafting Rizhao's master plans, February 2013, Beijing.
14. Interview with a planner at the CAUPD, involved in drafting Rizhao's master plans, February 2013, Beijing.
15. Interview with an official at the municipal DRC, working with the promotion of industrial upgrading and recycling, April 2013, Rizhao.
16. Interview with an academic at a local research institution, working with the policy advice for the eco-city plan, May 2013, Rizhao.
17. Interview with an official at the municipal construction committee, working with the promotion of renewable technology, March 2013, Rizhao.

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