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Scenarios—using the complexity frame of reference to inform the construction of available futures in the possibility space

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The global socio-ecological system in the era of the Capitalocene—the world system created by the use of fossil fuels to provide energy for the development of a growth-oriented capitalist logic in all areas of production and consumption—is facing a set of interwoven sub-system crises that come together to make it extremely unlikely that the global system can continue in its present form. The whole system is in a state of crisis—a system state that cannot continue to exist and in which the system must either return to a previous system state—be resilient in the common usage of that word to mean “bouncing back”—or be transformed into a new relatively long-lasting but qualitatively different state. The most evident whole system crisis is, of course, a product of the impending climate transformation contingent upon global warming, but there are related crises of increasing social inequality, demographic structures, healthcare systems, fiscal and public expenditure processes, and urban systems in an urbanized world. These are all interwoven to constitute a polycrisis across the global socio-ecological world system. They are also manifested at all geographical levels and, in particular, at the level of city regions, which, in a predominantly urbanized world, are crucial levels for administration and action. The complex realist frame of reference can be used to inform the development of scenarios for the available alternative system states in the path-dependent possibility space. We have to start from where we are to get to where we want to go. Scenarios are not only descriptions of possible futures but also include a specification of the actions—the drivers—that shape the creation of specific kinds of futures in those available to us. The construction of scenarios should be done through a process of action research, involving a dialog among system scientists, key actors in governance systems, and civil society. The co-production of knowledge as a guide to action is essential.

KEYWORDS

scenarios, complexity, action research, city region, polycrisis

Introduction

Complex systems theory has to be put to work in order to inform actions to face the fundamental issues facing us in the 21st century. The objective of this article is to outline how interdisciplinary applied research informed by the complex realist (Reed and Harvey, 1992; Byrne and Callaghan, 2022) frame of reference is a way of informing the construction of scenarios—descriptions of possible futures. Scenario construction is essential for both the development of policy and as a basis for engaging political actors and all actors in civil

society with the urgent necessity of acting to deal with interwoven crises such as the climate crisis/impending climate catastrophe, fiscal crisis, food crisis, health and care crisis, and inequality crisis. Together, these place the global socio-ecological order in an overall state of crisis. Systems are in a state of crisis when their current condition cannot continue (O'Connor, 1987). For complex systems, they must revert to a former relatively stable state or undergo a transformation into a new state of a relatively stable kind. We have to recognize that one such outcome is system disintegration—catastrophe. Human beings, individually and collectively, have the capacity to envision the future. The formal method deployed for this is the construction of scenarios.

Scenarios are not projections or projections. Rather, they are stories about the future with a logical plot and narrative governing the manner in which events unfold. Scenarios usually include images of the future, snapshots of the major features of interest at various points in time, and an account of the flow of events leading to such future conditions. Compelling scenarios need to be constructed with rigor, detail, and creativity and evaluated for plausibility, self-consistency, and sustainability. Scenario analysis challenges us to ponder critical issues and explore the universe of possibilities for the future. Scenarios also clarify alternative worldviews and values, challenge conventional thinking, and encourage debate. Since scenarios embody the perspectives of their creators, either explicitly or implicitly, they are never value-free. They draw on both science—an understanding of historical patterns, current conditions, and physical and social processes—and imagination to conceive, articulate, and evaluate a range of socio-ecological pathways (Gallopín et al., 1997, p. 5).

This comes from a resource paper by the *Global Scenarios Group*, which developed an influential account of potential global socio-ecological futures and explicitly identified the global socio-ecological system as a complex system. Given that much of the work is done by ecologists, the complex system character of the global socio-ecological system is taken for granted in this field and in the discussion of scenarios deriving from it. However, there is not much developed use of language and imagery—the metaphors—but then every scientific description of reality is a metaphor—the complexity frame of reference. Ramalingam and Jones (2008), in another influential and widely cited working paper, explored the value of the complexity frame of reference for development studies, and action did precisely that. They deployed the idea of phase space to describe the range of possible futures for the development of any complex system.

The concept of phase space suggests complex systems, such as those faced by aid organizations, are not best understood by simply “carving out” a number of dimensions and analyzing these as a subset. Similarly, it is not ideal to try to understand a variety of causes that have led the dimensions of a system to be the way they are and then moving on to examine each dimension and its cause in isolation. Attempts to understand the system should first identify the key dimensions and track changes in them over time; this approach helps develop a holistic picture of how the system changes and evolves. Fully utilizing the concept of phase space calls for aid organizations to at least make an attempt to understand the full

range of different dimensions of the systems with which they are dealing, the values these dimensions might take over time, and the implications of this for how the system changes and evolves. Ultimately, there should be an effort to contextualize the projects or programs of an agency within these patterns of system behaviors (Ramalingam and Jones, 2008, p. 36).

Following Morgan (1986), they consider that complex systems are located in strange attractors in phase space. This means that while they vary in terms of system parameters within the attractor, they do not change in essential ways. Transformational change occurs when the control parameters of the system change to such a degree that the system has to move to a new attractor location within the overall possibility space for its development. Here, the important general social science concept of path dependency comes into play. Although systems can change in kind, the range of possible transformed states is determined by the existing state of the system and the way in which that state has come into being. Here, “determined” is not used in an absolute specification but rather as setting limits to the range of possible outcomes as the system states (Williams, 1980). This means that the history of systems, the ways in which their current path-dependent state (in the sense of setting limits to possible futures) has come to be what it is, is an essential element in developing programs for effective changes. Causes in complex systems have to be understood in terms of processes; this argument aligns closely with the perspective advanced by Lewes, (1874–9), which is derived from his reflections on Darwin’s actual methods of investigation and reasoning. The understanding of the process as essential to understanding causation is central to macro-social theory and originates with Hegel (see Byrne, 2023). Process tracing is a well-understood method in political science (George and Bennet, 2005), which integrates qualitative and quantitative approaches. Characteristically for US political science, it moves toward multivariate modeling, which in reality has little value. However, the careful qualitative accounts developed and the potential use of quantitative time series as descriptions of system trajectories work in developing a good description of how any socio-ecological system came to be as it is. Both the construction of descriptions of possible futures and the specifications of what must be done to achieve any one of them are almost invariably done on the basis of mixing methods and typically include crucial stages of co-production in the generation and interpretation of the scenario set. Port city regions and locales, especially those vulnerable to the impact of climate transformation, will be used as illustrative examples of what has to be done and how it might be done. In addition to the more formal discussion, the contribution of near-future science fiction as a form of scenario will be reviewed for its potential in the development of narratives of transformation.

Scenarios typically take the form of narratives, of stories describing both a final outcome system state and an account of the trajectory from the present by which that state comes to be. Burnam-Fink describes this process as:

both analytic and synthetic, as it seeks to reduce the overabundance of available knowledge to the most critical elements and then blend combinations of those elements to create possible futures. These three tasks place divergent demands on scenarios and their generative methodologies (Burnam-Fink, 2015, p. 2).

In general, narratives are informed by a mix of historical and ethnographic information, much of which is organizational co-production reinforced by elucidating the tacit knowledge of key stakeholders through focus groups and interviews. Sometimes, this is formalized using the Delphi method. Numbers enter the process but primarily as a time series of relevant indicators or what Byrne, (2005) calls traces of the system's trajectory. Although formal mathematical models are deployed, Gallopin et al. (1997) were skeptical about their values.

Many global studies rely heavily on complex mathematical models. The aim is a desirable one: establishing a disciplined and internally consistent basis for understanding complex processes. However, formal models also have significant limitations for representing complex and open human systems, notwithstanding occasionally excessive claims for them. Models implicitly embody specific disciplinary paradigms (e.g., economics or ecology), and even within these paradigms, they can capture only those elements that are reasonably well-understood and amenable to quantification. In addition, the high level of spatial aggregation in many models can mask the local specificity underlying the calculated average global and regional trends (Gallopin et al., 1997, p. 7).

Many of these issues were apparent in the modeling approaches developed to inform policy interventions during the COVID-19 pandemic. Squazzoni et al., in an important editorial in the *Journal of Artificial Societies and Social Simulation*, put the issue clearly:

When policy decisions and people's reactions depend on perceptions of the future and scenarios are probabilistic and largely unpredictable, computer simulation models are seen as a viable method to project future states of a system from past ones in a non-trivial manner. What we see today in many media are predictions of the exponential growth of the number of infected persons based on equations that capture stylized populations and the distributions of their different states. However, any social or behavioral scholar can spot that these projections do not consider relevant factors of social complexity, which are intrinsically crucial to the modeled dynamics and a negligible exogenous force. Not recognizing social complexity can undermine the credibility of findings, and thus, we call for urgent initiatives to 1) improve the transparency and rigor of models to understand theoretical premises and details and 2) promote data access to help contextualize and validate models across various levels of analysis (i.e., micro, meso, and macro). This call is even more urgent when simulation findings can rapidly affect public policy decisions (e.g., on possible consequences of certain policy scenarios) and/or motivate individual actions (e.g., impact upon decisions to stay at home to "flatten the curve") (Squazzoni et al., 2020).

This was a particular issue in relation to scale. In England, national models were a poor guide to appropriate policy responses in the management of health systems at the crucial levels of health economies, a term used to describe the organization system of health services around major secondary care hospitals. Key actors were local Directors of Public Health, who both had to advise all governance agencies on how the epidemic would develop in their

locality and provide hospitals with good information on the developing numerical call on cases requiring hospital admission. Castellani, who has long argued that the complexity frame of reference needs to focus on cases as complex systems in themselves rather than try to understand systems by a reductionist approach to variables, pointed out that

many of these models do not think about disease transmissions from a case-based configurational perspective. Regardless of the method used, a case-based configurational perspective is anchored in four core arguments that deeply resonate with the majority of computational methods used today. First, the case (which in this case is someone with COVID-19) and its trajectory across time/space are the focus of the study, not the individual variables or attributes of which it is comprised. Second, cases and their trajectories are treated as composites (profiles), comprised of interdependent, interconnected sets of variables, factors, or attributes. Third, the relationships and social interactions among cases are also important, as are the hierarchical social contexts/systems in which these relationships take place. In addition, finally, cases and their relationships and trajectories are the methodological equivalent of complex systems—that is, they are emergent, self-organizing, nonlinear, dynamic, network-like, etc.—and therefore should be studied as such. Given that many public health models do not embrace this approach, they often struggle to demonstrate the differential impact that the spread of COVID-19 will have on different populations and subgroups (Castellani, 2020).

Castellani was part of a team which developed a refinement of his and Schimpf's et al. (2021) approach to case-based modeling and applied it with considerable success in a co-production approach with Directors of Public Health across the north of England (Badham et al., 2021).

Case-based methods, although quantitative in the form deployed in the work of that team and others deploying the approach, have a strong qualitative element. This is because the knowledge that informs the construction of an understanding of relationships, social interactions, hierarchies, and all aspects of context is first qualitative in form, although it can be converted into numerical measures. Here, Kemp-Benedict's distinction between the way narratives inform complexity and models inform what he calls "complicatedness" is helpful to our thinking. He suggested that there:

are essentially two analytical challenges that scenario models must address in order to achieve the goal of more robust planning in the face of both gradual and sudden change. One is to represent complexity, while the other is to represent what might be called "complicatedness." Complex behavior arises from the interrelatedness of different components of a system, while "complicatedness" as used here means that there are a lot of factors to keep in mind, such as constraints, actors, and resources. It will further be argued that complexity is best dealt with in narratives, and complicatedness is best dealt with using computers (Kemp-Benedict, 2004).

Castellani and Schimpf's approach is an important contribution to integrating the quantitative and the qualitative approach but

when exploring contexts of longer-term developing social transformation it must be reinforced by narratives, not only to produce good scenarios but also to engage both governance actors and general civil society in the process of developing scenarios so as to generate a socio-cultural basis for necessary social transformation. COVID-19 was absolutely a sudden disruption in social and especially healthcare systems globally. However, it was a system in which technological innovation through the development and production of vaccines enabled something like resilience in the sense of bouncing back. It has certainly contributed to the underlying crisis drivers in both the fiscal and healthcare systems, but in many ways, social orders are much as they were before the pandemic appeared. It has been no Black Death, the enormous demographic impact of which was one of the key drivers of the transition from feudalism to capitalism in Western Europe.

We need multiple approaches to develop good scenarios as a basis for social action. Brewer and Lovgren made the argument well:

Obviously, many disciplines and methods can contribute to the analysis of a problem. The problem, embodied in one's evolving appreciation of it, points out, perhaps demands, which disciplines and what methods should be brought to bear. Calling attention to multiple methods lessens a prevalent tendency to celebrate methodology at the expense of substance. Methods have blind spots that focus attention on highly selected aspects of a problem while blocking others. One must counteract this by viewing problems with different methods or approaches and working to assemble their partial insights into something approximating a composite whole [Brewer and Lovgren, 1999](#).

Before proceeding to an actual example to demonstrate how we might construct good scenarios at the crucial level of the city region within the global system, it is useful to reflect on [Wiebe et al.'s \(2018\)](#) useful categorization of scenarios by purpose, recognizing that any given scenario can embody multiples of these categories. They consider that there is a predictive role for scenarios. This involves the generation of knowledge about the past to derive probabilistic estimates of alternative future conditions. Second, scenarios can be exploratory in that they start from now and explore drivers, trends, and their inter-relationships into the future. Third, they can be normative in envisioning a desired future state and looking back to identify pathways to reach it.

[Gallopín et al. \(1997\)](#) produced a set of future scenarios that incorporated all of these elements but, in particular, had a normative component in that one of them was various forms of barbarism, which might be considered unattractive to almost everybody. Such scenarios do figure largely in post-apocalyptic science fiction. Others were more a matter of ideological preference since some continued to be based on unfettered market capitalism, while others moved toward something like a market socialism system in which market relationships and capitalist ownership continue but under state direction. This has existed in practice in contemporary China, Vietnam, and the UK during the Second World War. It is noteworthy that scenarios of this kind are the basis of much near-future science fiction, and SF is a good and useful scenario generator in its own right. [Gallopín et al. \(1997\)](#)'s scenarios were global, but with hindsight, we might

say, they applied most to the way global developments would play out in high- and middle-income states. What happens in much of the Global South may be very different.

Something very important needs to be said, and said firmly, at this point. Complexity work is often obsessed with quantitative modeling. Such modeling does have a role in the development of scenarios for possible futures, but it is not the strongest of the tools at our disposal. Some influential models of the future, notably integrated assessment models based on rational choice theory, embedded as they are in neo-classical economic theory in its RCT form, are not merely useless but dangerous. History is explored via a systematic process. Tracing is a mode for not only finding out how things came to be as they are but also for identifying key implemented decisions that generated what we might describe as bad aspects of the current system state. This allows social actors to consider how those decisions might be changed to rectify their consequences. Scenario construction can and often is about resilience and bouncing back to a previous state, but in a context of crisis with the current global drivers not only of global warming but also of global political instability, bluntly put, that is not on the cards. To quote a dictum of new public sector management, "status quo is not an option," or perhaps this should be expressed as a reversion to the previous status quo that is not available to us¹.

The kind of action research that will be necessary is not merely participatory or co-production. Participatory is usually deployed to describe the participation of subordinate groups in general civil society. Co-production is deployed when the participants are actors with some real power in the system. Both approaches can be used to describe the process of constructing "mere" knowledge of what is. Rather, action research means transformative action research, in which dialogical socio-ecological research is embedded in a cyclical, recursive fashion in the whole transformation process. The construction of scenarios as a mode of engagement for civil society has considerable implications for the character of politics as a basis for change by engaging both civil society and crucial policy actors in the process. This develops a commitment to action for transformation.

Scenario construction at the meso level—for port city regions

Port City regions are urban systems that have a crucial role in the circulation of production in a globalized world. [Ruth and Coelho \(2007\)](#) identify why we need complexity to engage with them:

Climate change is increasing the pressures on many urban systems and adding to this complexity. Many of the case studies investigating urban dynamics in the light of climate change have chosen narrow, sector-specific approaches. Few projects have built on insights from complexity theory and related bodies of knowledge that are more consistent with the perspective that urban infrastructure systems are tightly coupled with one another and

¹ I am grateful to a reviewer of the first version of this paper for pointing me toward this element in the article.

must respond to often subtle, long-term changes in technological, social, and environmental conditions (Ruth and Coelho, 2007, p. 317).

Here, we will attempt to do just what Ruth and Coelho (2007) are calling for by developing a discussion of the future development of the port city region of Tyneside in the North East of England. The English North East is one of the birth regions of industrial capitalism, as it contains what was one of the most important UK coalfields—the Great Northern Coalfield—of the carboniferous capitalism that drove the Capitalocene's development. It was one of the most industrialized places ever to have existed on Earth, but over the last 50 years—the author's adult lifetime—it has become severely deindustrialized. This is the region that created railways and was massively innovative in shipbuilding and electrical engineering, alongside deep coal mining. Tyneside is the larger of the two estuarine conurbations and has a history as a port dating back to medieval and even Roman Empire times. From the Middle Ages onward, it was the main source of coal for domestic use in London, and as international trade developed, it became one of the major coal-exporting ports in Britain. Shipbuilding and heavy engineering developed as derivatives of the coal industry. From the 1930s onward, there was a successful program of industrial diversification based on the development of industrial estates. This created jobs for women in clothing, textiles, and light engineering. In 1981, when the process of deindustrialization had already gotten underway, 40% of male employment was in manufacturing and the coal industry, and 32% of female employment was in manufacturing. Manufacturing provided 32% of all employment.

As of the 2021 census, there are no coal mining jobs left in the conurbation, and manufacturing provides just 8% of total employment. In contrast, public administration provides 9% of employment, as does education, with health and social care providing 17%. Construction, which provided 8% of jobs in 1981, has maintained the same level of employment. What was a port industrial conurbation is now a characteristically post-industrial, deindustrialized place. Other major changes have occurred in tenure patterns, where what was a very large sector of public housing has halved and owner occupation has become the dominant tenure; however, in the 21st century, there has been a marked revival of private renting by landlords. A workforce largely composed of manual workers has become one dominated by white-collar and pink-collar (service manual work) jobs.

The planning history of the conurbation is important. Under the Structure Plan of the 1970s, which was developed by a democratically elected metropolitan council, the emphasis was on the development of replacement industrial employment. That council was abolished in the 1980s, and a Tyne Wear (incorporating Sunderland) Development Corporation (TWDC) was established as an appointed body. The development corporation was given control over planning powers and acquired much public land, particularly brownfield docks and shipyard sites along the Tyne and Wear. It adopted a strategy of catalytic development that involved the injection of public subsidy into land clearance

and preparation for construction, with the sites being sold in large part to the private sector. Almost none of the resultant development has been industrial. Instead, large numbers of dwellings have been built on the riverfront, alongside leisure and retail uses. All of this has been done on sites sitting on tidewater and with full exposure to rising sea levels. Global warming and rising sea levels were not considered at all when these developments were constructed. Sites, which would have been of great value for offshore marine engineering in relation to sustainable wave and wind power generation, have been sterilized for that use in the near future.

The estuarine River Tyne is a made thing. Newcastle City Corporation had controlled the river since the medieval period, but in the mid-19th century, it lost that control to a newly established Tyne Improvement Commission, established by an alliance of local capitalist interests in coal and shipping and local government other than in Newcastle. The river was turned from one, which could be waded at the mouth at low tide, into a waterway that could float a battleship 25 km from the river mouth. Two giant breakwater piers were constructed, which turned a very dangerous harbor into the largest harbor of refuge, which can be entered at any stage of the tide and in any weather on the British east coast. Giant docks and shipyards were built along the riverfront. These constituted the largest coastal civil engineering works in Britain before North Sea oil. The Tyne Improvement Commission has been replaced by the Port of Tyne Authority. Some maritime uses remain in marine construction and dock work. Ironically, the largest ever cargo imported into the Tyne after these changes was a cargo of coal from New Orleans—coal to Newcastle, indeed. There is a contemporary significant RoRo (roll-on roll-off) trade, and cars were exported from the Sunderland Nissan Works. A key near the river mouth site—the Northumberland (coal export) Dock—reserved under the structure plan for maritime industrial uses (and tailor-made for both oil and offshore wind uses), was developed by the Development Corporation for housing, a retail park, and a water park building. The topography of the Tyne is such that a lot of the historic urban development has occurred on the ridges above the river, not least because, for many years, the river received untreated sewage and emitted foul odors. This was corrected before the entry of the TWDC by the public sector, which built two massive interceptor sewers along each bank and treated sewage. The salmon are back. Without that development, residential and retail uses for riverfront land would not have been possible. Sea level rise would convert about fifteen miles of the river banks and substantial flatter areas (some of which were developed by filling in mudflats) into a river rather than a river valley. This would include almost all the areas developed under the TWDC.

One important aspect of the radical impact of deindustrialization has been a transformation of the skill base of the conurbation. The shipyard and heavy engineering components created a large skilled workforce both in manufacturing and in design. Many of these jobs were transferable to heavy industrial construction, including in North Sea oil and related areas. They provided exactly the skill base needed for green energy production, especially offshore energy production. This skill base has not been

replaced at anything like an adequate level, although there do remain some firms that do have relevant expertise for the future. Likewise, shifts in urban transport patterns have changed along with the level of car ownership. In 1981, just 40% of those going to work used a car. By 2021, this had increased to 50%. In 1981, 40% of households owned a car or van, and just 7% had more than one car. By 2021, 65% of households were car owners, and 25% had more than one car. This is, in considerable part, a consequence of suburban households with two workers using both cars as transport to work.

The foregoing section provides a baseline for the development of scenarios for the future of Tyneside, along with an account of how the conurbation has developed in terms of its economic base and the consequences of past planning decisions toward its current condition.

Constructing scenarios for a sustainable and equitable future for Tyneside

By no means are all the potential control parameters for moving toward a sustainable future available at the level of the Tyneside conurbation, or even more practically, at the level of the larger city region as covered by the North East Local Enterprise Partnership, which includes Sunderland, Northumberland, Durham County, and Tyneside and has a population of over 2 million. Much of the population is located near the North Sea coast, and Sunderland is an estuarine city in its own right, alongside smaller ports like Blyth, Berwick, and Seaham harbor and fishing towns along the Northumberland coast. So, the city region will have to develop a general policy for its port urban areas, which contain about two-thirds of its population. Its powers should lie at the level of strategic planning, with local implementation being handled in partnership with local authorities. However, currently, although it is about to elect a regional executive mayor, it does not have the powers equivalent to structure planning powers in the 1970s. It needs at least that level of power because, without it, nothing meaningful will be done. The following assumes that such powers will be delivered by the national UK government. This should be associated with a reform of local taxation systems to draw equitably on housing wealth in a progressive fashion, in contrast with Britain's currently regressive and inadequate housing taxation, along with a needs-based system for allocating central government revenues to areas. The UK and devolved Scottish governments since 2010 have passed much of the burden of austerity onto the level of local government by reducing central resources allocated to the local level and failing to reform urban taxation. This has to be addressed if anything effective is to be done. Other important measures for equity lie at the national level, particularly in reforming income taxation so that taxes on earned incomes are no longer higher than on unearned incomes and introducing a general wealth tax on Swiss lines to mobilize resources for confronting crises.

The approach to scenario construction is based on the assumption that these things have been done. This may be a triumph of hope over intellect, particularly as the next UK General Election is shaping up to be one in which short-term

pandering to motorists over emissions and speed limits will be the policy of the Conservative Party, and see how labor will acquiesce to momentary party political tactics and fail to confront this. In the UK's first-past-the-post two party political system, momentary interests have dominated since the late 1950s.

So, let us be optimistic. Scenarios following [Kemp-Benedict \(2004\)](#) helpful advice on the complementary value of quantitative and qualitative approaches can address both complex and complicated issues. Quantitative approaches based on mathematical modeling can be deployed using a base of existing trend data to describe what will happen if particular policy approaches are adopted. An example would be the impact of making all local public transport within the region either free or very cheap (as in some French departments where all buses in the department charge one Euro for any journey). People have to get out of cars, but as the Gilet jaunes protests showed in France, it merely makes it more expensive for them to use cars, provoking a political backlash. Bus transport is effectively free for all pensioners in the UK, and in Scotland, it is also free for young people. Extending this to everybody is an incremental, albeit significant, move. Alongside, this would be a commitment of capital resources to public transport rather than road building and various constraining measures in relation to car access to central areas. This means a lot of carrots and quite a lot of sticks. In any event, policy innovations of this kind can be assessed using mathematical modeling. In [Wiebe et al.'s \(2018\)](#) terminology, they can generate predictive scenarios by combining this with an exploratory element.

Narrative scenarios have a twofold purpose and character. In terms of character, they are both exploratory and normative. Exploration involves drawing on qualitative knowledge, including this descriptive quantitative knowledge from trend data, to outline the set of possible path-dependent futures within the possibility space. Normative requires broad public acceptance achieved both through conventional political means and participatory approaches, which future states should strive for. Alongside this, the process of constructing scenarios is an important mode through which both governance actors and civil society can be engaged with the necessity of confronting interwoven urban crises, especially the impending climate catastrophe. The co-production/participatory development of narrative-based scenarios develops a general social commitment to meaningful action. Neither top-down imposition nor bottom-up action (which, in the author's considerable experience in community action, has all too often served merely to demonstrate their own powerlessness to people) is adequate. Both are required.

Future narrative scenarios require a historical base. We need to know where we are coming from to see where it is possible for us to go. We can deploy a whole range of descriptive data, documentary, and oral historical sources. Focus group construction of oral testimony is a particularly effective method, as seen in [Warren \(2018\)](#) for an outstanding example. Furthermore, the use of literary modes, especially near-future science fiction, can be valuable. All of this has to be informed by a realistic understanding of the global, national, regional, and local potential for social transformation in a context of interwoven crises. The UK government *Futures Toolkit*

(2017) has many useful elements, but the example it presents for the future of Britain (where Northern Ireland seems to have been reunited with the Irish Republic) is profoundly and, for the author, unrealistically optimistic.

The *Futures Toolkit* (2017) is an example of scenario construction organized around a scenario—trading places—that “describes a future where economic power has shifted to the eastern economies and where markets and cultures are open to each other” (UK Government Office for Science, 2017, p. 88). The description of Britain is remarkably optimistic. There are elements of good sense, notably an emphasis on the development of a circular economy and the assertion that

Some wonder if cities are about to change fundamentally. Certainly, distributed networks and remote working mean that a concentrated population is no longer absolutely required for success, and many would now say that we have gone way past what is sustainable. Local communities are strong. Government reforms have led to decentralized decision-making as far as possible. Public services still have some way to go to achieve the level of integration and efficiency that citizens demand, but the new crop of people coming into local politics have a high sense of responsibility and are making good progress (UK Government Office for Science, 2017, p. 89).

Interestingly and somewhat boldly, for a civil service publication, the scenario asserts that the development of this sunny upland has not been achieved by central government action:

Credit goes instead to the innovative partnership formed by environmental businesses, the UK’s young, talented, and compassionate workforce, and an education system that has nurtured them and provided the skills they need to create a sustainable future. A partnership, of course, that reflects the new reality of Britain and who really runs it. Perhaps that is why people in Britain smile so much because they have taken control and are now working hard to deliver what they value and care about. No one seems bothered that the economy is still flat rather than growing or that taxation is relatively high and people are less well off financially than a decade ago. Perhaps that is because anything is better than the drawn-out and deep recession that cost Britain so much pain post-Brexit (UK Government Office for Science, 2017, p. 89).

All will be well, and all will be well, and all things will be well. While control of power is essential, realigning power is hard. We can only hope.

Conclusion

This article is not intended as a comprehensive review of the use of scenarios. It does not seek to justify the understanding of urban systems as sub-systems of a global socio-ecological system, which are complex in themselves and parts of that overall complex system. That now must be taken as given (see Byrne, (2002)). It does not even review the literature on how planning as a process has engaged with the complexity frame of reference, although it must be said, not

so much, if at all, with the complex realist frame of reference. For a review of that, see Byrne and Callaghan (2022). Moreover, it is informed in large part by the author’s unease with the way in which complexity as a mode of understanding has become ghettoized as a mere academic game in areas as diverse as quantitative modeling and philosophical discussion. There have been some applications, notably in relation to ecological issues at their interface with the social system (Preiser et al., 2018). However, as important as those studies are, they are not embedded in engagement with the real here-and-now issues of policy and practice that relate to the emerging polycrisis. Although it is true that some periods of crisis can endure for a relatively long time², this is not the case for the present polycrisis, which is not just a crisis of the economic and social system but of the relationship of that system with the natural world. The case study presented here relates to a post-industrial city region characteristic of many across high- and high-middle-income countries. There is an urgent need for similar consideration of city regions in low-middle- and low-income countries, notably but not only in the megacities of sub-Saharan Africa. Interestingly, there is excellent near-future science fiction from this region (see Tade Thompson’s *Rosewater* series). Complexity has been put to work in many contexts, for example, in reshaping the way evaluation should be done in governance in the United Kingdom. It needs to be put to work to engage with crises and implemented now through concrete and grounded proposals for how things should be done.

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² Again I am grateful to a reviewer for raising this issue.

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