Interconnected responses for interconnected problems: synergistic pathways for sustainable wealth in port cities

Joe Ravetz

University of Manchester,
Oxford Road, Manchester M13 9PL, UK
E-mail: joe.ravetz@manchester.ac.uk

Abstract: Port cities as hubs for trade and exchange show the extremes of rapid growth and catastrophic decline: they show the complex and interconnected problems of change in urban systems, and the challenge of maintaining local 'sustainable wealth' and prosperity. This suggests a transition from a material-focused (mono-valent) *local economic development* to a prosperity-focused (multi-valent) *local integrated development*. This paper sets out a method and framework for working with such problems and responses: the 'synergistic' approach to mapping and design of complex systems. This helps to identify alternative development pathways, looking beyond a linear model, to a more synergistic model based on creative collaboration and shared intelligence. This mapping method for local integrated development is demonstrated with two contrasting examples from the UK: an urban regeneration case from Liverpool: and an urban public health programme from Glasgow.

Keywords: ports and shipping; environmental change; urban regeneration; public health; sustainable wealth; emergence and complexity; synergistic mapping.

Biographical notes: Joe Ravetz is the co-Director of the Centre for Urban Resilience and Energy at Manchester. His main books include *City-Region 2020* and the forthcoming *Urban 3.0: Creative Synergy and Shared Intelligence*. He has pioneered strategic thinking for sustainable cities and regions, with interests in environment-climate policy, urban development and new economics, innovation and futures studies, systems thinking and complexity science. He is on the board of *Foresight Journal*; coordinator of Greater Manchester Policy Exchange; Principal at SAMI Consulting; and delivers training, consultancy, keynotes, reviews, and also graphic facilitation in many countries.

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1   Introduction

Port cities can potentially be 'hotspots' for creative and sustainable urban development: but in practice there is often economic, social and ecological decline and obsolescence. An urgent question is how to steer from negative to positive, with progress towards the goal of 'sustainable' wealth creation? This paper takes a co-evolutionary complex systems approach, and applies the method of 'synergistic mapping' to the agenda for local/regional economic development. The ideas were presented in the International Conference on Port Cities at the World Urban Forum, Naples 2012: this paper is drawn from those discussions and the background of a continuing research programme (Ravetz et al., 2012).

Through most of history the majority of cities were located on the coast, as ports and harbours were generators of trade, investment and innovation (Hein, 2011; Wang, 2007). But with the global pressures of restructuring of trade, supply chains, logistics technology, passenger transport and shipbuilding, many ports have lost their historic functions and suffer rapid decline. However the restructuring port city can also offer new opportunities, based on mobilising hidden assets and creative collaboration, in the context of transitions on the spatial and economic axes (Figure 1) (Desfor et al., 2011).

Figure 1   Port-cities: pressures and transitions (see online version for colours)
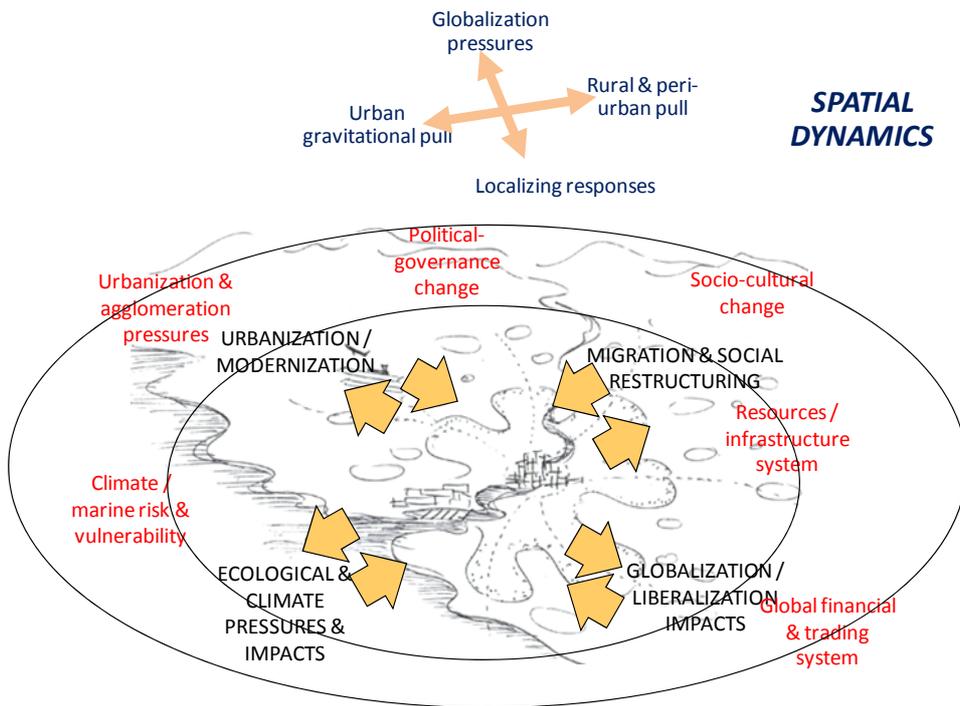
Source: Adapted from Roberts et al. (2009)

The new spatial geography of cities is fluid and emergent, and previously defined urban structures are now spreading into globalised 'edge city' sprawls, agglomerations, airport parks and other kinds of peri-urban hinterlands (Piorr et al., 2011; Ravetz et al., 2013). Port city functions follow a similar logic of agglomeration and relocation to out-of-town container transhipment deports. The port city is in transition not as a local facility but part of a global freight system, served by port-related infrastructure such as logistics centres or offshore loading platforms (Jacobs et al., 2010; Wang, 2007). This kind of transition leaves a physical space of obsolete waterfront areas and port infrastructure, where there is generally a clear direction for physical reuse and adaptation. However the social and economic impacts are often deeper and long-lasting, and call for social and economic creative innovation: to promote this, cities need to develop wider and deeper forms of social learning, creative collaboration and strategic intelligence (Girard, 2011; Ravetz, 2011a). Some of these are generic to the theme of cities as hubs of creativity and innovation (Glaeser, 2011; Landry, 2006). Others are generated by the particular history and prospects of port cities and port areas: as hubs for social minorities and migrants: as centres for trade and speculative accumulation: as magnets for new social movements and social enterprises: and as frontlines between old and new urban communities (Ravetz, 2013).

The implication of such extreme patterns of decline and regeneration, and the many interconnections between economic/social/ecological systems, is the need for more than 'linear' approaches to local economic development (LED). If indeed we understand 'wealth and prosperity' as not only economic values but social, cultural, ecological and so on, then we need to explore the interconnections between each of these in a more systematic way. These points to the main research question of this paper: how to understand and promote 'sustainable wealth creation' for the case of port cities in transition?

Taking this to the example port cities of Liverpool or Glasgow, we can understand their problems as interconnections of economic/social/ecological systems at local and global levels. We can also see potential responses or solutions as 'synergistic', in the sense they will be responsive and self-organising, and based on social learning, creative collaboration and shared intelligence. To fulfil such potential, this paper demonstrates the methods known as 'synergistic mapping', and its application to local economic development. Realising such models calls for innovative and creative forms of local social enterprise: for example, cultural heritage partnership enterprises: social finance and investment structures: socio-ecological restoration with participative governance, etc. Each of the case studies demonstrates examples of 'work in progress', but facing wider challenges, which calls for wider responses.

1.1   Structure of the paper

Following this introduction, the paper contains four parts. In the second section we outline the synergistic approach to complex systems analysis, and a generic '3.0' model for synergistic thinking. This provides a context for our main focus, a mapping of the LED agenda for sustainable wealth and prosperity. Taking an institutional approach to multiple value chains and networks, we apply the synergistic method to explore a wider 'local integrated development' (LID) landscape.

In the fourth section we apply the LED/LID mapping to the challenges and opportunities of a generalised port city, and we sketch the options for development

pathways, from linear to synergistic. There follows two contrasting case studies of UK port cities: the urban regeneration experience of Liverpool: and the public health programmes of Glasgow: each one demonstrating a very different angle on sustainable wealth creation. Finally, a brief conclusion suggests some implications for research and policy.

2 A synergistic approach

This approach starts with the observation that the urban agenda is not so much a 'linear' problem with simple policy solutions, as a 'systemic' or 'wicked' type of problem – complex, problematic, emergent, on the intersection of power and ideology, with conflicting perceptions and values (Rittel and Webber, 1973; Ackoff, 1973). It is also an 'ecological' kind of problem, as a 'complex adaptive system', which calls for complex adaptive types of responses (Waltner-Toews et al., 2009). It is also an 'epistemological' kind of problem which calls for new kinds of analysis and knowledge systems suited to the complex interconnections of the 'human urban environment' (Roberts et al., 2009). In response, the synergistic approach and mapping/design methods have been developed, of which a summary follows here.

2.1 Synergistic mapping of complex interconnected systems

'Synergistic' or the 'science of synergy' (in other words, 'how things work together') has developed from long-running policy-research on sustainable cities and regions. The synergistic method centres on 'mapping', on the principle that when finding a route through a large landscape, even a rough map can be useful. Such mapping is not necessarily a 'solution' or 'theory' in itself, but more of a 'sense-making' or social learning tool, promoting anticipatory thinking for complex issues.

This approach builds on a wide range of studies, as set out in detail in Ravetz (2013, forthcoming). One starting point was systems thinking, as applied to sustainability and 'adaptive systems' (Meadows, 2008; Clayton and Radcliffe, 1996). This led to conceptual developments on 'complex adaptive systems' (Folke et al., 2003; Waltner-Toews et al., 2009): and 'post-normal science' for situations of uncertainty and controversy (Funtowicz and Ravetz, 1994). In parallel many applications of relational thinking have emerged: the 'relational turn' in human geography (Darling, 2009; Jones, 2009; Murdoch, 2006) 'relational economic geography' in firms, sectors and territories (Bathelt and Gluckler, 2003; Sunley, 2008): 'relational sociology' as an approach to a complex society (Donati, 2011; Emirbayer, 1997): 'relational governance' and complex institutions (Ferguson et al., 2005; Grandori, 2006): and creativity and improvisation (Scharmer, 2007; Nachmanovitch, 2007).

Synergistic mapping focuses on two modes of thinking: 'relationality' and 'emergence'. The first observes how many forms of *relationality* – e.g., in economic, political, social, cultural or ecological interactions – have a common thread of value generation and exchange in many diverse forms. The second observes and *emergence*, growth, transition, self-organisation and co-evolution, generally moving towards higher levels of complexity. The process of combining these can be visualised as a cycle with

four main stages: mapping, analysis, deliberation, synthesis, design and evaluation, as in Figure 2.

- scoping/landscape mapping: (questions – who/what is involved, what are their relations and connections?)

- scenario/change mapping: (questions – what are the drivers of change, trends, tensions and alternatives?)

- synergy/idea mapping: (questions – what are the most creative visions and collaborative opportunities, and who could realise them?)

- strategy/road-mapping: (questions – what to do next/soon/later: and who to do it?).

Figure 2   Synergistic mapping and design (see online version for colours)
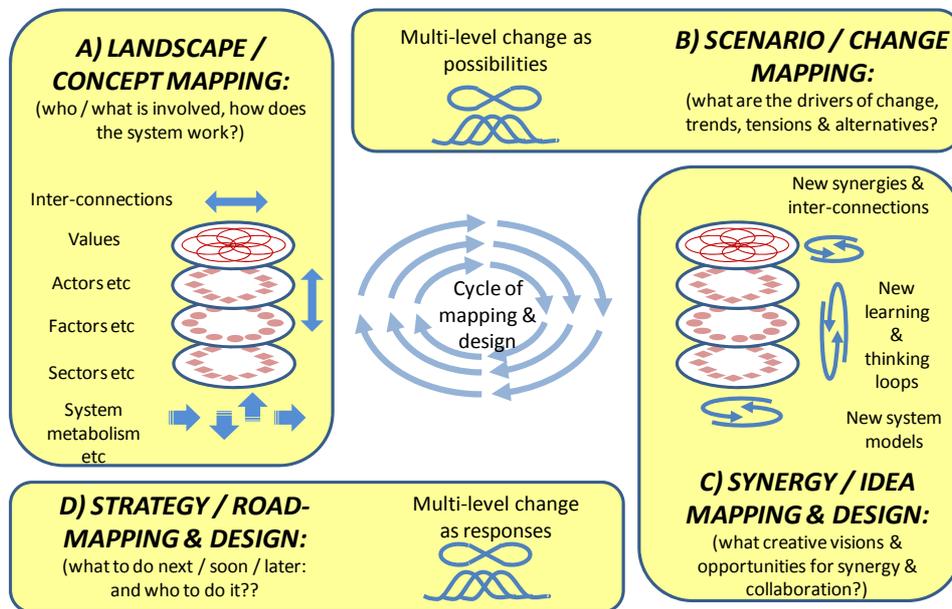
This four-stage cycle can look to different horizons – short-term practical issues: more strategic thinking: and beyond that, a third horizon of systemic transitions. At the heart of this is the concept of 'synergy' – literally the capacity to 'work together' – and different levels of how dynamic change can evolve different levels of synergy:

- *1.0: linear change:* 'functional systems': responding to direct short-term change (with an image of a large and complex *machine*)

- *2.0: adaptive change:* 'complex adaptive systems' which evolve with longer-term changes and transitions (with an image of *biology or ecosystems*)

- *3.0: synergistic change:* 'intelligent adaptive systems', shaped by human qualities – thinking, learning, questioning, creativity, strategy, self-awareness, shared intelligence (with an image of a *human or personal development situation)*.

This '3.0' model is then a wide-ranging concept which helps to navigate many kinds of evolutionary change. As such it can apply to almost any kind of human system, (e.g., social, economic, technological or political systems), where there are complex interconnections and emergent change. In terms of urban systems, the *Urban 3.0* agenda represents a framework or model for the next generation city: which might be framed as self-organising, networked, inclusive, creative, responsive, multi-valued, with high collective intelligence (Cohen, 2012; Ravetz, forthcoming). 'Urban 3.0' is not just a blueprint or checklist for land-use or economic policy: rather it points towards a city system with the cognitive capacity or shared intelligence, which can move towards economic vitality, social inclusion, ecological responsibility, cultural creativity, political participation and so on. By implication the Urban 3.0 agenda is interconnected with other parallel agendas, such as:

- Economy 3.0: an economic/financial system which includes for plural and non-material values, responsive to global limits, creative and resilient, self-organising and self-stabilising.

- Governance 3.0: a relational and networked way of decision-making and management of shared resources, with pro-active participation of stakeholders, based on shared intelligence for synergistic collaboration.

- Community 3.0: application of social enterprise, mutual aid, community cohesion and cultural diversity across all sections of society, with creative enabling for the excluded and vulnerable.

- Ecology 3.0: ecological intelligence for global and local resources, with synergistic policy and investment, responsive and participative governance, integrated management of water, carbon, biodiversity etc.

- Knowledge 3.0: development and innovation in technology, ICT and infrastructure: synergistic science and multi-level knowledge management, with social technology as the enabler and catalyst of change.

These and similar 3.0 models are not blueprints or fixed 'solutions': but they can help to make sense of complex interconnected problems, and to design interconnected responses. Local initiatives and transitions which point towards the 3.0 model, can be seen all around, in areas such as social enterprise, cultural heritage, urban food systems, or ecological restoration. But there are also powerful forces, of globalisation, financialisation or commodification of cultural assets: these can lock the economy into hierarchy, alienation, extraction and expropriation. The result is that a typical local economy which should be 'smart' is arguably 'stupid' – by blocking most of its native intelligence and capacity for collaboration. The diagram (Figure 3) shows a visualisation of the Economy 3.0 transition, from a hierarchical, mono-functional materialistic economic model, towards a synergistic, self-organising and multi-level model of shared prosperity.

Figure 3   Transition from linear to synergistic '3.0' models (see online version for colours)
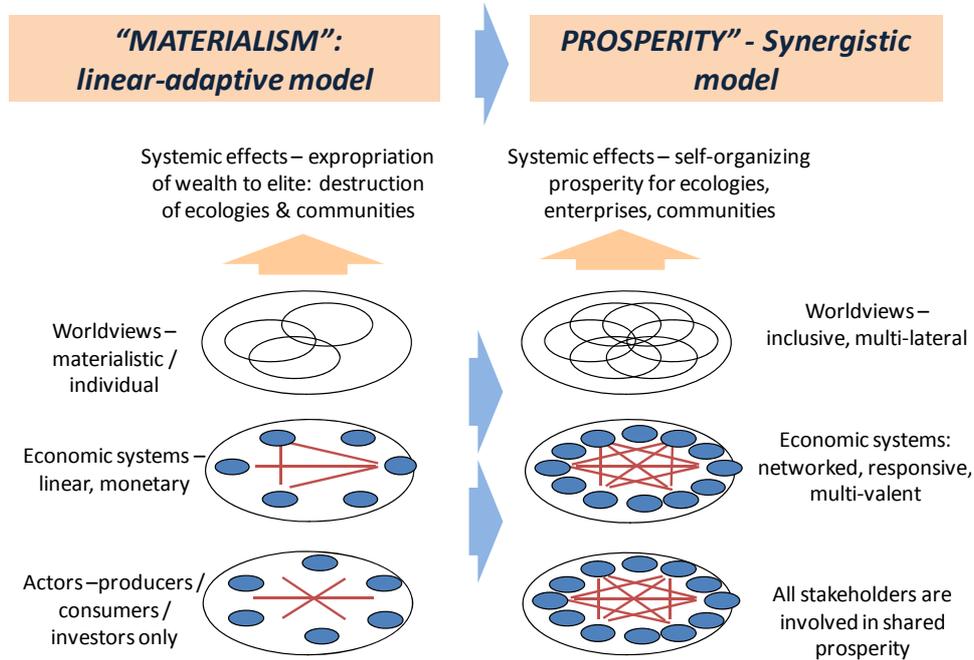

3   Synergistic mapping of local integrated development

This section is an outline of a more detailed discussion in Ravetz (forthcoming), where the Economy 3.0 chapter includes themes such as production-consumption, enterprise and livelihood, finance and investment, ecological and macroeconomic growth/prosperity. Here we focus on generic models of local/regional economic development, with a demonstration of the synergistic mapping approach. The key concepts include: human needs with multiple values: core-periphery models with multiple values: synergistic transitions in core-periphery models: and institutional relations in the core-periphery models.

The question of 'value' is as old as human thought, but in the current crisis of financial and economic development, there are new insights. Some of these come from the anthropological perspective (Graeber, 2001; Mauss, 1967): some from the ecological-institutional (Jacobs, 1997): or from the sustainable-economic (Soderbaum, 2008). In search of a practical and visual landscape mapping, we take the 'hierarchy of needs' (Maslow, 1970), with a mapping of the relationships between the need and the provision, as a generator of socio-cultural-economic value of different kinds. In the lower part, this identifies the dominant 'market model' of materialistic value, capitalist exchange, and production-consumption chains. The power of this model tends to deny space at one end of the hierarchy for meeting basic needs, such as food, shelter and security. It also tends to sideline the 'higher needs', which are often commodified and financialised, by the logic of the market model.

Applying this to a local economic development system with its full spectrum of human needs and demands, it appears that the mono-functional market model often fails to provide for more than the material parts. This situation could be improved with more active interchange with a 'basic needs' model, where the allocation is more concerned with social equity and justice, i.e., a political agenda for welfare and cohesion. It could also be improved by interchange with a 'higher needs' model, more focused on the cultural, ecological and spiritual dimensions of values. So the upper part of the mapping shows a more synergistic system where the links between political/institutional, economic/material, and sociocultural can be explored in more detail: this is then a guide for the next stage below.

**Figure 4** Integrated value mapping (see online version for colours)
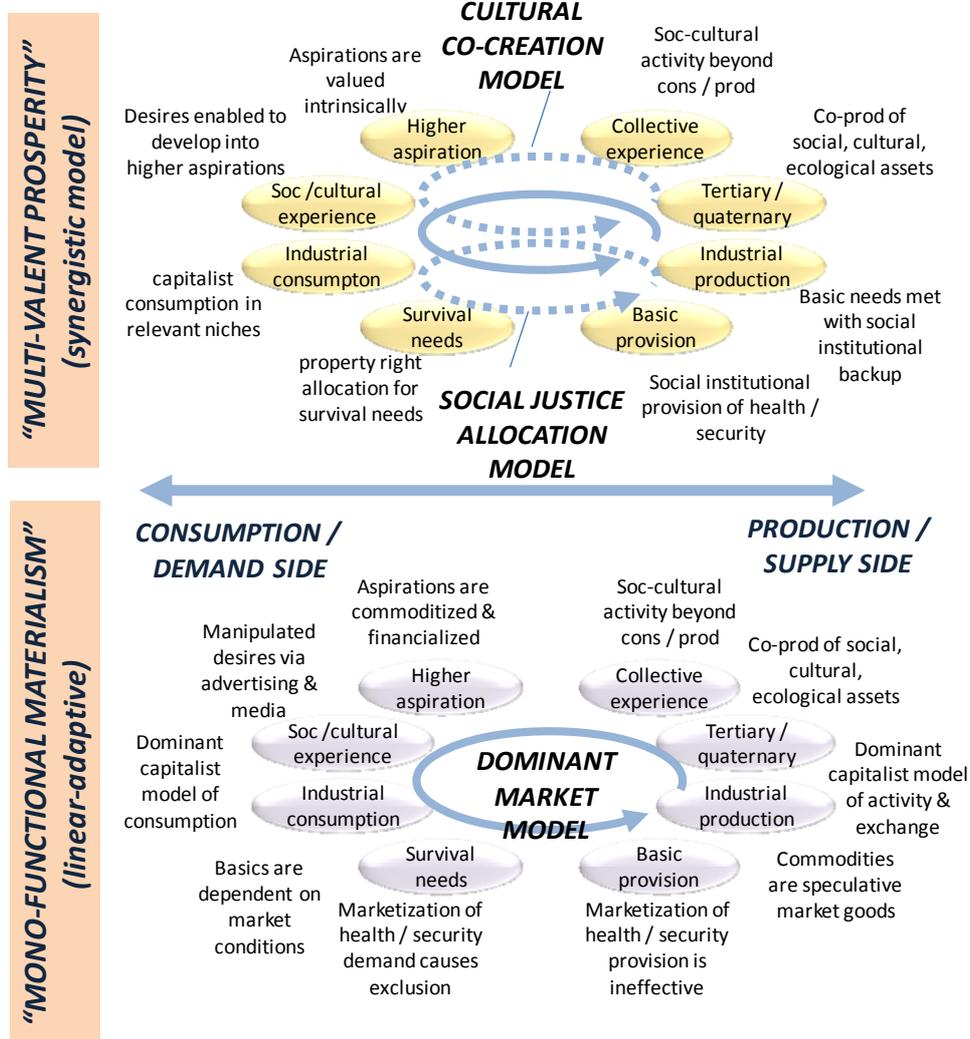
Source: Adapted from 'heirarchy of needs' (Maslow, 1970)

3.1   *Implications for local-regional economic development*

The next stage takes the different levels of economic activity, in their wider sense, and explores the implications for a local or regional economy, as one subset of a national/global economic system. This follows on the insights of the 'relational economy' and 'economic complexity' (Bathelt and Gluckler, 2011; Hausmann et al., 2011). It then aims to build on this with insights from the synergistic approach: i.e., extending towards multiple types of values, with multiple relational systems: with multiple forms of dynamic change and pathways for emerging shared intelligence.

Figure 5   Integrated development dynamics (see online version for colours)
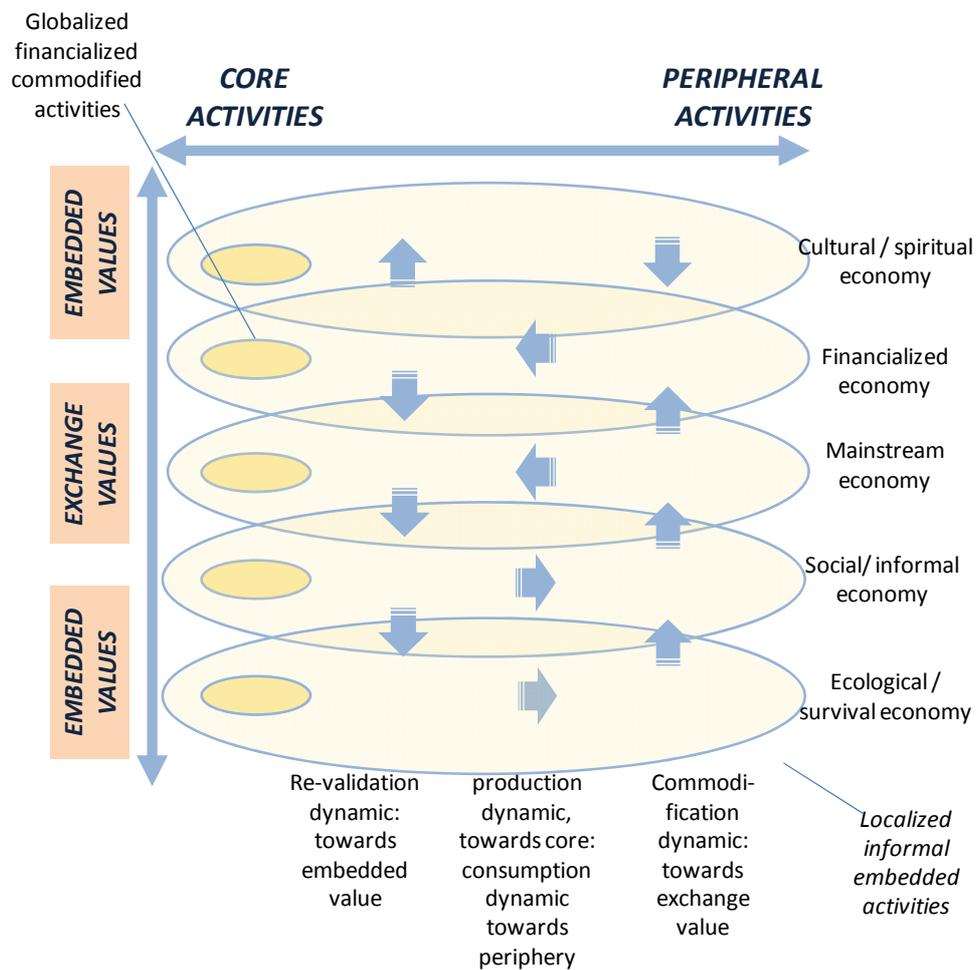
Following the 'core-periphery' concepts of global development and world systems thinking, we can visualise a core-periphery model for each of the main dimensions of economic activity (Hornborg, 2009; Froebel et al., 1980): in this case these are arranged on a spectrum from 'exchange values' (i.e., directly tradable), to 'embedded values', with a different kind of logic. At the top is a cultural-spiritual level, not an economy in the normal sense, but in many ways a system of assets and exchanges. Then a the 'financialised' economy shows the 'Wall Street' system where assets and securities of all kinds are traded as speculative items, more than any intrinsic value. Secondly there is the 'Main Street' economy of production and consumption of 'real' goods and services (although as above, such realities cannot be assumed as simple). There follows a social/informal economy, where there is a different kind of logic, where the relation to the market system can be problematic: and lastly the ecological or basic survival economy of exchange of physical resources.

In each of these there is some kind of core-periphery model of systemic organisation. At the core is the hub of organisation, learning capacity, strategic thinking and added value accumulation: at the periphery tends to be found the raw physical materials or human resources. This is quite obvious in the mainstream economy, for instance the automotive sector, where HQ type activities at the core bring together the financial, marketing and engineering, while peripheral 'branch plant' activities are concerned with components and assembly functions. In the social/informal economy, the 'core' effects of individual or community talent and charisma are clear. In the ecological economy, certain locations such as river deltas, or certain substances or species, are like hubs around which others revolve.

Following through the logic, we can explore the dynamics and interactions between the parallel systems, and between cores and peripheries. In summary, we can see horizontal and vertical effects, producing some kind of cycle of value generation:

- A dynamic of 'commodification', which pushes embedded values towards market exchange values. The logic is if there is risk or doubt attached to the embedded value, then the commodification (i.e., converting to tradable market assets) provides some security and certainty. Following that logic to its end, all assets of all kinds would be converted to financial products for the global marketplace.

- A dynamic of 'production value', which pushes peripheral activities towards the core: this follows the logic of each economic level, where value accumulates towards the core functions of allocation decisions and strategic thinking. In the example of the automotive industry, every branch plant has some kind of aspiration towards the HQ functions (but often little chance of achieving them).

- A dynamic of 'revalidation' or 're-socialisation', which pushes the exchange back towards more embedded values (Robinson and Tinker, 1995). This raises questions of utility and 'welfare' on the edges of neoclassical economics: when consumers have satisficed their material utility functions, e.g., having bought a car, then they need to transfer the material asset into some kind of social, cultural or psychological value functions.

- A dynamic of 'consumption value', which pushes back towards the periphery. Again this concept can be challenging for neo-classicists, but at the centre of new thinking on prosperity, drawing from studies of social reciprocity (Graeber, 2001; Mauss, 1926; Jackson, 2009). In a reciprocal exchange system, receiving is as important as giving: following the logic, a social-cultural hinterland experience can be as important as the high-pressure hub of activity. One obvious example is the tourism sector which turns leisure experience into a high value commodity.

Overall a picture begins to emerge of 'value' as a relational experiential quality, which can be realised or reproduced through dynamic interaction between parallel systems of exchange, and between core and peripheral modes of activity.

3.2   Synergistic transitions in core-periphery relationships

The next step is to explore a generalised core-periphery economic system, in the light of the synergistic transitions above. The mapping (Figure 6) shows in the lower part, a '1.0' linear 'value chain' system typical of an industrial city. There is a small core of organisational intelligence and value accumulation, driven by the incentives of expropriation and accumulation of wealth. At the periphery are mono-functional 'workers', dispossessed from their surplus values of production, with negative externalities of a peripheral role such as pollution, hazard and insecurity. On an adaptive '2.0' system model, typical of a post-industrial city, there is a partial decentralisation of core functions to other levels: the elite system organisers find advantage in devolving, franchising, outsourcing or similar arrangements, where branches have some limited capacity for social learning and collaboration. Meanwhile the externalities are displaced and often hidden by such partial decentralisation: for example the automotive industry sets up national firms or distributors, while the raw materials producers are further outsourced.

This contrasts with a synergist '3.0' model of distributed activity, shown at the top of Figure 6, which visualises a system of 'value constellations' or 'value networks' for intangible assets (Normann and Ramirez, 1993; Allee, 2008). Secondary cores revitalise the periphery, and there is recirculation of multiple value systems from the periphery to the core, i.e., not only economic-financial, but social, cultural or ecological values. The benefit is not only for the newly empowered periphery, but also adds to the learning and intelligence capacity for the cores and hub functions, which are thereby enhanced. Such a concept model can be useful in exploring opportunities for a single firm, an industrial sector, or an entire regional economy.

Figure 6 Economic development and core-periphery systems (see online version for colours)
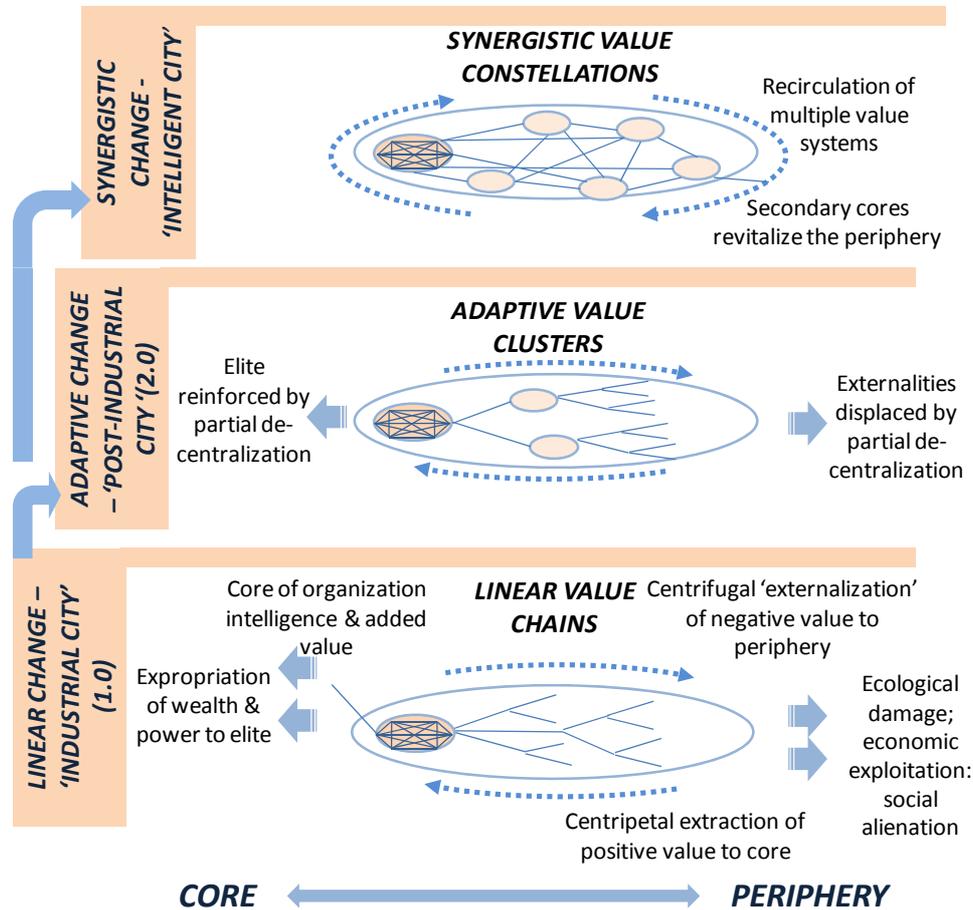

3.3 *Institutional ecosystems in local integrated development*

A further step is to explore more specific relationships between types of institutions and 'actors', which can be part of a value generation network or constellation. Previous versions of this pictured the institutions as public/private/civic, and focused on the overlaps between [Ravetz, (2000), p.248]. A further iteration explored the interactions of three cycles of value generation – economic/social/ecological-material – and the cumulative value generation which could be identified at key intersections from one cycle to another (Ravetz, 2006). Here we take the synergistic 'round table' image, and diligently try to map some of the many kinds of extended value generation which can occur between economic, sociocultural and ecological actors (Figure 7).

The benefit of this is to visualise in more detail the interconnections of materialistic-economic concepts of value, with other dimensions: this is then the vital step to exploring opportunities and designing policies. The next step is to look beyond simple bilateral relationships, to explore more extended chains, loops and networks of added value. For example in spatial planning policy, success in management of

peri-urban ecosystems seems to involve multiple value generation cycles between governance/social enterprise, citizens/civil society, finance/infrastructure and others (Ravetz, 2011b). Another example is that of public health in Glasgow, and its many interconnecting 'determinants' (Birley, 2011). Here we can see social value questions such as diet, lifestyle, culture, gender issues and occupational health: there are economic value questions where healthcare is costly and prevention is cheap: and ecological value questions where health, housing, pollution and others are each interconnected.

Figure 7   Institutional ecosystems and multi-valent exchange (see online version for colours)
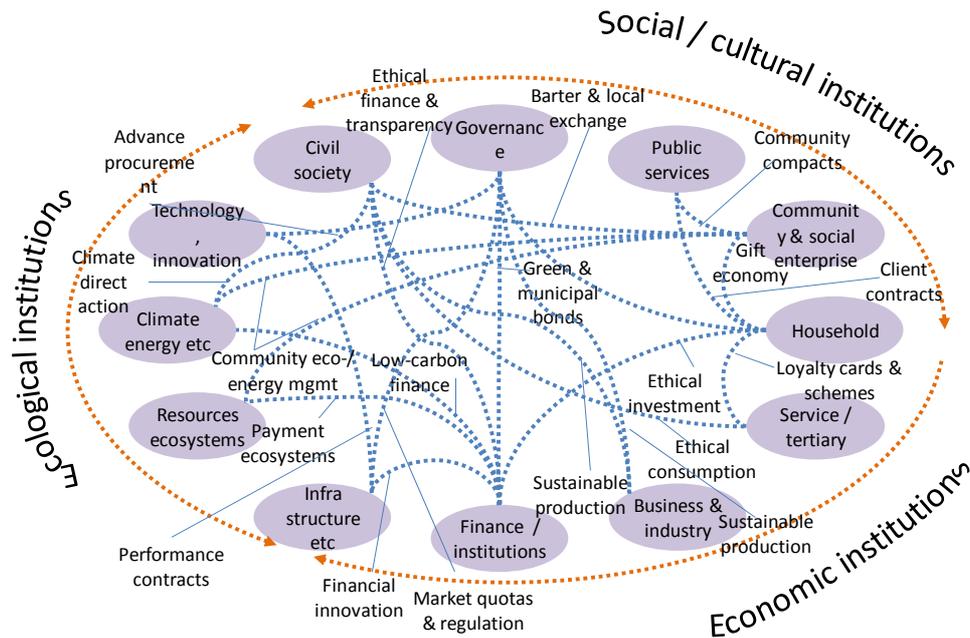
This and similar mappings suggest a general proposition: that the synergistic qualities of any system, depend on the density, interconnectivity and robustness of such multiple value generation chains, loops and networks (Normann and Ramirez, 1993; Allee, 2008). To enable and promote such value-added, could involve many kinds of policy responses: institutional design, direct regulation, fiscal policy, technology or infrastructure. As possible combinations of all these, *synergistic pathways* for intervention can be designed. These can be framed as transition 'roadmaps', based on social learning, creative collaboration and shared intelligence, across public, private and civic sectors: and combining economic with social, cultural and political values: in chains, loops, cycles and networks. Examples can be traced on the mapping above: e.g., cultural heritage as a social enterprise and micro-financial investment: local ecosystems as resources for health and education: or urban micro-cultures as social-ecological management agencies. Such pathways also involve so-called 'horizontal capacities', with the underlying components of social learning, creative collaboration or strategic thinking: with an overall concept of 'social intelligence' in multiple modes (Gardner, 1983):

- institutional intelligence: skills with designing and management of organisations, policies, programmes, to enable and promote creative innovation

- entrepreneurial intelligence: looks for added value in social/ecological/financial innovation

- partnership intelligence: looks for opportunities in 'communities of interest' – organisations and networks

- cognitive intelligence: enhances functional information and learning for shared tasks: (here, information and communications technology can help)

- cultural or ethical intelligence: senses the creative and subliminal opportunities from collaboration and synergy with other actors

In summary, the mappings above aim to provide some navigation aids for a more complex and interconnected model of local integrated development. While there are many more relevant issues, this serves to demonstrate the applications to port cities, with the case studies below (Ravetz, 2013, forthcoming).

## 4 Local integrated development and port cities

The transitions towards a synergistic '3.0' model has to start from current processes of development, with their various options and alternatives. This applies particularly to the case of port cities and other gateways, with a historical path-dependency and cultural heritage, but facing very modern and global pressures (Wang, 2007; Jacobs et al., 2010):

- pressures of globalisation, liberalisation, modernisation, capital accumulation, which tend to concentrate values (financial, human or ecological resources) from port city functions.

- detachment of port-related infrastructure from specific cities, so that energy, raw materials etc are supplied on global networks with only incidental connections to their neighbouring cities.

- internal pressures and contradictions of migration, demographics, economic restructuring, cultural change

- spatial dynamics of urbanisation, peri-urbanisation, and re-urbanisation: often the obsolete port infrastructure is a physical barrier to effective spatial development.

- environmental impacts from the city on to the marine and coastal zone (water, air, solid waste, habitat and land use change etc): also, vulnerability to natural hazards and catastrophes (climate related sea level rise, storms, earthquakes, tsunamis, landslides etc).

The combined effect of such pressures can be framed as a 'linear' model of change, as shown at the lower part of the mapping (Figure 8). This includes an interpretation of the regional development concepts of 'cumulative causation', i.e., cyclic patterns of decline in capital investment, urban infrastructure or skilled labour (O'Hara, 2008). Secondly, we can see a 'complex adaptive systems' effect, where stakeholders innovate and create business models or value-chains, for their own interests, and within their own business models. The result may be materialistic economic growth, while 'extraction-expropriation', and 'externality dumping' are displaced to a global scale.

Hence we can map out the likely side-effects of a typical post-industrial adaptive restructuring port city: foreign owned cruise ships with mass-market tourists: waterfront gentrification: community and small business displacement: social exclusion from new occupational types: global dependency and vulnerability: cultural destruction and commodification: ecological damage and displacement on a global scale.

Figure 8   Port city pathways: from linear to synergistic (see online version for colours)
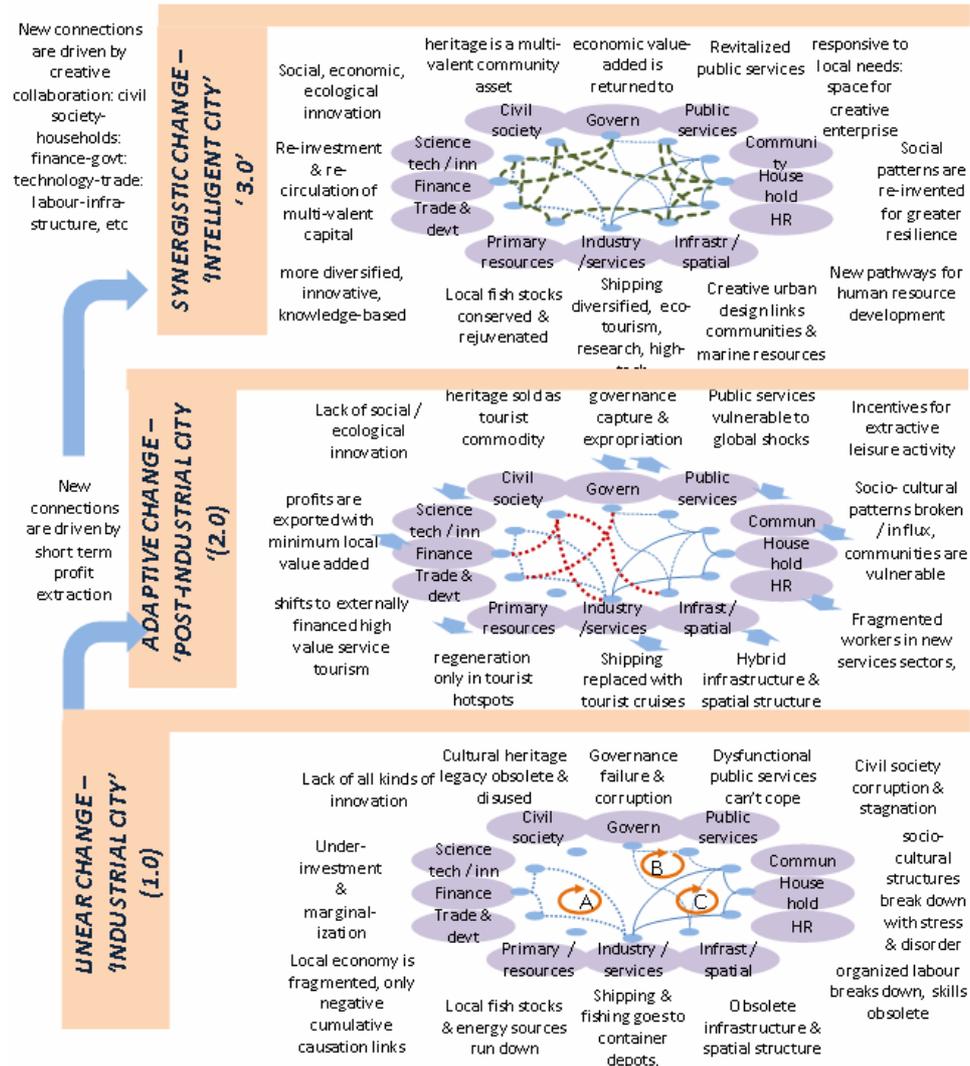
In response, the *Urban 3.0* concept model sets out a 'next generation' city system: networked, inclusive, creative, responsive, multi-valued, intelligent and self-organising.

Applying this model to a generic port city, we can see how the synergistic pathways then involve social learning, creative collaboration and shared intelligence. This again rests on the synergistic principles: multiple forms of value: multiple actors and relationality: multiple factors and value models: multiple pathways from linear to

synergistic. The result of a synergistic 'local integrated development pathway would include (Figure 8):

- Shipping and waterfront activity moves to more diversified, niche, value-added activities – ecotourism, research, high value manufacture: then, economic value-added is returned to the city and region.

- Local economy develops more diversified, innovative, knowledge-based socioeconomic model: then, socio-cultural patterns are re-invented, communities are more resilient.

- Cultural heritage is managed as a multi-valent community resource: urban design creates new connections between communities and marine resources. Then, cultural heritage is resilient to global shocks: responsive to local needs and resources: enables space for creative development.

4.1 Cultural heritage issues

A major resource of historic port cities is a typically deep and rich cultural heritage, in some cases dating back for several thousand years. Such heritage often suffers physical displacement, as where modern dock areas and container ports cut off the city from the waterfront. It often suffers economic disinvestment and social dislocation, as where the indigenous active users of churches, marketplaces etc, are in decline or active dislocation by high value tourists, service industries or culture-seekers. To counter this, a synergistic approach to cultural heritage, with its valuation and evaluation, is a key component of local integrated development. Examples can already be seen in many port cities around the world, but more are urgently needed to combat rapid decline or cultural destruction in many other areas.

This demonstrates one further general theme from Section 3, the question of how to frame and formalise values which are by nature embedded and intangible. In the case of cultural heritage there is a clear concept of 'relational value' – not only material-economic, but social, ethical, and concerning the relations between people, ideas, experiences, objects or places. In this case, 'values' are not fixed quantities, but more like potential energy, potential innovation or potential for relational activity (the metaphor is like money in the bank, which is only useful when circulated. Likewise, cultural heritage has potentials which are often hidden, so to realise its value depends on a creative process of social learning and creative collaboration – i.e., a synergistic approach.

Following the mapping approach, we can see cultural heritage values in two parts (Figure 8): on the left is an analytic view, and on the right a typical application. On the left are relational domains, in a range from economic 'exchange values', to 'embedded values', i.e., ecological, social or cultural. Firstly we can look at (a) relational values within each domain, i.e., an economic flow of money from consumers to producers, or an ecological flow of materials. Then we can look for relational values between domains, where economic values are assigned to ecological flows, or social values to cultural practices. Thirdly, beyond the static view we can explore the 'emergent value' potential from dynamic change: which might be linear-adaptive as with increasing tourist numbers: or synergistic change as with a new cultural business model. Finally there are potential values in relations between models, in hybrid forms of value reproduction: for example, where tourists pay to see religious ceremonies from a very different culture.

One example is shown on the right hand side, a reinterpretation based on the Castlefield area of Manchester (Ravetz, 1999). This sees a 'virtuous circle' of multilateral emergent innovation, where value can be generated at each step:

- new adaptations of the built heritage can emerge around new functions and services

- new patterns of social learning and creative collaboration, emerge around these adaptations

- new sociocultural perceptions and aspirations can form around these collaborations

- new cultural and social communities can emerge around these perceptions and aspirations

- new financial and investment models can emerge around these communities

- new functions and services can emerge around these financial models – and so on…

Figure 9 Values and evaluation in culture and heritage (see online version for colours)
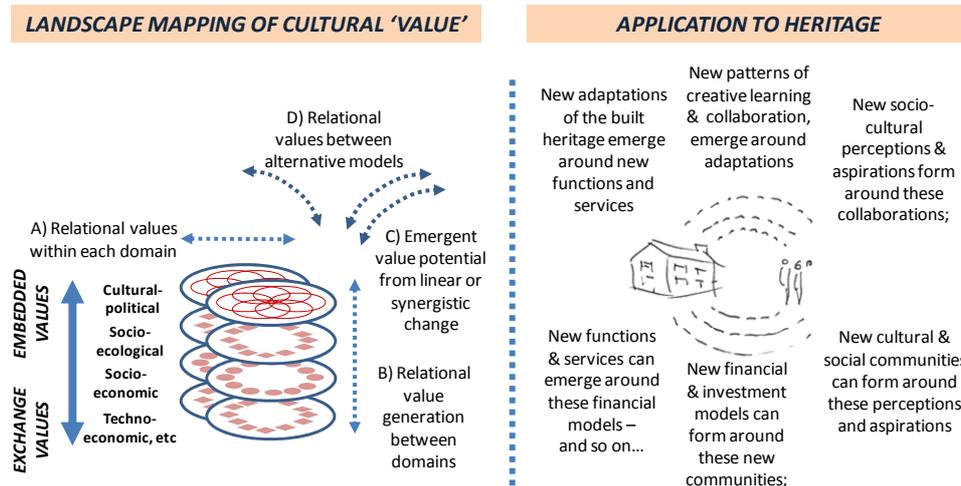
5 Case studies

Here we look at two vignettes, from two of the UK's major port cities. The case of Liverpool looks at the contradictions of city-centre urban regeneration and development, following on the author's involvement in the northwest England 'integrated regional strategy' (Ravetz, 2006). The case of Glasgow looks at deep-rooted and complex public health challenges, and possible responses based on the synergistic approach (drawing from the author's contributions at the Glasgow Centre for Population Health).

5.1 Urban regeneration challenges in Liverpool

Liverpool is a classic example of a port city with a history of rapid growth and decline, with huge challenges alongside huge potential. From its first dock in 1715, Liverpool became a major hub port of the British Empire in the 19th century, with much of its wealth built on the former slave trade. The city then lost half its population in the period 1945-95, accompanied by massive de-industrialisation and dereliction. A brief outline of recent history includes:

- 1950s – post war restructuring, rapid decline of shipping and fishing

- 1960s – new cultural wave of 'Merseybeat'

- 1970s – strategic planning for city-region of Merseyside (a city-region unit which includes Liverpool with four others)

- 1980s – Confrontation between socialist council and right wing government: and between union labour and large firms in sectors such as automotive, chemicals, and the dockyards

- 1980s – 1st wave of urban regeneration and reclamation: rise of cooperatives and community initiatives

- 1990s – new realism, continued by new labour government: expanding airport, new industries, culture-based waterfront regeneration, green infrastructure

- 2000s – 2nd wave of large 'urban development corporations' and 'housing market renewal' areas: large city centre retail investment of Liverpool One

- 2010s – major redevelopment proposals in the former port areas in Birkenhead, as part of private sector driven 'Atlantic Gateway'.

There is now approximately 11 million square metres of Liverpool which is considered decayed and unprogrammed space (North Liverpool & South Sefton SRF, http://www.liverpoolvision.co.uk/). There is continuing relocation of freight traffic, a result of containerisation and mechanisation: with shrinking national fishing fleets; and passenger ferry activity declining in competition with budget airlines. In terms of social deprivation, some inner and outer areas are among the worst 1% in the UK: and in the UK Coalition government's austerity programme, Liverpool was one of the worst affected by financial cuts to the public sector and welfare.

In spite of new rhetoric on regional cooperation, there is a rivalry and lost competition with nearby Manchester, for regional centre and 'world city' role. Recent initiatives such as 'European City of Culture' 2008, the UNESCO World Heritage status for the central waterfront, and the urban tourism revival, have helped to generate large commercial investment such as 'Liverpool One'. The benefits of this are not aimed at the more deprived neighbourhoods: but meanwhile there is a parallel stream of third sector social enterprises: cooperatives, ecological projects, local heritage, utopian grassroots and community initiatives.

Some key experiences from Liverpool are summarised in Table 1. This sets out the main dynamics of change, using the STEEPCU framework ('social, technical, economic, environmental, policy, cultural, urban'). On the left side, this shows contrasting models of change: a linear '1.0', as against a synergistic '3.0' model of change. On the right hand side, the table contrasts the key features of the Liverpool case with those of the Glasgow case. Each of these demonstrates the dynamic tension between the '1.0' discourse of decline and fragmentation, and a potential '3.0' agenda for synergistic change, towards creative mobilisation of holistic wealth-health.

From the 1990s, the concept of the 'sustainable city-region' was a topical debate across the North of England, drawing from parallel research on Greater Manchester (Ravetz, 2000). For Liverpool, a wide band along the waterfront across the city-region, contains areas labelled 'development opportunity', otherwise framed as 'obsolescence and dereliction'. The scale of change and legacy from port and industrial restructuring is huge: including negative image, contamination and dereliction, high development costs, obsolete infrastructure, declining local services, and unskilled labour. A quarter of the most deprived neighbourhoods in England are to be found on Merseyside, and the statistics show little change in a decade (Liverpool City Council, 2012). The regeneration industry has been active for 30 years, with many 'flagship' projects to be seen: on the broad area of large-scale derelict land, it has achieved many successes: but there is also a powerful downward spiral across a broad swathe along the modern industrial port areas, rather than the historic heritage, where current efforts may not be enough to reverse the combination of physical dereliction, economic obsolescence and social exclusion.

One example of regeneration which is arguably based on the '2.0' model, is the Liverpool One development (You and Louwaars, 2012): at the time the largest city-centre regeneration project in Europe. The 18 hectare site includes shops, housing, hotels and restaurants, leisure, 30,000 ft^2 offices, a transport interchange, and a circular park on top of 3,000 parking spaces. However the acquisition of land by the developer Grosvenor Estates (owned by the third richest man in the UK, the Duke of Westminster) involved a controversial new legal structure for streets and public spaces, where traditional rights of way were replaced by 'public realm arrangements' policed by private security guards. While this is seen as a benefit to commercial interests and shopping functions, non-shopping or alternative social activities such as skateboarding, picnicking, begging, and any form of campaigning or demonstration, are banned or at the will of the estate managers.

As one example, the development master plan required the destruction of Quiggins, a historic warehouse containing small low-rent spaces for young craft-people and cultural creatives: after a long campaign a Compulsory Purchase Order was granted in 2007, and the creative community was dispersed, at the same time that 'official' Liverpool was celebrating its role as capital of culture. All this can be seen as symptomatic of the privatisation of city centres, (ironically at the same time that the countryside is more accessible than ever), in the interests of extractive and divisive wealth creation based on unsustainable debt, and a vulnerable retail industry based on materialistic consumption (Minton, 2009; Kingsnorth, 2008).

An alternative example of so-called 'sustainable regeneration' is the Ropewalks Initiative, a typical edge of centre historic area, with a culture-focused regeneration

programmes through the 1990s (Couch and Denneman, 2000). This could be criticised from many angles: it seemed to fall short on its aspirations for ecological sustainability, and there was continuing tension between local residents, businesses, and the incoming investment which was needed, in part to justify the public expenditure. It is now on the border of the Liverpool One development which is pushing high value development into a low to middle value historic neighbourhood. In context this initiative was part of a much wider landscape of experiments in regeneration and community development. This included Groundwork Trusts in various parts of Merseyside, from the 1980s: these brought together public and private sectors, civil society and residents, to work on derelict or unused urban or fringe land: (Bromley, 1990; Nicholson-Lord, 1987). Inner city housing cooperatives and community technical aid centres, reclaimed or built new neighbourhoods on an integrated social model: the largest of these, the Eldonians, is now the location of a zero-carbon development and employment hub.

5.2   Public health challenges in Glasgow

This vignette looks at a different side of the port city-region: the social and demographic issues of public health, and the potential for synergistic design of organisations and enterprise models. In the decade to 1991 the Glasgow manufacturing sector lost 44% of its jobs, by which time the service sectors had increased to 77% of all employment (Green, 1994). The town of Port Glasgow for example began shipbuilding in 1762, and continued for 200 years until the mass closures in the 1950–1960s, leaving at present only one specialist shipbuilding firm. While the Glasgow and Clyde Valley strategic governance shows a level of integration far in advance of anything now in England, it could not keep up with the level of deprivation and dysfunction, coming from the effects of deindustrialisation and globalisation of local supply chains: hence the moniker of the 'sick man of Europe' (Whyte and Ajetunmobi, 2012).

   For the effects on health, it is well established that deindustrialisation causes economic and social upheaval and impacts on population health (Taulbut et al., 2012). However for West Central Scotland, the particular poor health status of WCS compared to similar European regions, maps better onto inequality measures rather than absolute poverty or deprivation indices. Around Europe, Merseyside (the Liverpool city-region) appears to be the most similar in social and economic problems, but showing an even worse public health profile. In Glasgow city-region particular groups with high mortality rates included young Scottish males, with substance abuse, suicide and violence: and middle aged Scottish females showing effects of diet and mental ill-health through syndromes such as chronic obstructive pulmonary disease (COPD) and liver cirrhosis.

   A wide range of agencies is looking at such interconnected problems from a systemic perspective: one is the Glasgow Centre for Population Health, where at the time of writing there is an application of the synergistic approach, building on the ongoing work of the International Futures Forum and the World Game technique (Hodgson, 2011).

It is clear that such deep rooted problems of ill-health emerge from interconnected processes of 'cumulative causation', where health is cause and effect on issues such as housing, education, diet and lifestyle, substance abuse, crime and deviance, and cognitive behavioural patterns of self-destruction. Surrounding these are both surface layers and deeper layers. Such forces include religion (both cities showing tension between Catholic and Protestant groups of various kinds, which surfaces through football rivalry): conflict between classes, between labour and capital, and competition between the hegemonic 'development' agendas of private versus public. There is recent conflict with ethnic groups, migrant workers in a post-colonial discourse, overlaid on historic tension with Irish migrants.

In response there are interesting directions in the public health debate from around the world. One is the 'assets-based' approach to the collective resources of households and communities, to promote and maintain positive health, where patients are seen as part of the solution rather than the problem (McLean and McNeice, 2012). Another is to look afresh at the role of public sector and non-profit organisations in healthcare co-production (Bunt and Harris, 2009). However experience shows that such approaches can meet with many kinds of resistance, from organisations locked into existing linear structures.

The synergistic approach in a Glasgow-based workshop aimed to look further ahead, in an iterative process which moves from problem mapping (analysis) to response design (synthesis). Firstly, the 'landscape mapping' stage looks at the interconnecting cycles of relational value generation: one example is the diet-health cycle, seen as a relational interaction of nutritional health and diet, the food industries, popular culture and household economy. Another example is the cycle of drug use, criminalisation, popular culture and self-destructive patterns.

The 'change-mapping' stage explored a range of 'what-if' questions at several levels: individual, household, community and health sector: with questions to explore cumulative change: external conditions pressures: and alternative visions and discourses on personal health and lifestyle issues. Thirdly, the 'synergy-mapping' stage looks for emergent problems such as cumulative risks or self-destructive cycles: then it explores opportunities such as health co-production, community resilience, and social learning for organisational change. Finally the 'road-mapping' stage aims to converge towards concrete policies and collaborations, such as the food-health cycle, the youth-crime cycle, or the substance-mental health cycle. In each of these and similar, the goals of holistic health and policy integration can be navigated and negotiated, in full knowledge of the complexity of problems and opportunities. At present the Glasgow programme is mainly focused on process issues: learning, collaboration, organisational design and social enterprise models. In other words, there is clear potential for interconnected responses to interconnected problems: but this is not so much a blueprint, more like a continuous process of design, negotiation and collaboration building.

5.3   Comparison

The wider issues raised by this brief example are set out in Table 1 showing the synergistic themes in terms of general port city issues, with experiences from Liverpool and Glasgow. In parallel the mapping approach shows a visual comparison (Figure 10). The urban regeneration case shows a strong value-added loop between finance and

property investment, infrastructure and built environment, and governance. Contributing factors include civil society as 'cultural arbiters': ecological assets in the waterfront and its rehabilitation: local community organisations as users and animators of space: and human resources in the general up-skilling of the labour force.

In contrast, the public health case shows some very different value chains and cycles, centred on households as sociocultural units, human resources as self-educators and managers, civil society and the professions, and public services. There are contributions from other sources including housing, technology, finance and so on. At the moment the central value chain is far from robust and fully effective – explaining why public health work is an uphill struggle – but there would be further opportunities to be explored, as above.

The idealised 'synergistic pathway' model for each of these remains for discussion and work in progress in both locations. Drawing from the above mappings, a generalised road-map outline could be recommended for policy and research:

- include a wider range of actors and multiple value chains and cycles

- enhance the social learning and shared intelligence capacity through horizontal factors

- mobilise under-used assets through creative collaborations and multi-value interconnections

- design policy interventions which enable self-organisation and self-empowerment, particularly of the most vulnerable and marginalised actors

- establish policy processes as continuous programmes of social learning and creative collaboration.

Figure 10 Synergistic mapping comparison of case studies (see online version for colours)
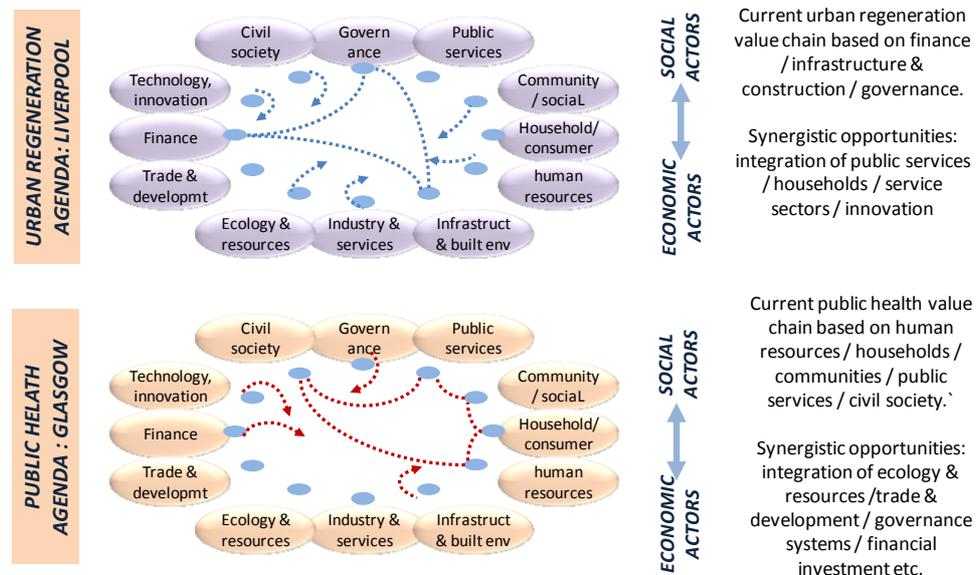
Table 1   From linear to synergistic change: case study comparison

	Linear change: (1.0 model)	*Synergistic change: (3.0 model)*	*Urban regeneration: the case of Liverpool*	*Health regeneration: the case of Glasgow*
System paradigm	Linear systems (mechanical)	Creative, cognitive, co-evolutionary systems (human)	Post-industrial 'urban' decline – VS – post-decline cycle of renewal	Post-industrial 'public health' decline – VS – post-decline cycle of renewal
Combined dynamic	Hollowing Unemployment Alienation	Creative learning Socio-cultural inclusion Ecology internalisation	Economic/industrial decline – VS – creative pathways for economic development	Social/community/ health dysfunctions – VS – re-integration and empowerment
Social dynamics	Alienation and migration Ethnic tension Generation gap Gender role conflict	('*Community 3.0*') Co-production of health Social enterprise Learning society	Multiple disadvantage in human resources – VS – rebuilding local social assets and livelihoods	Multiple deprivation and cycle of abuse – VS – co-production of positive health outcomes
Technology and infrastructure dynamics	Obsolete infrastructure and industry: global export and expropriation	('*Infrastructure 3.0*'): local innovation community: start-ups with appropriate tech	Socio-technical infrastructure as burden – VS – opportunity for mobilising USP	Socio-technical systems of ill-health – VS – mobilising and empowering tech for well-health
Economic dynamics	Dis-investment Asset liquidation Structural unemployment	('*Economy 3.0*'): Social reinvestment SME diversity Knowledge diversity	Financial dynamics of extraction – VS – rebuilding resilience of local chains and clusters	State withdrawal and public deficit – VS – new ways to mobilise human wealth.
Ecological dynamics	Dereliction and disinvestment	('*Ecology 3.0*'): Local-global balance Climate and resource protection strategy	Urban pollution and dereliction – VS – vacant land and buildings as resources	Environmental health hazards – VS – positive lifestyle responses
Policy and governance dynamics	Union and labour decline Local/national conflict Public deficits	('*Governance 3.0*'): Active participation Anticipatory governance Knowledge society	Fragmented economic governance – VS – collaborative rebuilding of inclusive economy	Fragmented public health/social care/other services – VS – positive re-integration
Cultural dynamics	'Dole culture' 'Fragmented community' 'Neo-liberal heist' 'Cultural alienation'	('*Network 3.0*'): Living heritage Creative exchange Active multi-culturalism	Culture of alienation and obsolescence – VS – culture of can-do and opportunity	Cultural dynamics of poverty and depression – VS – empowerment and identity
Urban/spatial dynamics	Obsolete infrastructure Industrial dereliction Hollowing and shrinking	('*Urban 3.0*') Urban-rural links Neighbourhood renaissance Social reinvestment	Urban disinvestment and displacement – VS – weaving a more collaborative urban structure	Housing decline and marginalisation – VS – built environment as driver of community renewal

6 Conclusions and prospects

This paper is a brief outline of the challenges and opportunities facing port cities, drawing on the examples of urban regeneration and public health. In each there are complex, cumulative and interconnected problems: and in each there are alternative types of development path or policy response, from the linear to the 'synergistic'. To explore these possibilities calls for a suitable method: for both analysis of complex interconnected problems, and for design of complex interconnected and 'synergistic' responses.

The method is then part of a wider landscape of potential opportunity, framed as the '3.0' models: covering not only the urban, but also economic, social, cultural, political, ecological, and knowledge systems. Further research is currently following avenues such as:

- systematic mapping of urban systems, for policy challenges such as climate mitigation or adaptation, security, resilience, and sustainable consumption

- process methods for public deliberation and research knowledge management

- social technology to assist and enable the above

- metrics and benchmarks for urban analysis and policy evaluation.

There is more to describe in parallel papers and a book (Ravetz, 2013, forthcoming). However the overall implication should be clear: that to respond to the challenges and opportunities of port cities in a synergistic, inclusive, creative, responsive and sustainable way, needs a new generation of methods and concepts for local integrated development. This paper aims to provide some steps on that journey.

References

Ackoff, R. (1973) 'Science in the systems age: beyond IE, OR, and MS', *Operations Research*, Vol. 21, No. 3, pp.661–671.

Allee, V. (2008) 'Value network analysis and the value conversion of tangible and intangible assets', *Journal of Intellectual Capital*, Vol. 9, No. 1, pp.5–24.

Bathelt, H. and Gluckler, J. (2003) 'Toward a relational economic geography', *Journal of Economic Geography*, Vol. 3, No. 2, pp.117–144.

Birley, M. (2011) *Health Impact Assessment: Principles and Practice*, Earthscan, London.

Bromley, P. (1990) *Countryside Management*, p.164, Taylor & Francis, London.

Bunt, L. and Harris, M. (2009) *The Human Factor: How Transforming Healthcare to Involve the Public Can Save Money and Save Lives*, NESTA, London.

Clayton, A. and Radcliffe, N. (1996) *Sustainability: A Systems Approach*, Earthscan, London.

Cohen, M.A. (2012) 'Reinventing the future: designing Urban 3.0', *Harvard International Review*, Summer, Vol. 34, No. 1, pp.52–57.

Couch, C. and Dennemann, A. (2000) 'Urban regeneration and sustainable development in Britain: the example of the Liverpool Ropewalks Partnership', *Cities*, Vol. 17, No. 2, pp.137–147.

Darling, J. (2009) 'Thinking beyond place: the responsibilities of a relational spatial politics', *Geography Compass*, Vol. 3, No. 5, pp.1938–1954.

Desfor, G., Laidley, J., Stevens, Q. and Schubert, D. (2011) *Transforming Urban Waterfronts: Fixity and Flow*, Routledge, New York and London.

Donati, P. (2011) *Relational Sociology: A New Paradigm for the Social Sciences*, Routledge, New York.

Emirbayer, M. (1997) 'Manifesto for a relational sociology', *The American Journal of Sociology*, Vol. 103, No. 2, pp.281–317.

Ferguson, R.J., Paulin, M., Moslein, K. and Muller, C. (2005) 'Relational governance, communication and the performance of biotechnology partnerships', *Journal of Small Business and Enterprise Development*, Vol. 12, No. 3, pp.395–408.

Florida, R. (2002) *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community, and Everyday Life*, Basic Books, New York.

Folke, C., Colding, J. and Berkes, F. (2003) 'Building resilience for adaptive capacity in social-ecological systems', in Berkes, F., Colding, J. and Folke, C. (Eds.): *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*, Cambridge University Press, Cambridge, UK.

Froebel, F., Heinrichs, J. and Kreye, K. (1980) *The New International Division of Labour*, Cambridge University Press, Cambridge, UK.

Funtowicz, S. and Ravetz, J. (1994) 'Emergent complex systems', *Futures*, Vol. 26, No. 6, pp.568–582.

Gardner, H. (1983) *Frames of Mind: The Theory of Multiple Intelligences*, Basic Books, New York.

Girard, L.F. (2011) 'Creativity and the human sustainable city: principles and approaches for nurturing city resilience', in Girard, L.F. and Nijkamp, P. (Eds): *Creativity and Sustainable Cities*, Heinemann, Oxford.

Glaeser, E. (2011) *Triumph of the City: How Our Greatest Invention Makes Us Richer, Smarter, Greener, Healthier, and Happier*, Penguin Books, NY.

Graeber, D. (2001) *Toward an Anthropological Theory of Value: The False Coin of Our Own Dreams*, Palgrave, New York.

Grandori, A. (2006) 'Innovation, uncertainty and relational governance', *Industry and Innovation* Vol. 13, No. 2, pp.127–133.

Green, A. (1994) *The Geography of Poverty and Wealth*, University of Warwick Press, Warwick.

Hausmann, R., Hidalgo, C.A., Bustos, S., Coscia, M., Simoes, A. and Yildirim, M.A. (2011) *The Atlas of Economic Complexity: Mapping Paths to Prosperity*, Harvard University Press, Boston, MA.

Hein, C. (2011) *Port Cities: Dynamic Landscapes and Global Networks*, Routledge, London.

Hodgson, A. (2011) *Ready for Anything: Designing Resilience for a Transforming World*, Triarchy Press, Edinburgh. Associated materials are available at [online] http://www.gcph.co.uk/events/126 (accessed 30 April 2014).

Hornborg, A. (2009) 'Zero-sum world: challenges in conceptualizing environmental load displacement and ecologically unequal exchange in the world-system', *International Journal of Comparative Sociology*, Vol. 50, No. 3–4, pp.237–262.

Jackson, T. (2009) *Prosperity without Growth*, Sustainable Development Commission, London.

Jacobs, M. (1997) 'Environmental valuation, deliberative democracy & public decision-making institutions', in Foster, J (Ed.): *Valuing Nature: Economics, Ethics & Environment*, Routledge, London.

Jacobs, W., Ducruet, C. and De Langen, P.W. (2010) 'Integrating world cities into production networks: the case of port cities', *Global Networks*, Vol. 10, No. 1, pp.92–113.

Jones, M. (2009) 'Phase space: geography, relational thinking, and beyond', *Progress in Human Geography*, Vol. 33, p.487.

Kingsnorth, P. (2008) *Real England: The Battle against the Bland*, Portobello Books, London.

Landry, C. (2006) *The Art of City Making*, Earthscan, London.

Liverpool City Council (2012) *Liverpool Economic Briefing 2012: A Monitor of Jobs, Business and Economic Growth*, Liverpool City Council.

Maslow, A. (1970) *Motivation and Personality*, Harper & Row, New York.

Mauss, M. (1967) *The Gift: Forms and Functions of Exchange in Archaic Societies*, Norton Library, London.

McLean, J. and McNeice, V. (2012) *Assets in Action: Illustrating Asset-based Approaches for Health Improvement*, Glasgow Centre for Population Health and NHS Health Scotland.

Meadows, D.H. (2008) *Thinking in Systems: A Primer*, Earthscan, London.

Minton, A. (2009) *Ground Control: Fear and Happiness in the Twenty-First Century City*, Penguin, Harmondworth.

Murdoch, J. (2006) *Post-structuralist Geography: A Guide to Relational Space*, Sage, NY.

Nachmanovitch, S. (2007) 'Bateson and the arts', *Kybernetes*, Vol. 36, Nos. 7/8, pp.1122–1133.

Nicholson-Lord, D. (1987) *The Greening of the Cities*, Routledge, London.

Normann, R. and Ramírez, R. (1993) 'From value chain to value constellation: designing interactive strategy', *Harvard Business Review*, July–August, Vol. 71, No. 4, pp.65–77.

North Liverpool & South Sefton SRF, *Summary* [online] http://www.liverpoolvision.co.uk/news/publications/north-liverpool-and-south-sefton-strategic-regeneration-framework-2010/ (accessed 24 April 2014).

O'Hara, P.A. (2008) 'Principle of circular and cumulative causation: fusing Myrdalian and Kaldorian growth and development dynamics', *Journal of Economic Issues*, Vol. 42, No. 2, pp.375–387.

Piorr, A., Ravetz, J. and Tosics, I. (2011) *Peri-urbanisation in Europe: Towards a European Policy to Sustain Urban-Rural Futures*, Synthesis report of the PLUREL Project, University of Copenhagen.

Ravetz, J. (1999) 'Economy, environment & the sustainable city: notes from Greater Manchester', in Roberts, P. and Gouldson, A. (Eds.): *Integrating Environment and Economy: Local and Regional Strategies*, Routledge, London.

Ravetz, J. (2000) *City-Region 2020: Integrated Planning For a Sustainable Environment*, Earthscan with the Town & Country Planning Association, London.

Ravetz, J. (2006) 'Regional innovation & resource productivity – new approaches to analysis and communication', in Randles, S. and Green, K. (Eds.): *Industrial Ecology & Spaces of Innovation*, Edward Elgar, Cheltenham, UK.

Ravetz, J. (2011a) 'Exploring creative cities for sustainability with deliberative visualization', in Girard, L.F. and Nijkamp, P. (Eds): *Creativity and Sustainable Cities*, Heinemann, Oxford.

Ravetz, J. (2011b) 'Integrated development for peri-urban territorial cohesion', in Piorr, A., Ravetz, J. and Tosics, I. (Eds.): *Peri-urbanisation in Europe: Towards a European Policy to Sustain Urban-Rural Futures*, European Commission Communications Unit, with University of Copenhagen, Luxembourg [online] http://www.plurel.net/Synthesis_report_Peri-urbani_-sation_in_Europe-115.aspx (accessed 30 April 2014).

Ravetz, J. (2012) 'Urban synergy foresight', in Forward Planning Studies Unit (Ed.): *Urban Governance in the EU: Current Challenges and Forward Prospects*, pp.31-44, EU Committee of the Regions, Brussels [online] http://cor.europa.eu/pages/EventTemplate.aspx?view=detail&id=d1e23dfc-27f1-4069-a884-fc4bbd5d63ce (accessed 30 April 2014).

Ravetz, J. (2013) *New Futures for Older Ports: Synergistic Development in a Global Urban System*, Sustainability 2013, Vol. 5, pp.5100–5118 [online] http://www.mdpi.com/2071-1050/5/12/5100 (accessed 30 April 2014).

Ravetz, J. (forthcoming) *Urban 3.0: Pathways towards Shared Intelligence for the Urban Century*, Earthscan, London.

Ravetz, J., Fertner, C. and Nielsen, T.S. (2013) 'The dynamics of peri-urbanization', in Pauleit, S., Bell, S. and Aalbers, C. (Eds.) *Peri-Urban Futures: Land Use and Sustainability*, Springer, Berlin.

Ravetz, J., Girard, L.F. and Bornstein, L. (2012) 'A research and policy development agenda: fostering creative, equitable, and sustainable port cities', *Bollettino del Dipartimento di Conservazione dei Beni Architettonici ed Ambientali*, Vol. 12, No. 1, Universita degli Studi di Napoli 'Federico II' [online] on: http://www.wufportareas.it/ (accessed 30 April 2014).

Rittel, H. and Webber, M. (1973) 'Dilemmas in a general theory of planning', *Policy Sciences*, Vol. 4, pp.155–169, Elsevier Scientific Publishing Company, Inc., Amsterdam.

Roberts, P., Ravetz, J. and George, C. (2009) *Environment and City: Critical Perspectives on the Urban Environment around the World*, Routledge/Taylor & Francis, Oxford.

Robinson, J. and Tinker, J. (1995) *Reconciling Ecological, Economic & Social Imperatives: Towards an Analytical Framework*, University of British Columbia, Sustainable Development Research Institute.

Scharmer, C.O. (2007) *Theory U: Leading from the Future as it Emerges*, Berrett-Koehler Publishing, CA.

Soderbaum, P. (2008) *Understanding Sustainability Economics: Towards Pluralism in Economics*, Earthscan, London.

Sunley, P. (2008) 'Relational economic geography: a partial understanding or a new paradigm?', *Economic Geography*, Vol. 84, No. 1, pp.1–26.

Taulbut, M., Walsh, D., Parcell, S., Hanlon, P., Hartmann, A., Poirier, G. and Strniskova, D. (2012) *Health and Its Determinants in Scotland and Other Parts of Post-industrial Europe: The 'Aftershock of Deindustrialisation' Study – Phase Two*, Glasgow Centre for Population Health and NHS Health Scotland.

Waltner-Toews, D., Kay, J. and Lister, N. (2009) *The Ecosystem Approach: Complexity, Uncertainty and Managing for Sustainability*, Columbia University Press, NY.

Wang, J.J. (2007) *Ports, Cities, and Global Supply Chains*, Ashgate, Aldershot, UK.

Whyte, B. and Ajetunmobi, T. (2012) *Scottish Mortality in a European Context 1950–2010: An Analysis of Comparative Mortality Trends*, Glasgow Centre for Population Health.

You, N. and Louwaars, S. (2012) 'Port cities: capitalizing on re-development with examples from Baltimore, Bilbao and Liverpool', *Bollettino del Dipartimento di Conservazione dei Beni Architettonici ed Ambientali*, Vol. 12, No. 1, Universita degli Studi di Napoli 'Federico II' [online] http://www.wufportareas.it/ (accessed 30 April 2014).