DEEPER-CITY

Synergistic pathways from smart to wise

Joe Ravetz

Earthscan / Routledge

Synergistics:

A PRACTICAL GUIDE

METHODS & TOOLS FOR MAPPING & DESIGN of SYNERGISTIC PATHWAYS

v0.85 – July 2017

This Practical Guide is an illustrated manual for the Synergistic Toolkit. It includes:

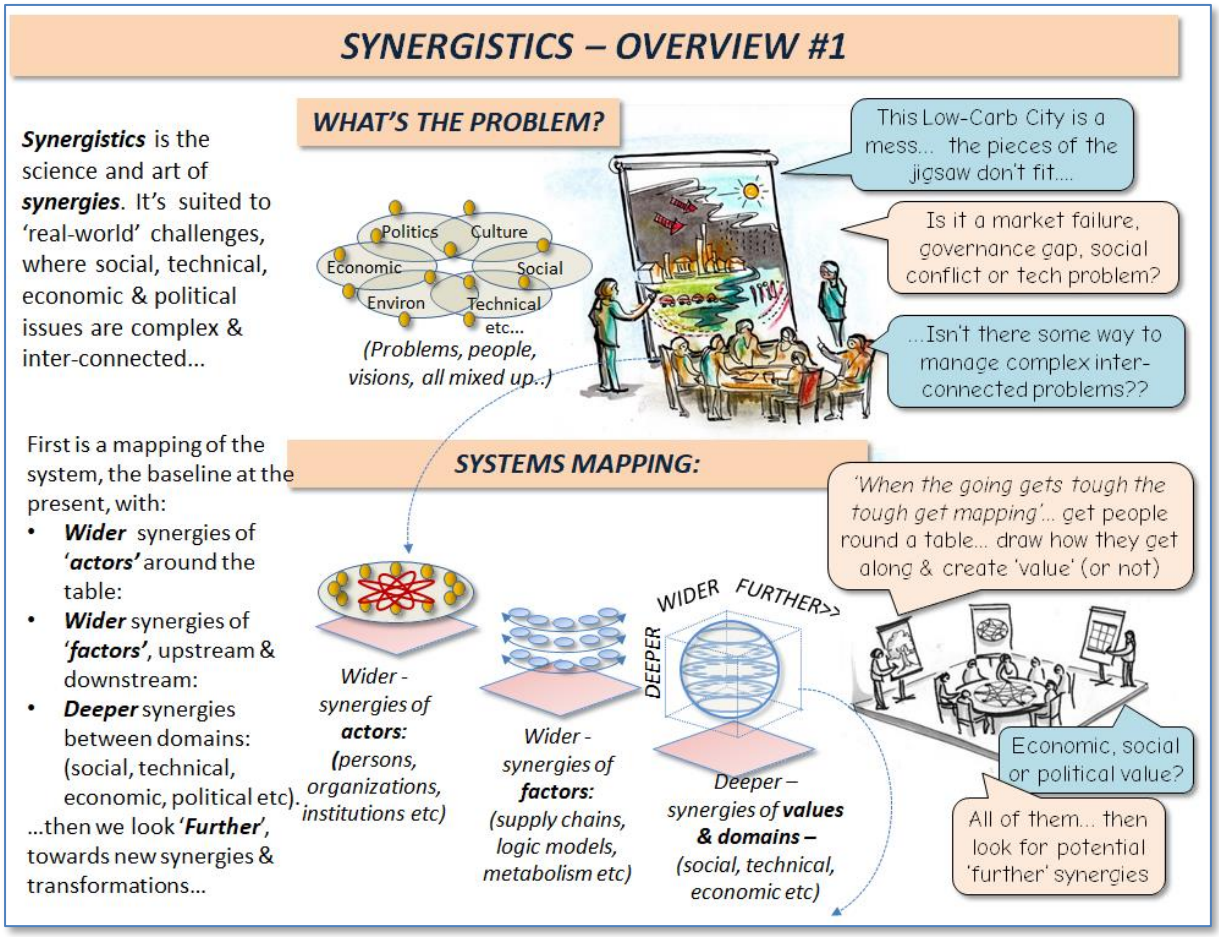
- *FAQ's – what is synergistics?*
- *Synergistic Toolkit: the overview*
- *Step-by-step guide*
- *Synergistic Mind-Lab: the context*

CONTENTS

FAQs: WHAT IS 'SYNERGISTICS'

We are surrounded by hugely complex inter-connected challenges. Climate change, for example, combines earth science with society, technology, ecology, economics, politics and cultural issues. Local and global, short term and long term are all mixed up. Others such as artificial intelligence, or social inequality are equally complex, inter-connected, controversial. How to work with them?

'Synergistics' – the science and art of working with synergies – has been developed for such challenges. It provides practical methods and tools for joined up thinking, for complex inter-connected problems and solutions, where progress depends on collective intelligence.



So where to start? With simple drawings or diagrams, on flipcharts or napkins or sticky notes, we can do 'synergistic mapping' of people and organizations and systems (i.e. 'actors' and 'factors'). We use as much detail as needed at each stage, whether technical information or social deliberation. Then we can begin to explore systematically, beyond the normal boundaries and silos:

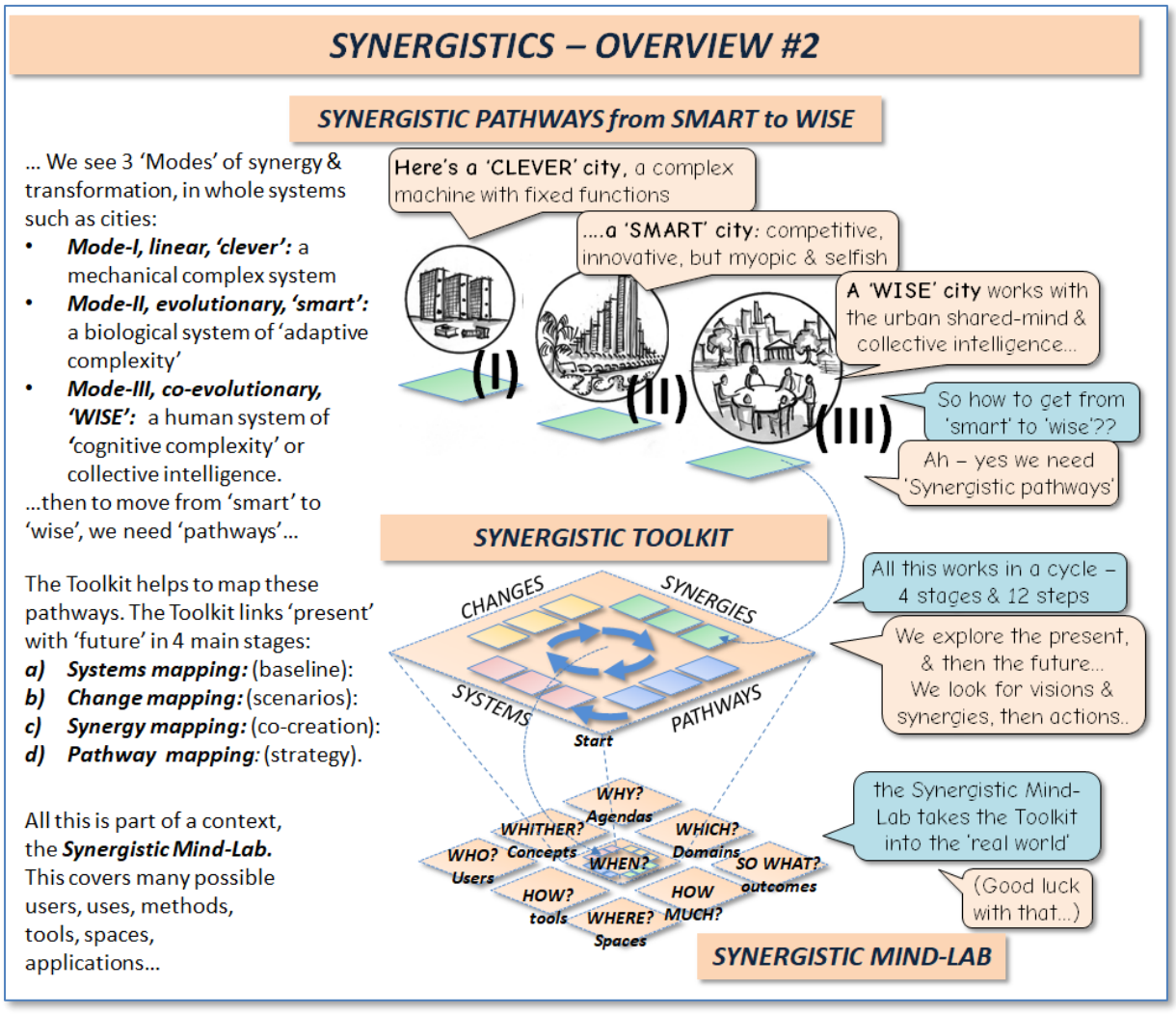
- ***Wider*** - synergies of actors, and of factors, (people or organizations or institutions or objects).
- ***Deeper*** - synergies between different domains and value systems (social, technical, economic, political etc).
- ***Further***, with synergies which emerge from whole systems, not just the parts.

This 'further' dimension is the key to transformations, which can turn problems ('syndromes') into solutions or 'synergies'. A city is a good example of such transformation:

- ***Mode-I,*** ('1.0'), mechanical change and ***'clever'*** systems: 'a city as machine'
- ***Mode-II,*** ('2.0'), biological evolution and ***'smart'*** systems: 'a city as jungle'
- ***Mode-III***, ('3.0'), human co-evolution and ***'wise'*** systems: 'a city as civilization'.

To explore these Mode-III systems, and put them into practice, we use the Synergistic Toolkit. This is a set of methods and tools. It has a basic process which works in 4 stages:

- ***System mapping / co-learning:*** the baseline syndromes and issues on the table:
- ***Change mapping / co-knowledge:*** the dynamics of change and alternative futures:
- ***Synergy mapping / co-creation:*** design of opportunities, innovations, transformations:
- ***Pathway mapping / co-production****:* design of pathways, road-maps, policies, projects:



Here, these mappings are like maps of London, but in this case we are mapping complex cognitive systems of thinking. And these maps are beyond any single person or expertise – so we need collaborative / collective learning or 'co-learning', co-creation, co-production and so on. All this adds up to a collective intelligence – of cities, economies, governments or any other human system. The question follows – 'what if' we could organize societies, economies, politics etc, around a 'wiser' collective intelligence? And how to do it?

To answer this, we need ways to move from 'problem' syndromes (generally in Mode-I or II, clever or smart) – to 'solution' synergies (generally in Mode-III or 'wise'). So we design 'pathways', in the form of ***'synergistic pathways from smart to wise'.*** These are flexible and creative combinations of co-learning, co-creation and co-production. We design these with ***Pathway Mappings,*** i.e. structured visual representations, to help explore and navigate the space between problems and solutions.

This is the basic idea of the Toolkit. And the context for the Toolkit is the ***Synergistic Mind-Lab*** (aka '***Collaborium'***). This brings in the questions of who are the users, what is their purpose, where are the best places, how much in resources, how long does it take, and so on.

Overall, Synergistics doesn't claim to be a 'theory of everything'. It doesn't claim to forecast the future or provide easy answers. It's more like an umbrella for other theories or models. It's a 'heuristic' – probably more useful than not – based on practical experience, insight, skill, judgment, and as far as possible, wisdom. The Synergistic Toolkit and the Synergistic Mind-Lab aren't fixed in stone, they are for users to adapt and improvise wherever needed.

The Deeper-City book shows over 40 pathways – not all possible combinations but enough to get started – to help explore any human system with potential for collective intelligence. These pathways are labelled 'Mode-III or just '-III' for short. For example:

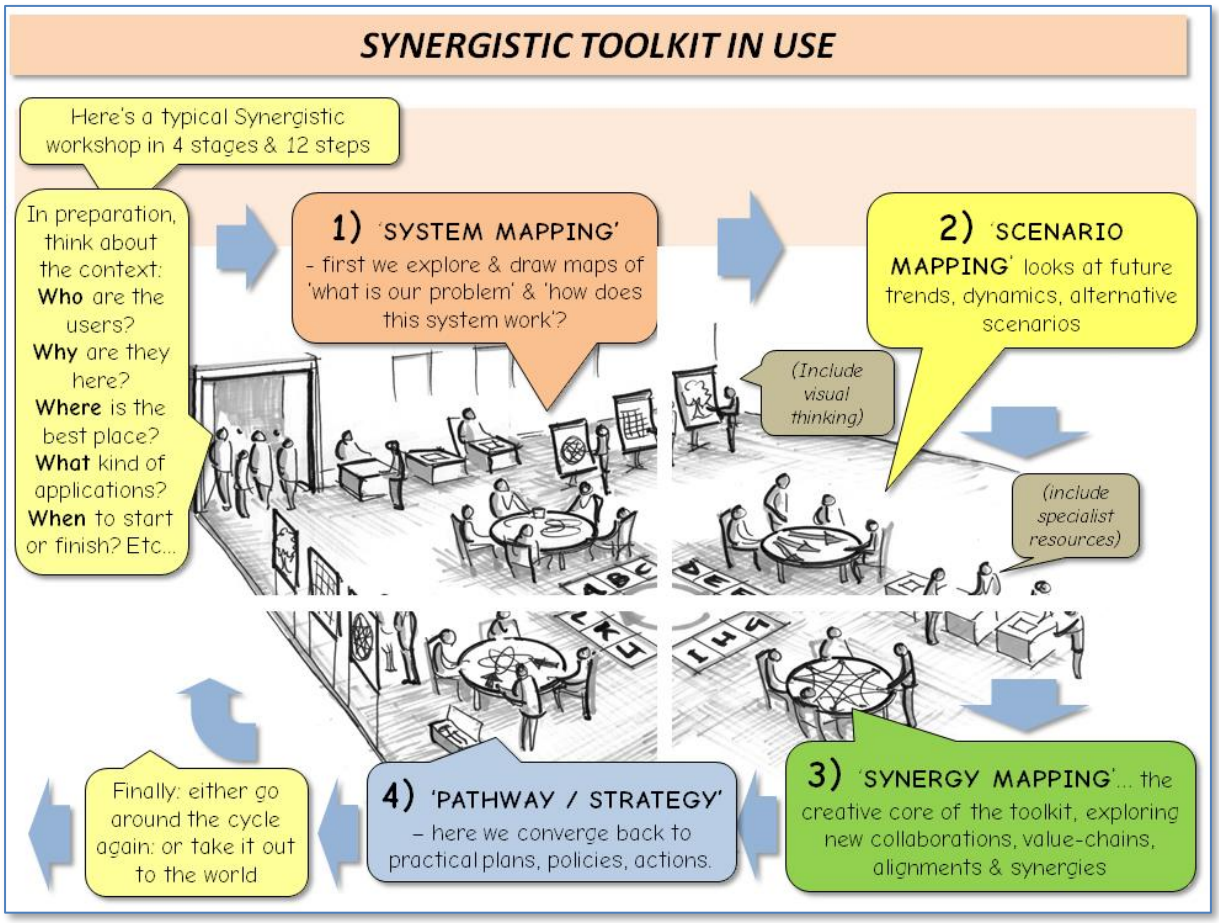
- ***City-III:*** an intelligent, self-organizing, responsive city and/or region, which provides livelihoods, takes responsibility for ecological effects, and builds a just & equitable society
- ***Economy-III***: systems of production and livelihoods, with recirculating profit and mutual finance, moving from 'winner-takes-all' to 'winners-are-all'.
- ***Ecology-III:*** ways of organizing energy, food, resources and ecosystems, which mobilize collective intelligence, for increased added value with less impact.
- ***Technology-III:*** managing the digital transition from 'smart' tech to 'wise' systems: which integrate markets and supply chains in their context of communities and livelihoods.
- ***Governance-III***: political structures which by nature are 'empowering with' rather than 'power over', with public services based on co-production.

SYNERGISTIC TOOLKIT: OVERVIEW

This and the next 4 sections focus on the 'Toolkit': the cycle of mapping and design in 4 stages and 12 steps. We use a worked example, a typical Low-Carb City (i.e. the linkage of urban development and climate change, on which our future depends). This is based on real experience in Greater Manchester, and a prototype 'Mini-lab' (Metropolitan Innovation / Intelligence Lab). The book *Deeper-City* demonstrates the method with 44 Pathway Mappings.

In each of the 12 steps there is a process of mapping (more analysis), and design (more synthesis). Each step can be more about the interactive discussion process, or more about knowledge (as in the book).

First – here is an overview of the Toolkit as interactive discussion. The Toolkit is a flexible, adaptable set of methods, resources, techniques. It's based on a circular process of thinking, with 4 stages and 12 steps. If there is time and resources, we go right around the full cycle: otherwise, select the steps which are most relevant and useful. For each step there are tried and tested methods and tools (e.g. for Step F, 'scenarios', there are many tools, methods, guide-books, organizations, links etc).



The picture here shows all four stages in one big room (in reality each could be at a different time and place)**.** The scheme is completely flexible: it can take 4 hours, 4 days, 4 weeks or 4 months, depending on time, people and resources. It can be formal or informal, all the way to a drink in a bar. The cycle can be more interactive, with a real-time workshop type programme, with maybe 40 participants in each session. Or the cycle can be more about desk-study, data-mining, analytic mapping, expert panels and interviews.

Overall this Toolkit helps to identify 'what kind of problems' are we talking about: and then link to 'what kind of solutions' are most useful:

- *If the problem is mainly functional or technical (e.g. we just need 500 houses), then we look for '**Clever'** functional / technical solutions.*
- *If the problem is mainly about incentives & innovations, then we look for **'Smart'** solutions and evolutionary type systems (e.g. we need better housing markets, values, incentives).*
- *For human type problems (often messy, creative, inter-connected), we look for synergistic and **'WISE'** solutions, (responsive, intelligent, integrated). For example, we want more than just 500 physical houses, more like a 'liveable community'… and this is a different kind of problem...*

#1: WHAT'S THE PROBLEM? SYSTEM MAPPING

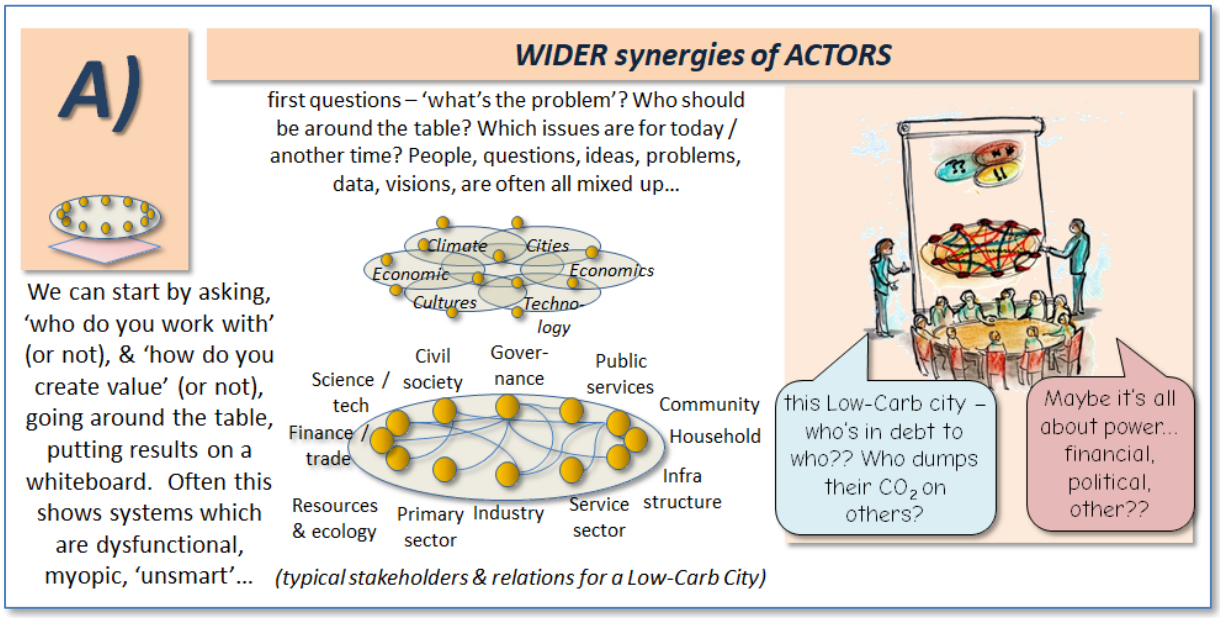
This first stage of System Mapping is all about 'relational thinking': i.e. 'what is the system, how does it work, who is involved, and what are their relations and interactions and inter-connections'.

Step (A): Wider - Actors

The best way to start, from experience, is by visualizing and mapping what's on the minds of the people: (this works best in real time discussion). The flipcharts or whiteboards (larger the better) might start off messy, but sooner or later they can take shape as 'relational mappings'. So, first sketch the agendas / problems / issues, using bubbles, arrows, cartoons, leaves or whatever works. Then, sketch the 'actors' / 'stakeholders' around a table (real or virtual), with their main relations and interactions: positive / negative, safe / risky, powerful / vulnerable, etc.

The picture shows typical actors in a typical Low-Carb city debate. Often it's not easy to get everyone into an actual room, and the most powerful people stay away, so we follow up meetings with interviews where needed. These diagrams show 10-12 places around the table, not as fixed numbers, but as practical limits for interactive discussion. As the mapping develops, we find some issues are more about the external or global context: others are more internal and local. In cities, often the local government isn't 'running' the city, but 'running to keep up' with the distant forces of finance or trade. To explore this we have to think 'out-of-the-box' with problematic or controversial issues of power, paranoia, corruption or expropriation.

> *For the Low-Carb city, first we have to debate the problem – is it about climate change, economic growth, new technology or finance? We have to draw some boundaries just to get started. Then we can begin mapping the main 'actors' and their interactions: governments, public services, communities, citizens, services, industry, finance, civil society and so on.*



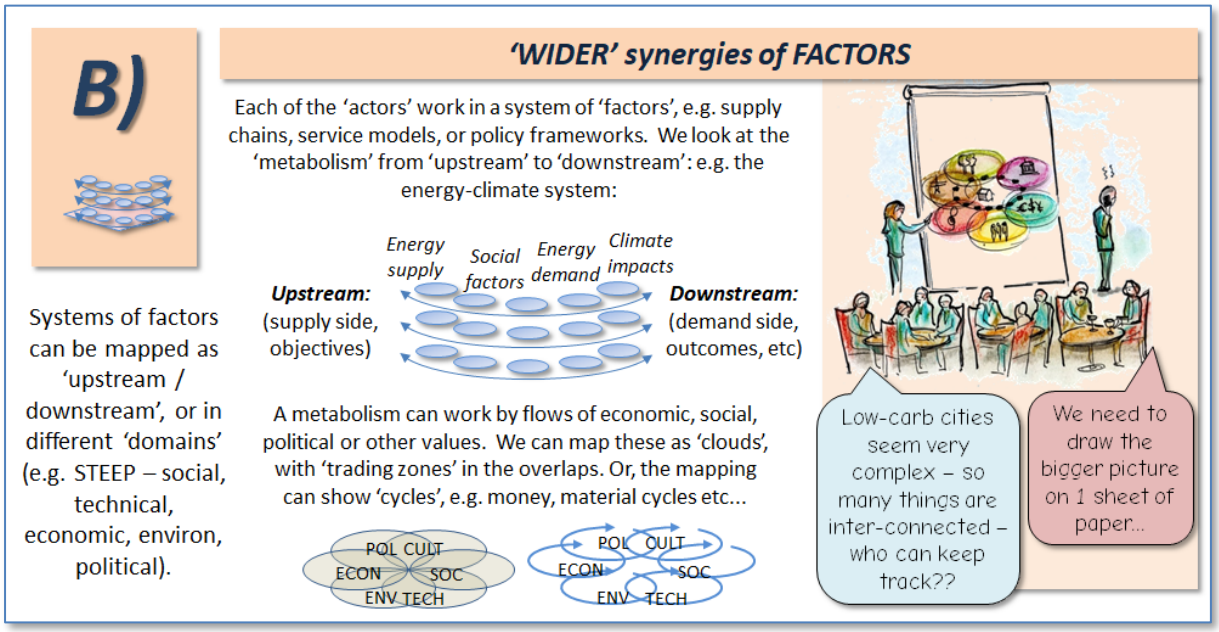
Step (B): Wider - Factors

As we explore the actors and their relations around the table, there are different things going on. For our Low-Carb city, there's a metabolism of energy, from primary supplies and conversion, to end uses and emissions. There's an economic-energy metabolism, from investment to infrastructure, to markets and consumers: and so on. These are all under the heading of 'factors' – meaning things, institutions, technologies which all interact (aka 'actants'). For each there's generally an upstream supply side and 'downstream' demand side or impacts, in a 'value-chain' metabolism. And for human systems there's always more than one level: we can map this with different domains, such as 'social, technical, economic, environmental, political, cultural' ('STEEPC' from the futurist toolkit).[1]

These layers can be customized to our problem, and drawn as bubbles, boxes, clouds or cycles. A 'cloud view' shows the overlaps between domains, and the overlaps or 'trading zones', e.g. ecological-economics. A 'cycle' view shows more of the 'activity cycle' or value-chain: the economic domain has a circular flow of money, or the environmental has a cycle of material flows. Within each domain there are hubs of activity, and peripheries of dependency and vulnerability. There are economic centres of wealth, political centres of power, or ecological keystone species.

Which factors and which domains to include, and how to arrange them? There's nothing fixed about the STEEPCU scheme shown here: the point is to select the most relevant domains for the problem, with a balance between detail and practicality.

> *For the Low-Carb housing agenda: we include 'upstream' factors such as energy supply and house design / construction: and 'downstream' factors of well-being or climate emissions. There's also an economic upstream-downstream, from investment to return: and a policy upstream-downstream, from objectives to outcomes....*



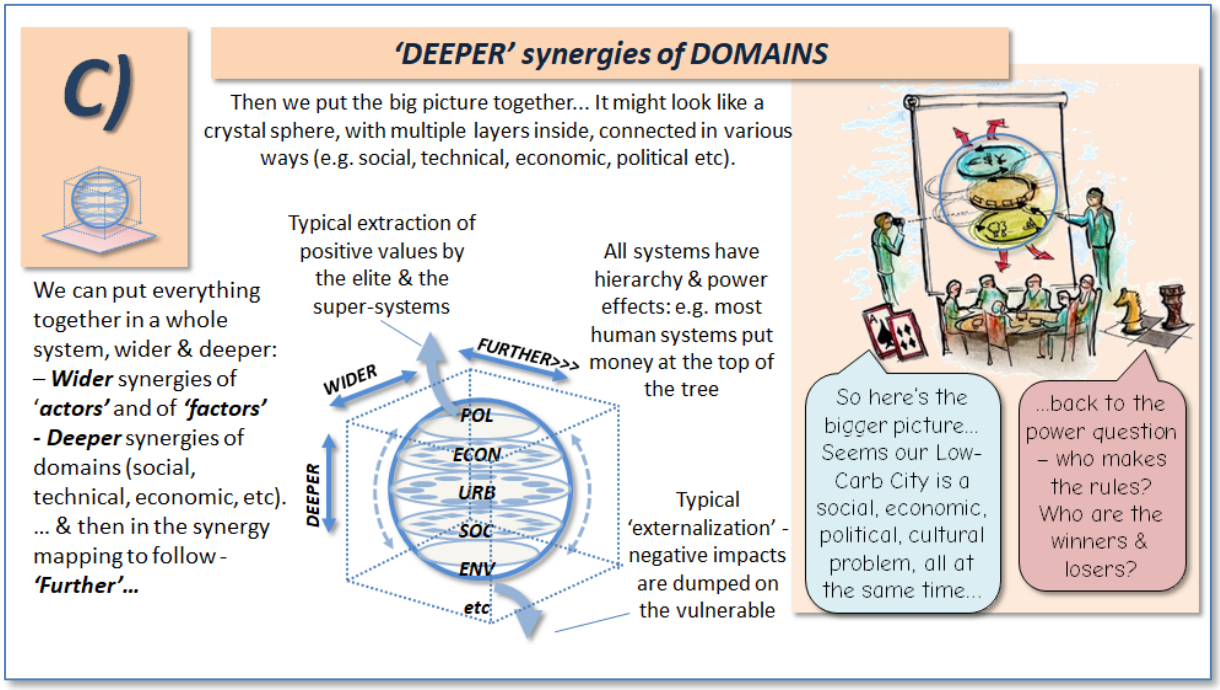
Step (C): Deeper - domains

Now we can put together the domains which are most relevant, and look for the whole system effects, with links and interactions between them. We can visualize them in the form of circular layers, stacked up inside a sphere, like a translucent ball used by jugglers. This is just an image, but it helps to think about the whole system, and the inter-connections between domains. It highlights the principles such as recirculation (as in circular economy) or resilience (as in climate adaptation).

The Deeper City can be visualized as a physical layer (streets and buildings): a physical-human layer, (interactions between people and buildings): and a human-human layer, of conscious learning and thinking. Similar ideas come from 'causal layer analysis',[2] with surface level, structural, and mythic levels. The interaction between layers or domains comes up in the idea of a 'nexus' , a hub of connections, e.g. a 'food-energy-water' nexus. If we look not just at tangibles, but the cognitive-conscious level, then we talk about a ***'connexus'*** or 'cognitive nexus'.

For the whole *connexus*, there is also a whole metabolism. There are hierarchy effects, where one domain controls or dominates others: for instance, finance tends to dominate ecosystems (until the next natural disaster. There is extraction of value by the elite, as shown at the top of the *connexus*. There is 'externalization' or dumping of negative impacts, shown at the bottom. The *connexus* needs to be opened and unpacked, as if opening a drawer full of maps. These images are just metaphors, but seem to be useful in exploring human systems.

> *In Low-Carb housing, there's a technical domain of energy physics: an economic domain of markets and investments: a social domain of behaviour and welfare, and so on. At present, there are huge negatives: energy systems cause climate change, and market systems produce energy poverty. To change this, look for 'wider' synergies between all actors: 'deeper' synergies e.g. energy-ecology-social: and 'further' to the next steps....*



#2: WHAT'S THE FUTURE? CHANGE MAPPING

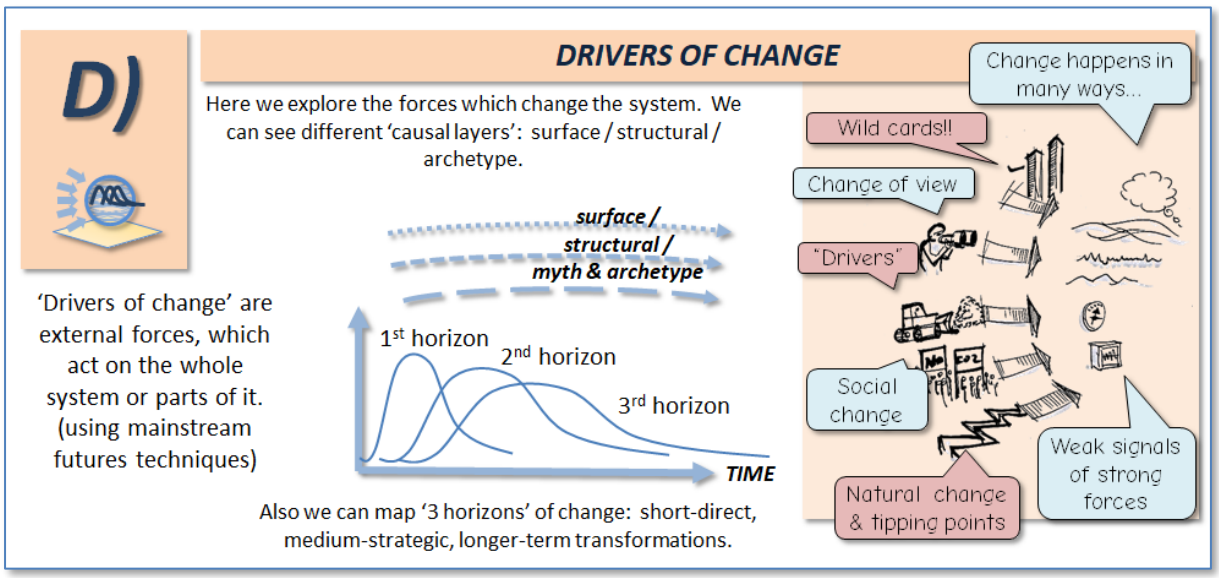
Change mapping centres on **'divergent'** thinking, which spins off in different directions, some creative and some destructive: 'what-if' questions are the ones to raise.

Step (D): Drivers of change

Futures thinkers often start with the 'drivers of change', including external forces, internal forces, and compound effects from a complex inter-connected system. The crystal mind-ball on the left is like a prism which refracts the changes onto '3 horizons'.[3] Horizon 1 is for shorter term tangible effects: Horizon 2 is about medium term strategic thinking: and Horizon 3 is about wider transformations (similar but not the same as the 1-2-3.0 model of co-evolution).

A conventional futures method would arrange the long list of drivers into simple categories of 'probability' and 'impact'. In contrast a synergistic approach looks for more inter-connected system-wide perspectives, as the picture on the right: wild cards, changes of thinking, intentional social change, unplanned natural change, all seem to overlap and intersect.

> *For Low-Carb housing: population change & economic growth are obvious drivers of change. So are changes in domestic technology and social technology: with effects on lifestyles, mobilities, housing tenures, housing finance etc. Meanwhile don't forget the 'archetypes'... a house is a mythic object, but not as we knew it...*

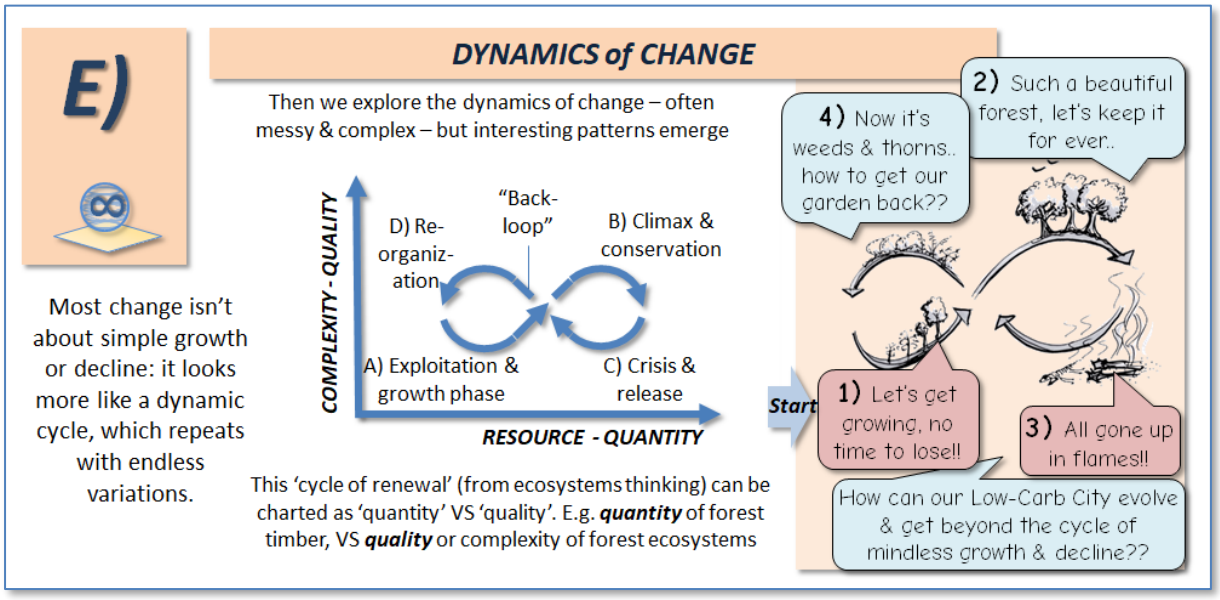


Step (E): Dynamics of change

System change is not always about growth, but is often more about cycles. Here we draw on the idea of adaptive renewal or 'panarchy' in ecological systems and modelling.[4] A typical 'phase-space' diagram shows a "Y-axis" of system potential / quantity (biomass, carbon etc): and an "X-axis" of system complexity / quality. The typical cycle starts with a phase of growth and exploitation, where both quantity and quality increase, heading towards a 'climax' condition. Sooner or later there is a crisis such as a forest fire or flood: there follows a 'back-loop' of re-organization, where a different system is reconstructed: eventually this sets the conditions for a new cycle of exploitation. This concept from ecological systems can be very useful for other domains: cities, economies, technologies and so on.

This gets more involved with multiple-layer systems such as cities. It's more likely that different domains – social, technical, economic and so on – may be at different points on the dynamic cycle. There are interesting lessons for practice: urban planning for instance, tends to focus just on the growth phase, and hasn't often got the capacity or mindset to manage the whole cycle. We can also can look for multiple cycle effects: Manchester's post-industrial split economy, has a city-centre strand in a growth phase while peripheral areas are in a regrouping phase, while local governance is in a financial crisis and political opportunity.[5]

> *Low-Carb housing could be interesting – we could build a load of houses to meet demand, and the right people could come to live in them – then something happens, like a financial crisis and industrial shrinkage – our houses are empty and derelict – then the gentrifiers move in, but now with a rising market the locals can't afford to live in 'their' town...*

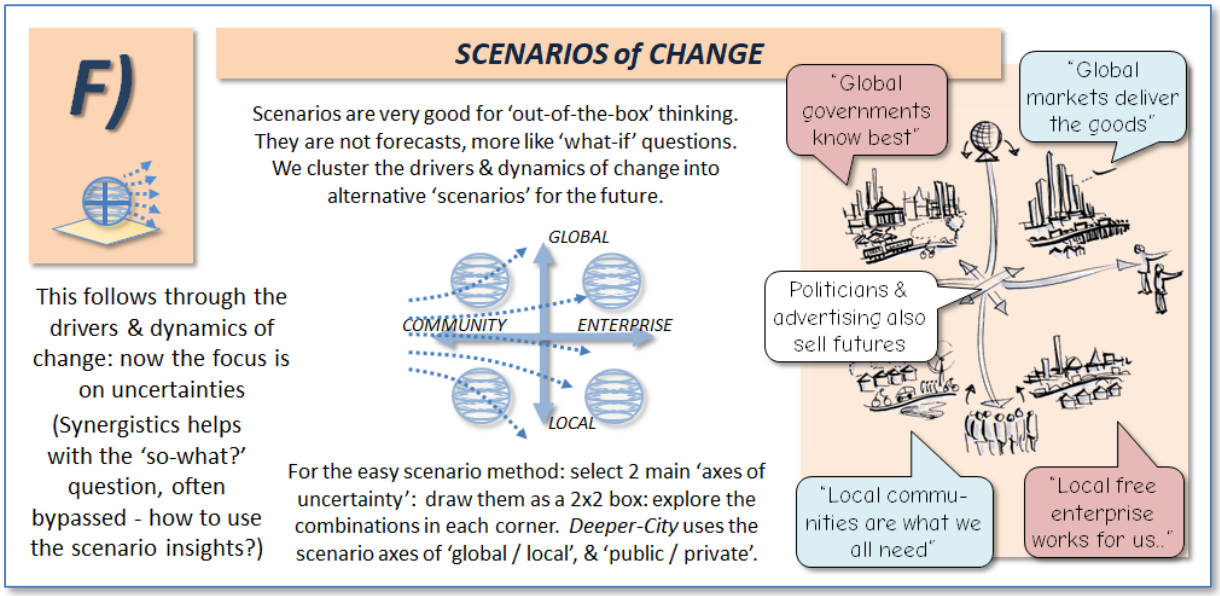


Step (F): Scenarios for change

Here are the drivers of change, again with external and internal, this time with uncertainties all around. The uncertainties of the drivers lead to many more uncertainties on their impacts. To make sense, we can cluster both drivers and impacts into alternative 'scenarios'. Scenarios aren't forecasts, more like a series of 'what-if' questions, structured in a way that is useful for following up. The scenario axes shown here are used through the pathways book, i.e. 'global-local' and 'public-private'. These originated with the IPCC 'SRES' scenarios in 2001, and used in many projects since. Many other combinations are possible, but these represent a good starting point to explore alternative social, technical, economic and political futures.[6]

A forward-looking scenario method is highlighted by experiences of scenario workshops. Often there are great aspirations for a Low-Carb city or similar visions and goals, but huge gaps between aspiration and reality. The synergistic approach can help with the next question - 'so-what' – how to use the scenarios to link present and future in a practical way. To do this we bring in the next stage of Synergy Mapping. Then we can compare, a linear growth-type scenario, with a 'co-evolutionary' scenario, where change comes with synergistic collective intelligence.

> *Low-Carb housing has many possibilities: a higher level public sector could organize everything – or maybe the global corporate will own all housing assets and lease them to us? There are alternatives – local private firms could build, sell or rent our houses: or indeed, local mutual societies, cooperatives or savings institutions could do this (as the 19th century)*



#3: WHAT'S POSSIBLE?? SYNERGY MAPPING

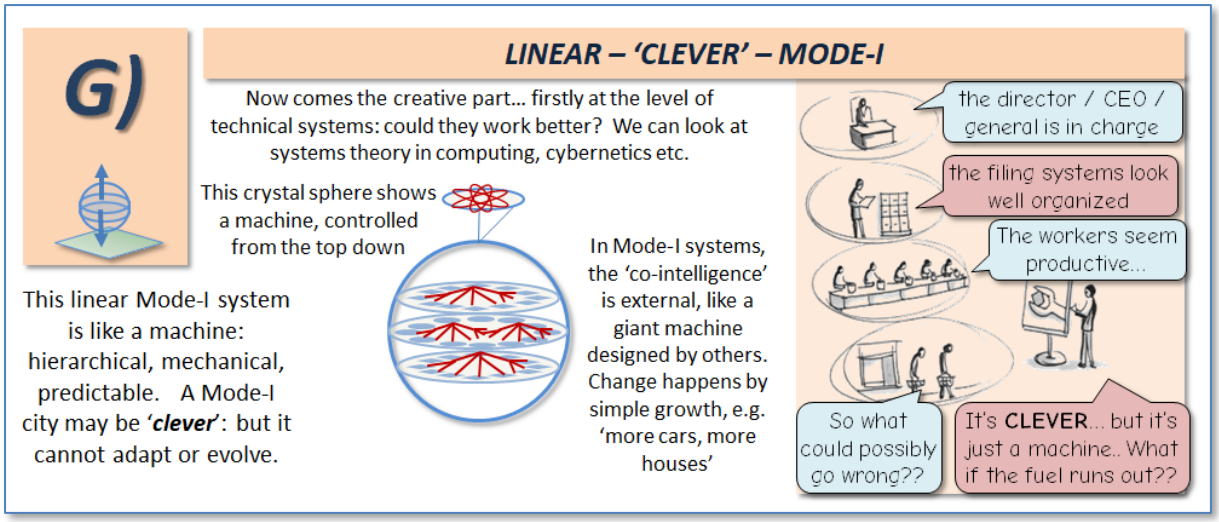
With a range of possible futures on the table, positive and negative, it's time for 'emergent' thinking. This stage is like a crucible or laboratory, a space where new ideas can emerge.

The next three pictures show three *connexus* spheres: moving from mechanical ***'clever'*** systems, towards more complex ***'smart'*** systems such as markets: and then to ***'wise'*** systems of collective intelligence. Mode-III doesn't replace the others – rather, each has its role and works in parallel. Our Low-Carb City needs a good Mode-I energy system for basic supply: Mode-II markets to allocate resources and incentives: and Mode-III systems for social equity and sustainability.

Step (G): Linear – 'Clever' – Mode-I

Here we track 'functional systems'. These respond to direct short term change, like a complex but single purpose machine. While there might be growth, the structure of the machine is stable, and our cognitive understanding of the machine is also stable. In our Low-Carb city, the vehicle engines are (hopefully) clever at transforming fuel into motion, but the engines can't transform or evolve into anything different. The *connexus* sphere shows the guiding intelligence outside of the system: i.e. the thinking of the designers or entrepreneurs is outside of the products and assembly lines. Likewise, the negative impacts of congestion or emissions are external to the technology: the engine itself doesn't care about its impacts (but its designers should).[7]

> *For the Low-Carb housing problem: we just need 500 or 50000 or 5 million houses ('dwellings') to meet our population projections. So we arrange a good supply of land and permissions, concrete and steel, construction workers etc. What could possibly go wrong??*



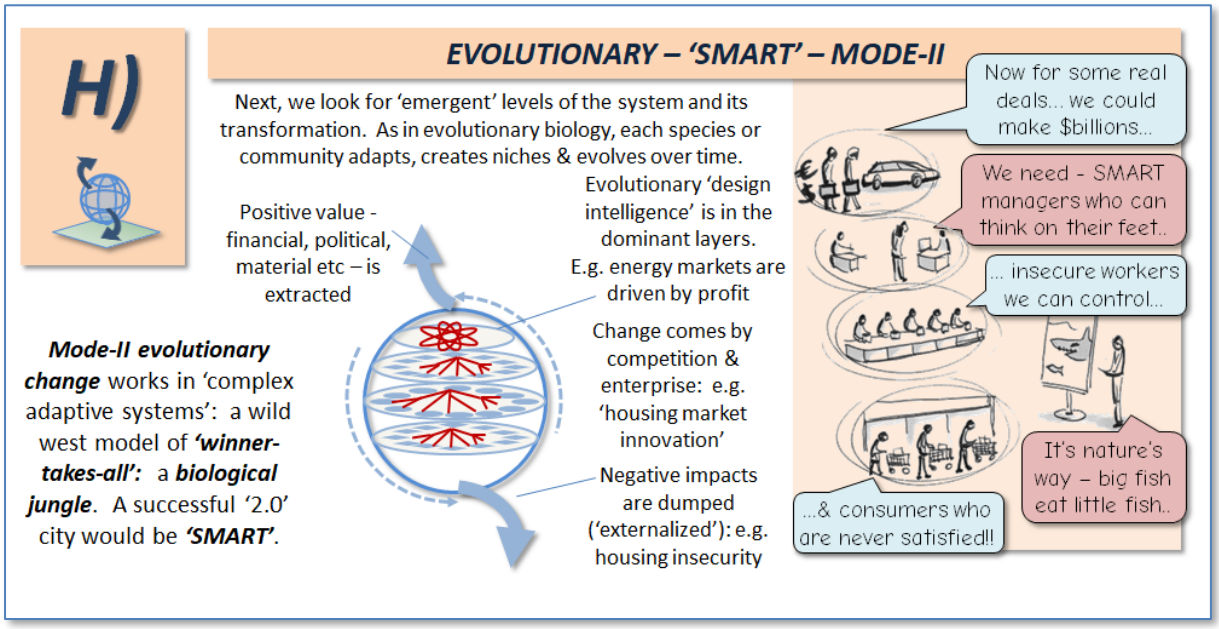
Step (H): Evolutionary – 'Smart' – Mode-II

This sees many natural and human activities as 'complex adaptive systems', with a biological image of jungle or wilderness. A complex adaptive system creates niches, habitats and symbiotic relations, in which species can evolve over time. In the human sphere this kind of system applies to markets or innovations which are driven by a 'winner-takes-all' motive of extraction and dominance.

For our Low-Carb city, a 'smart' urban transport system might be complex and adaptive, evolving new markets and product combinations. However it would also tend to extract financial profit or political values, and dump the social impacts on others. The cartoon shows how the 'intelligence' functions of inter-connected learning and thinking are clustered in a few elite pockets, while workers and customers are maintained as commodities for exploitation.

Within this simplistic picture there are many nuances. Socio-biology, for instance, shows how all ecosystems and communities involve cooperation, symbiosis, even altruism.[8] In human organizations, even the most rapacious firms or mafia gangs need internal cooperation and social norms. So we have to be careful to look for the most relevant unit of analysis. Our Low-Carb city would look at the relations of stronger actors such as government, finance, utilities, property and construction, where the profit or power motives might be uppermost. The role of other actors such as education, arts and sports, or just plain residents, might be up for debate.

> *For Low-Carb housing, a Mode-I system may not work: landowners will hoard their land, builders will cut corners, residents will divert the funding... So - we need incentives such as rising markets, energy innovation, finance products.... If some people can't keep warm that's not our problem...*

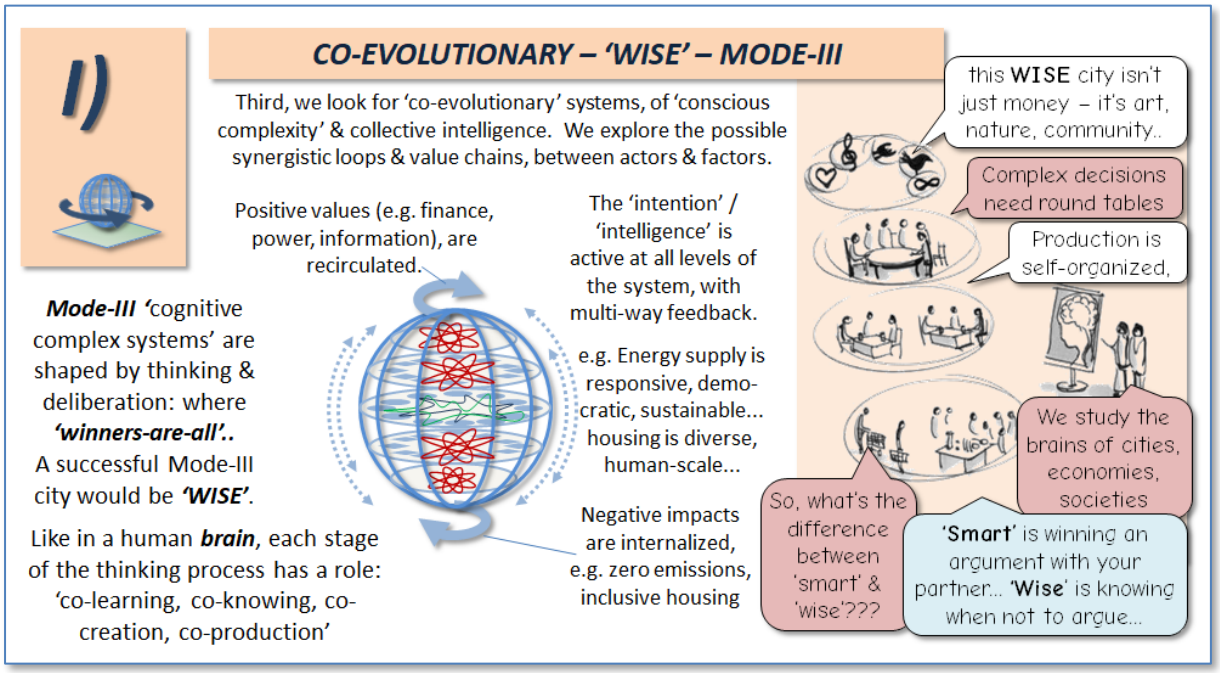


Step (I): Co-evolutionary – 'Wise – Mode-III

This is the core of the synergistic toolkit. Here we explore the human qualities of thinking, learning, designing, questioning, intention, self-awareness and collective intelligence (however that is defined). The image is that of a *human psyche or human community*. The system architecture is more like a human brain than mechanical computer: it shows multiple feedbacks and inter-connections, flexible self-organization and 'neuroplasticity', parallel processing, higher order cognition and reflexive consciousness. There's a huge debate on intelligence, what it is and how it works. In the Technologies pathways of *Deeper-City* we look at 'CHAI' or 'Collective Human-Artificial Intelligence': and in the Insights we look at various combinations of shared or distributed mind.

'Collective intelligence' may never be fully defined, but we can track technical intelligence, emotional or cultural intelligence. Or we can look at cognitive-collaborative processes, with the 'co-' word, as in 'co-learning, co-knowing, co-creation, co-production'. Or we can take a synergistic design approach, working with stakeholders on co-learning for potential for synergies and value-loops around the table, the co-creation of new synergies, and co-production of pathways. As a successful round table generates synergies, and as multiple synergies add up to a whole greater than the parts, the effect can be really transformative. In our Low-Carb City we can shift the problem definition and the solution space, from '500 houses', towards growing 'liveable communities'.

> *Low-Carb housing, (as part of a Low-Carb city-region), is about liveable communities, micro-economies, social enterprises, neighbourhood cohesion etc. Housing designs and tenures and finance packages could be more diverse, flexible, responsive and adaptable. For 'wise' Housing-III we look at the collective intelligence of design, policies, and markets.*



#4: WHAT'S TO BE DONE?? PATHWAY MAPPING

The fourth stage is 'convergent thinking', where future potentials are linked to present actions.

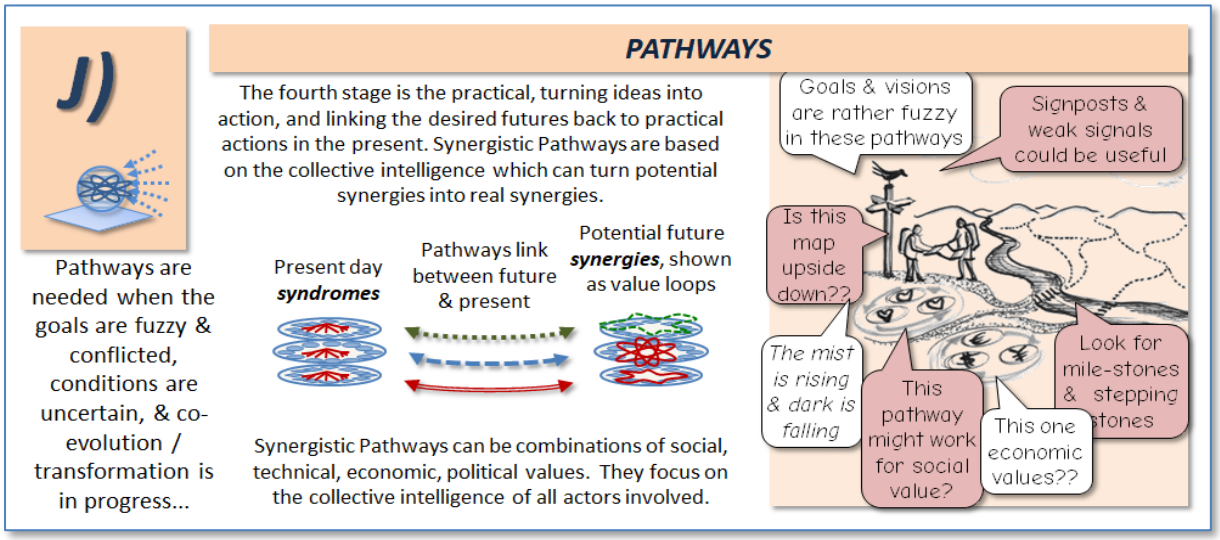
Step (J): Pathway-mapping

A Synergistic Pathway is a kind of mental journey, which turns the potential synergies, from the previous 3 steps, towards realities. Such pathways often cross an uncertain landscape, with fuzzy destinations, conflict among travellers, and a lack of maps to follow. There are different levels:

- Mode-I pathways are often focused on functional or technical modelling: the Low-Carb City would use energy analysis, extended to economic or policy issues.
- Mode-II 'smart' transition pathways are more about evolution, innovation, incentives and competition: the Low-Carb City could use evolutionary economics.
- Mode-III 'synergistic' pathways explore the potential for social learning, co-creation, co-production, and the overall collective intelligence: the Low-Carb City would explore the potential for co-learning and co-creation for urban transformation.

Synergistic pathways, can be focused on actors, or factors. They can be focused on combinations of domains: a Low-Carb city driven by social valuation / ecological ethics. The *Deeper-City* book shows many different types as examples of what can be useful. Synergistic pathways adapt to uncertainties or risks across the STEEP range (social, technical, economic, political): they also respond to negative forces, such as corruption, alienation, hierarchy and others. For guidance we look for stepping stones, milestones, or signposts. Overall, a synergistic pathway is about the practicals of transformation, from 'syndromes' to 'synergies', and so is adaptable, improvised, collaborative, self-organizing and self-questioning.

> *For Low-Carb city: a social innovation pathway would look for community re-investment in greenspace & neighbourhood facilities. A financial pathway looks for financial innovation, social crowd-funding & inter-generational collateral. And so on…*

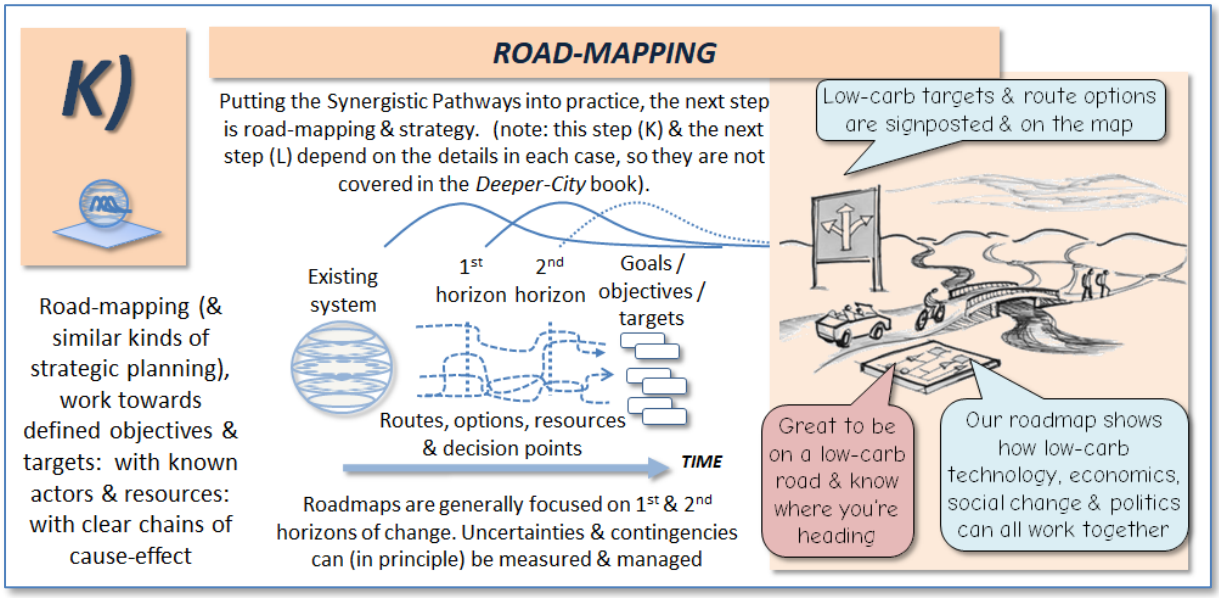


Step (K): Road-mapping

Road-mapping follows, along with similar forms of strategic planning. A road-map generally works with more clear objectives and targets, more definition of actors and resources, and more specific ways to mobilize them. While 'pathways' generally point towards a 3rd horizon of change, road-maps are more focused on the 1st and 2nd horizon. There may be uncertainties and contingencies to be resolved, but at least (in the jargon) these are 'known unknowns'.

The wider uncertainties don't come into road-maps too much, neither the darker factors of corruption or alienation. This highlights the contribution of synergistic thinking. The Mode-II and Mode-II forms of road-mapping are about tangible targets and actions, but they could fall down at the first unforeseen human factor or wild card. In contrast, a synergistic Mode-III type road-mapping focuses on these human factors of co-learning, co-creation and collective intelligence. It includes for corruption and alienation and the processes, better suited to bridging the aspiration-reality gap.

> *For the Low-Carb housing agenda: we need a detailed road-mapping with energy / emissions modelling: demographic or economic projections: and retrofit / construction schedules. A synergistic mode-III roadmap then shifts towards reality checks, e.g. fragmentation of housing stock, alienation of residents, or inertia of construction, and looks for responses*

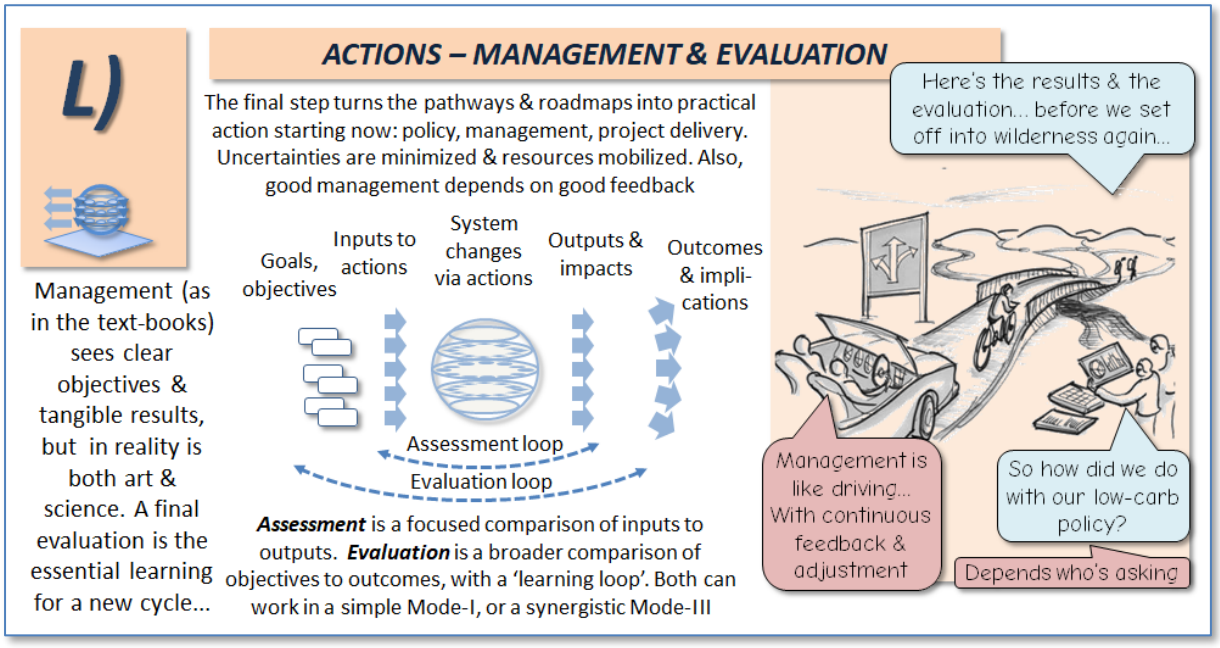


Step (L): Management & Evaluation

Finally we get to the stage of policies, projects, decision-making and management. These are covered by countless business and management text-books, mainly with a linear mode-I 'logical framework' in mind. This generally assumes that we 'pull a lever', that objectives are clear, inputs and outputs are known, and outcomes can be measured. Policy and management is then about 'cybernetic' monitoring and adjustment: and the assessment and evaluation loops also assume a machine which is well-oiled. The Mode-II evolutionary approach is more focused on competition, innovation, entrepreneurs and incentives: smart psychology or behavioural economics are useful here, e.g. as in 'nudge theory'.

In contrast a Mode-III co-evolutionary policy and management is more about co-learning and co-production, between policy-makers / managers, workers / suppliers, and stakeholders / users. A Mode-III business model and management style is more about relationships and communities, upstream and downstream. Likewise, Mode-III assessment and evaluation are not just about functional cause-effect – more about synergistic opportunities and transformation effects.

> *For the Low-Carb housing: to upgrade 1 million dwellings, we need Mode-I type construction schedules and skills profiles. We also need Mode-II type finance packages, procurement platforms and innovation competitions. We also need Mode-III actions, such as community energy companies, neighbourhood mentors, climate learning schemes and social co-production in public health or social enterprise.*



12-step summary

Here's a summary of the whole Toolkit cycle, with 4 stages and 12 steps: (a summary table with worked example is at the end).

1) System Mapping looks at the baseline, the problems, issues or challenges on the table. This involves collaborative learning - ('co-learning') - with *'relational thinking'* on whole systems, which are more than the sum of parts:

a) ***'Actor' mapping:*** explore the problem / system, and the relations of the actors.
b) ***'Factor' mapping***: Explore how the system works, with a metabolism of cause & effect
c) ***'Domain' mapping***: Explore deeper links between domains in a multi-level system.

2) Change mapping looks at the processes of change: the drivers, dynamics and uncertainties. This involves *'divergent thinking'* on the boundaries or knowns / unknowns.

d) **Drivers of change**: look for forces of change, both external and internal.
e) **Dynamics of change**: define the most significant dynamic cycle effects.
f) **Scenarios of change**: explore alternative futures with structured 'what-if' questions.

3) With possible futures on the table, it's time for *'emergent thinking'*. This stage is a crucible, a space where new ideas, synergies, visions, value-chains can emerge.

g) **Linear – Clever - Mode-I**: map the system qualities which are linear and mono-functional
h) **Evolutionary – Smart - Mode-II**: map the qualities which are evolutionary.
i) **Co-evolutionary model – Wise – Mode-III:** qualities which are synergistic and based on collective intelligence.

4) Pathway Mapping looks at the practicalities, with *'convergent thinking'*, where future potentials are linked to present actions.

j) **Pathway mapping**: look for ways to link present 'syndromes' to future 'synergies'.
k) **Road-mapping**: look for synergistic links between objectives, resources, actions, enablers.
l) **Action & evaluation**: look for synergistic contribution to policy & project management.

DEEPER-MIND-LAB / COLLABORIUM

Synergistic thinking helps with complex inter-connected problems and opportunities. Then come the practical questions for the outside world. 'Who' can use all this, and 'why' would they want to? 'Where' are the best kind of spaces, and 'how' to use the methods and tools? 'How much' money or human resource is needed, and 'what' applications or benefits can we expect? And so on.

And the setting for all this experimentation – we call this a ***Synergistic Mind-Lab,*** or ***Collaborium*** – a 'collaboration laboratory'. A *Collaborium* at the city level can bring together many actors to work on complex challenges, and there are many varieties of 'city-labs' around the world. Technology *collaboriums* can be seen here and there, in the shape of foresight or road-mapping or 'outlooks'. Conflict mediation or reconciliations also share some of these features: policy think-tanks, scientific symposia, organization away-days, each try to capture some of the synergistic potential. But often they fall short. Often, power structures and conflicts continue, vested interests dominate, people stay in their silos and comfort zones, deliberation turns into 'performance', key people are missing, time is too short and the underlying challenges are too difficult….

So the *Synergistic Mind-Lab / Collaborium*, is a general model, for many applications in cities, economies, ecologies, technologies or politics. Results are not guaranteed, just as in other laboratories. And the model constantly evolves, with new technologies, political ideas, cultural actions and social innovation. Can the *Mind-Lab / Collaborium* model scale from local to global, in time to respond to a world tearing itself apart?? Good question….

Components of the Deeper-Mind-Lab / Collaborium

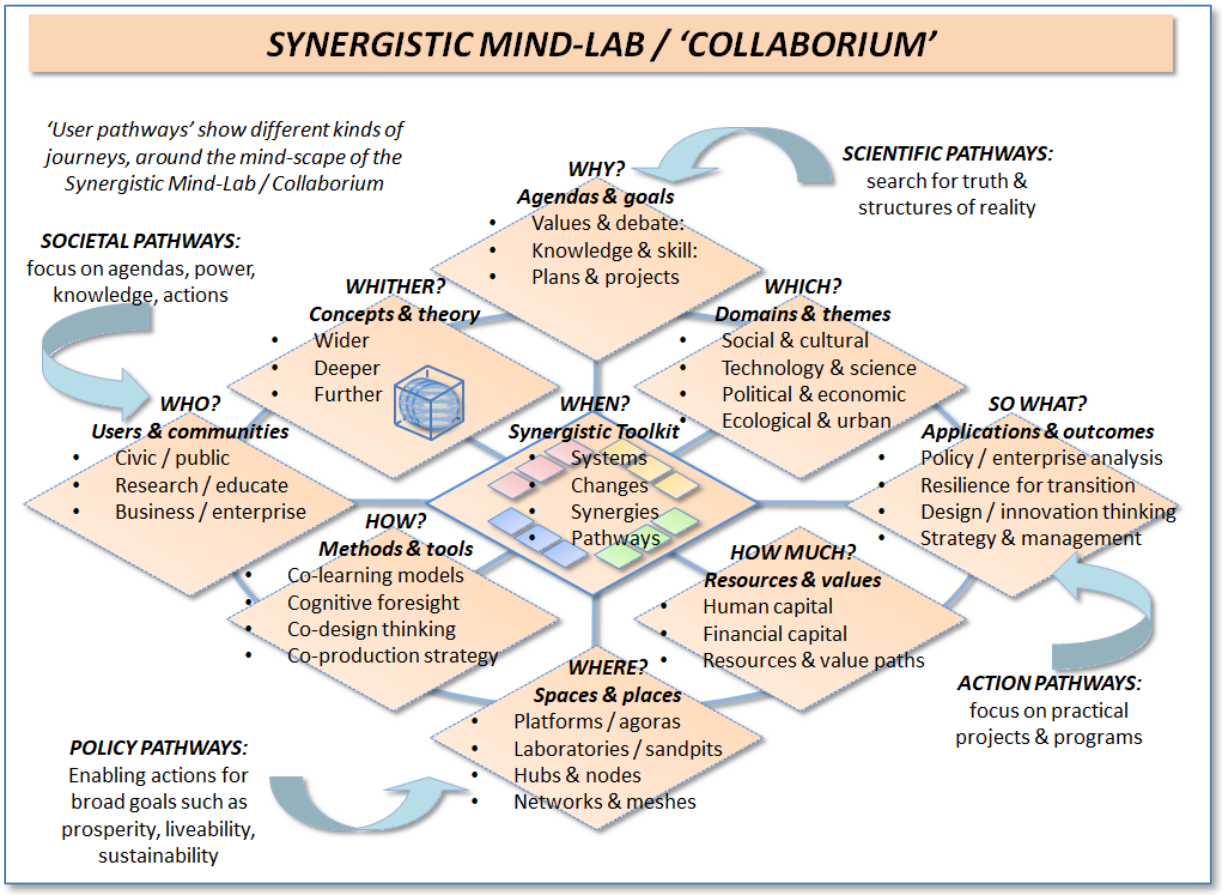
The Collaborium is basically all of the context which surrounds the Toolkit: users, uses, resources, methods, spaces, applications, and so on. Just nine questions cover this, shown in the picture below of the ***MIND-LAB & COLLABORIUM***. The first three are already covered:

- ***When*** to do what in the process? (this is the 'toolkit', shown in the centre of the diagram).
- ***"Whither"*** comes the theory? (this is the synergistic framework of 'deeper, wider, further').
- ***Which*** are the key themes? (Social, technical, economic, political, and other domains).

And the remainder are more about how the *Collaborium* works:

- ***How*** to use the methods & tools? (network mapping, visual thinking, matrix analysis, etc).
- ***Where*** are the best places for this? (incubators, forums, agoras, round tables, etc).
- ***How much*** in resources is needed (finance, human, knowledge)
- ***What*** kind of applications are most useful? (evaluation, foresight, etc).
- ***Who*** are the users and organizations or communities for this, and ***Why*** are they involved? (Visions, agendas, practical needs).

The arrows at each corner of the graphic below show the general direction of different pathways through the *Collaborium*. We could start with the 'users': or the 'agendas'. We could focus on the enabling 'spaces': or work back from the end-applications (evaluation, foresight, business analysis and so on).



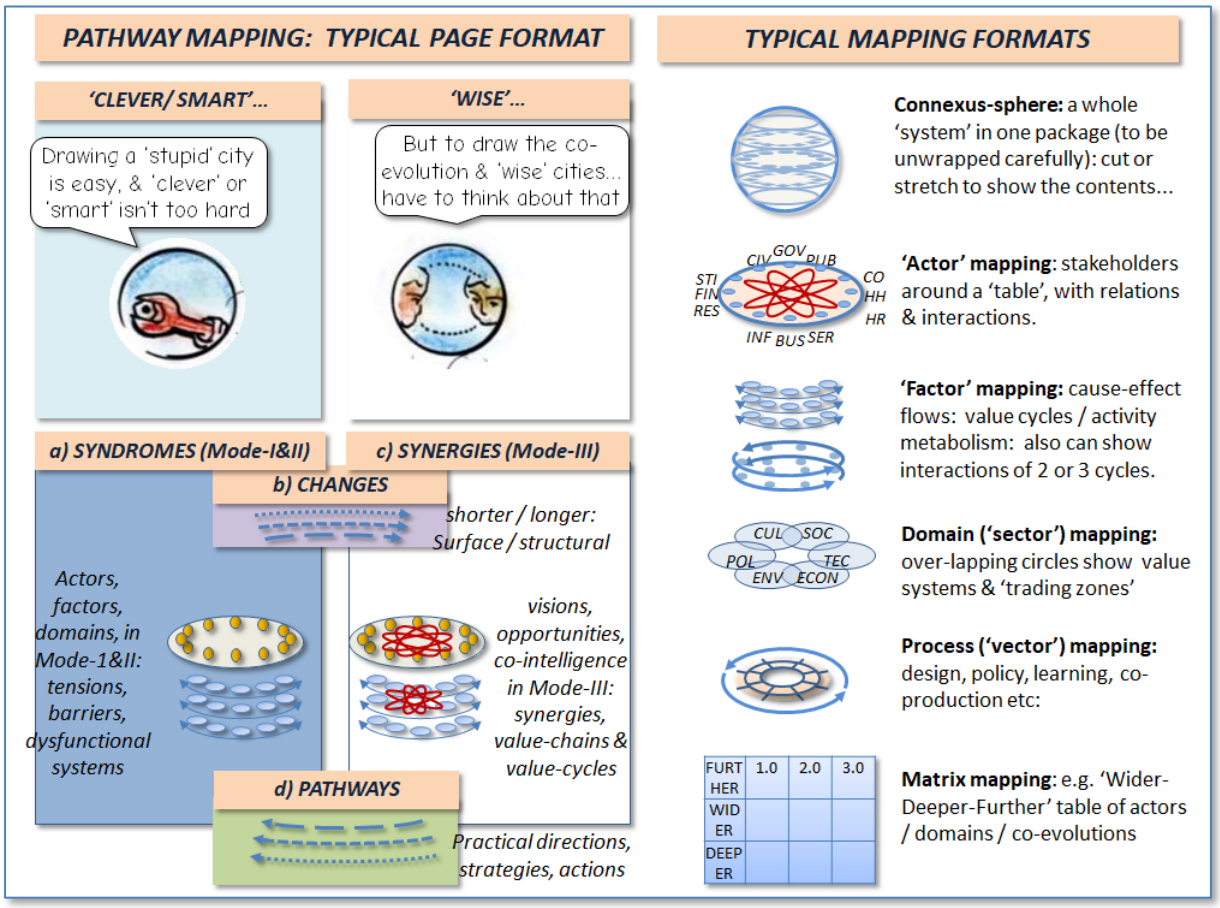
How to use the tools?

Summary page format:

if our Low-Carb city needs different kinds of mappings for every angle of large complex systems, some kind of structure is needed. *Deeper-City*, after much trial and error, developed a full page format, with variations for each of the main Pathway Mappings:

- On the left side of each page, the Mode-I / Mode-II 'linear / evolutionary' models; (these are usually shown together to save space, but sometimes separately);
- On the right, the transition towards Mode-III co-evolutionary and synergistic systems;
- The upper half of each page shows mainly images, for more 'right brain' visual thinking;
- The lower half shows the analytic mappings / diagrams, for more 'left brain' visual thinking.

The lower half is a condensed version of the larger Synergistic Toolkit cycle. On the left are current 'syndromes' (Mode-I and II), and on the right the potential 'synergies' (Mode-III). The pathway mapping in the lower centre then shows the main pathways (social, technical, economic etc), towards this potential.



Mapping components

The basics can be sketched on a flipchart or a napkin, and indeed this is how the method began to emerge. At the other extreme, a full enquiry on a Low-Carb city could produce 5 full size mappings for each of 12 steps. Each step can use different channels and formats: 'soft' mappings and 'hard' wiring diagrams, visual images, matrix tables, or just text.

On the right of the picture is a small catalogue of the most common synergistic mapping formats. Some people seem surprised that there isn't a simple 'answer' for huge complex societal challenges…. All we can say is, each of these formats seems useful for some problems, in some stages of the process. At the top is the translucent *connexus* sphere, a nice image, but to see its layers clearly we have to unwrap it carefully.

On the lower right of this picture is a matrix format. While a relational mapping is good for whole-system qualities, the same information in a matrix format can work better for certain kinds of detail. So we experimented with a simple matrix in the shape of a 3x3 square. To fill this, we first do 'emergent' thinking, and put the Mode-I, II, III steps into columns. Then, we do 'relational' thinking,

with various layers in rows. This starts with the ***'actors',*** i.e. stakeholders or organizations: there follow the ***'domains'*** (a.k.a. 'vectors') of social, technical, economic, ecological or political ways of thinking and generating value. Then come the ***'factors'***, institutions / systems and their components: for a Low-Carb city, energy supply, construction, transport, landuse, housing, demographics and so on, each with its own logic. The result is a basic 3x3 template, where each row can be expandable to almost any kind of problem. An example of a full-scale desk study using the matrix format is the UK Foresight Future of Cities Report on Urban Ecosystems.[9] Here the example is the City-III summary table: -

C) FURTHER>>>	***Mode-I: Linear***	***Mode-II: Evolutionary***	***Mode-III: Co-evolutionary***
	'CLEVER': (complex)	***'SMART': (emergent complexity)***	***'WISE': (cognitive complexity)***
A) 'WIDER': (actors/factors			
Housing / neighbourhood	Housing as units	Housing as markets	Housing as communities
Spatial / transport	Transport as trips	Transport as networks	Transport as accessibility
Industrial / commercial	Industrial units	Industrial systems	Industry in co-evolution
Urban dynamic	Linear urban expansion	adaptive growth & rural-urban links	Community enterprise & cohesion??
Urban Policy	Simple regulation, e.g. green belt	Market-based incentives e.g. ecosystem services	Co-learning & co-creation: e.g. 'eco-belt'
B) DEEPER: (domains)			
Social	Social units	Social networks	Social intelligence
Technical	Mono-functional	Multi-functional	Integrated systems
Economic	Industrial production	Extractive capital	Holistic livelihoods
Environment	Green-space area	Green-space functions	Green-space in society
Political	Institutional structures	Power games & processes	Political intelligence
Cultural	Cultural niches	Cultural markets	Cultural civilizations
Spatial	City as machine	City as jungle	City as multi-versity
D) SYSTEM LEVEL:	*functional-mechanical?*	*entrepreneurial-biological?*	*cognitive-human?*
Structural layers / archetypes / myths	*Economic & population & space growth*	*Capitalist evolution & Suburban aspiration*	*System transformation & 'Quality of life'*

Visual thinking:

Here and there is a 'visual activist' drawing on a flip chart, looking beyond the technical-rational left-brain, towards other kinds of experience.[10] Visual thinking is not the only way, for instance video or role-play can be better, but visuals are cheap, quick and fit easily with text. As for mapping – even a rough map in a large city is more useful than a long list of directions. Such mappings aren't 'solutions' or 'theories', any more than a map of London is a solution or theory of London. But a good mapping sets up a visual dialogue with users, and helps to move forward in collaborative thinking. A modern city depends on spatial maps – and co-evolution of human systems depends on another kind of mappings.

Existing tools & software

There's a large portfolio of techniques in systems thinking and strategic management. Synergistics brings together Soft Systems Methodology for more fuzzy issues, the Viable Systems Model for

organizational problems, and systems dynamics modelling where the parameters and links are measurable. For the Change Mapping there's a range of futures and foresight tools, such as horizon scanning, Causal Layer Analysis, scenario planning, success scenarios, wild card / weak signal analysis, cross-impact or morphological analysis, Delphi rounds and expert elicitation.[11] For Synergy Mapping there are many kinds of design thinking, 'sandpits, 'unconferences' and other brainstorming. For a digital / AI track, a whole new field of possibilities in genetic algorithms, neural networks and big data analysis. For the Pathway Mapping stage there are techniques of road-mapping and strategic planning with complexity and uncertainty.[12]

In each of these we look for tools best suited to the 'wider-deeper-further' scope of synergistics. Such tools include for the interconnections of actors and factors: for deeper values and worldviews: and for the longer horizons of co-evolution. Experience suggests to keep it simple as far as possible. The 40 Pathway Mappings in this book use mainly intuitive low-tech mapping guides, matrix templates, and process templates, in more or less detail.

As to software, many have tried and few last long while new possibilities arrive every day. 'Futurescaper' enables horizon-scanning and sense-making from large datasets arranged in 'stories': 'Metro-Quest' links online participation with visualizations and a systems model. The Greater Manchester 'Mini-Lab' prototype uses the 'Litemap.net' online mapping platform. Social Network Analysis holds great promise, but its specific logic points away from the wider-deeper scope of synergistics. It seems so far that technology tends to shortcut more fuzzy qualitative human kinds of thinking, so at the moment, it seems more effective to use low-tech tools.

'Where' to do this?

Civilization (the word shares its roots with 'city' and 'civic') has physical 'spaces and places' at its centre. There is the marketplace, agora, chamber or forum: essential for an open society, but also easily captured by dictators or demagogues. The same applies to virtual-digital spaces, with new wiki-nomic and open-source technologies, but these may be even more open to misuse and abuse.[13] For both sides there's a principle of 'round tables', 'platforms', 'observatories': the famous 'outlook tower' in Edinburgh took this to the logical extreme. The point is how best to enable the inter-connections of creative strands – social innovation, experimentation, prototyping, visioning, evaluation, change management, action learning, design thinking and so on. Spaces, whether physical, virtual or social, can help or hinder. (Full disclosure: as a space activist I go around the world's meeting rooms, converting straight rows of chairs (suitable for Mode-I thinking) into circles and networks (for synergistic Mode-III thinking).

'What' applications?

In many walks of life, yesterday's linear thinking isn't enough, for the inter-connected challenges of today and tomorrow. For instance, it's now accepted that flood resilience needs not only 'hard' concrete walls, but 'soft' social inter-connections, (which can be tricky for engineers in charge). The point is that 'resilience' can be framed as a mode-I mechanical problem and solution, as a mode-II evolutionary, or mode-III co-evolutionary. And Resilience-III thinking works in parallel with Foresight-III, Evaluation-III and other parallel applications:

- Risk and resilience assessment: not only 'hard' but 'soft' human factors;
- Foresight and future-proofing: linking reality with aspirations for real change;
- Valuation and evaluation: measuring real qualities beyond a mono-functional 'utility';
- Social learning and intelligence: thinking and sense-making for bigger pictures;
- Policy / enterprise analysis / design: understanding what's going on and improving it;
- Innovation and transition: managing structural change and transformation;
- Strategy and management: leadership and operations for complex challenges.

'Who' are the users and 'why'?

The most important questions are who would be the users of the Synergistic Toolkit and participants in the Mind-Lab, and why would they want to? The Mind-Lab picture above shows societal users with deliberation: policy users aiming to enable: scientific users in search of knowledge: and action users who make things happen. In practice these user types and knowledge types are quite inter-connected. A major challenge – such as the Low-Carb-City – calls for public debate on the scope of the problem: scientific research and evidence: and action-focused policy or business know-how. There are many ways to bring these different knowledges together...

Societal user pathways

'Societal users' are actively involved in the shaping of society, now and in the future. For citizens, households, communities, networks or organizations, the most useful knowledge comes firstly through human interaction, with the archetypal round tables of enquiry and deliberation. In the digital age there is now a parallel track, online and off-line, virtual and distributed. Such debate generally starts and finishes with the people, the 'actors'. Here we start a session by going around the table, asking who is (connected to whom, and then, who is NOT connected to whom? and if possible, putting the results directly on a large whiteboard). Following this through gets into multiple layers. Are these relationships economic, political, cultural, or some combination? Which is about the present and which is the future? It seems every human problem is full of dilemmas and contradictions, which test the skills of facilitators to keep on track.

At the heart of such human interactions is the co-creation and 'synergy mapping', where human potential can be mobilized, where the sum is greater than the parts. Many similar versions have worked in different times and places, such as the *parliament, potlatch, panchayat, althing* or *indaba.* Each in its way can unlock the collective thinking and imagination, through exploring and visioning and deliberation, and bring the insights towards practical decisions. Other versions – from corporate paint-ball weekends, to academic away-days, visioning forums and community blackboards, un-conferences and goldfish bowls, think-and-do-tanks and living-labs, Lego-days and leaf-trees, role-plays and sand-pits. Such experimentation can only spread and grow in times of turbulence...

Knowledge user pathways

Knowledge-based users or 'cognitive' users are more focused on Aristotle's *episteme*, a scientific rationale and worldview based on evidence and reasoning. Such users could be researchers and academics, teachers and students, consultants and advisors, knowledge-based professionals of all kinds. In an ideal world we might gather pure knowledge on everything in sight: in practice we have

to prioritize, scope and filter for relevance and significance. For that we need links to the societal users, for the relevance and 'why' questions, and links to the enterprise users for the 'so-what'.

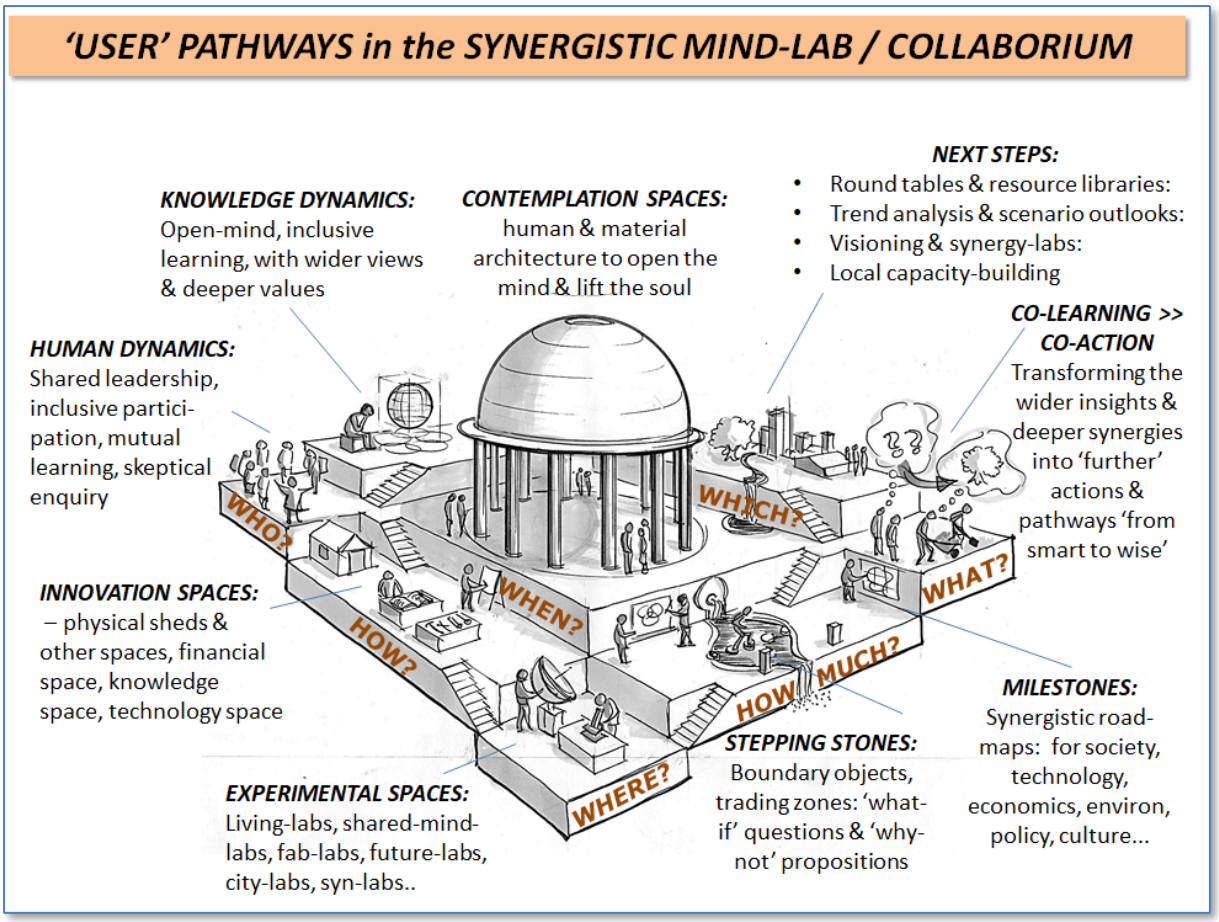
This pathway focuses on the 'whither' questions (to use an old English word), and 'how'. Chapter 3 set out the principles and framework of 'wider-deeper-longer', but reality is often more messy and fuzzy. Is our Low-Carb-City an economic or social or technical problem: who should be around the table: and is the system clever, smart or wise (or – stupid, un-smart and unwise)? Using the wider-deeper-longer framework could be as much art as science.

Enterprise and policy user pathways

Enterprise / policy users are each in their way 'people who get things done', with a focus on practical strategy and management. On the business side, there are corporate and small-medium firms in production, services, knowledge economy or creative economy. On the policy side there are many levels of governance and public services, such as health, education, infrastructure, economy, environment and social policy. For each of these the starting point is the 'what' or 'so-what' questions of applications and results. As in the *Insights* of Chapter 9, at each stage in the cycle of thinking and action, from the largest project to the smallest, there are combinations from a menu: enterprise / project design, risk / resilience management, futures and foresight, organization change and learning , innovation and transition management, strategy planning and project management, and evaluation.

Under the surface the agenda is about the 'when' and 'how' questions, the capacity of the firm, enterprise, organization or project involved – meaning capacity for co-learning, co-knowledge, co-creation and co-production. So for tools and techniques, we're into more well-trodden paths for 'innovation' and 'change management'. We need the enterprise to co-learn in the creative spaces of labs and observatories, and then to gather co-knowledge via horizon scanning, delphi rounds and technology assessment. We need the enterprise to co-create via spaces for innovation such as incubators and science parks, joint ventures and strategic procurement, with enablers such as seed-funds, venture capital, and gap-funding for the 'valley of death' between prototype and deployment. We need the enterprise to 'co-produce' with its partners, with the help of indicators, benchmarks, feedback loops for evaluation and cybernetic management…

As above there are countless variations and experiments in progress on similar lines – hubs, labs, forums, chambers, hives, platforms. But it seems now is the time to step up a gear. So far (to generalize) it seems that most Living-Labs or City-Labs or Futures-Labs are focused on the 'inter-connections of ***things'***. But here we're looking towards the 'inter-connections of ***thinking'***. We're looking for a more synergistic kind of 'Mind-Lab' or *Collaborium*. We need everything we can get for the challenges of co-learning, co-knowledge and co-creation, everywhere from local to global.



Where to start?

If in doubt, start with a Societal Pathway, and branch out into a Knowledge Pathway and/or Enterprise Pathway when needed. Naturally any co-creative process works better with good surroundings, food and drink, and basics such as a large whiteboard and/or flip charts (if possible, find a beautiful country house… A synergistic programme can be anything from an hour to a day, week, month or year: with numbers from three to 30 or 300 (experiments are in progress on social media-enhanced large community formats).

The collective state of mind is essential, and from experience it's best to be honest and open, creative but critical, ready for serious fun. If the mapping goes well it will challenge boundaries between sectors, disciplines or professions, explore controversial issues and problematic relations, and bring out hidden controversies and conflicts. As in any macro-scale mediation or micro-scale psychotherapy, we have to use skill and judgement to avoid traps and mobilize opportunities.

And most important are the people. We need people who are creative, collaborative, critical and constructive, who are committed to the future, and who can challenge their sectors, disciplines or professions where needed. There is much written about leadership, but more important is to spread leadership qualities out to the whole community.[14] If the results are not (yet) challenging and creative and controversial, then we have to raise the game.

ANNEX: Synergistic Toolkit summary

	GENERAL AIMS	KEY QUESTIONS	EXAMPLE – HOUSING POLICY
SYSTEMS MAPPING	***'RELATIONAL THINKING'***	***'What's the problem?'***	
A) Wider-actors	Explore the scope of the problem / system, & the actors & their relations	*Who are the actors: how do they interact?*	Who are the owners /users: providers / consumers, intermediaries, etc??
B) Wider-factors	Explore how the system works, with the key factors	*How does the system work? what are the upstream & downstream links?*	How does housing work – investment, production, distribution, usage?
C) Deeper-domains	Explore the overall system & linkages of social, technical, economic, political etc.	*Which values are important, in which domains of thinking?*	Which are the key layers in housing? social / technical / economic /political etc.
SCENARIO MAPPING	***'DIVERGENT THINKING'***	***'What's changing?'***	
D) Drivers	look for forces of change, both external and internal.	*Which forces of change and uncertainty? shorter / medium / longer?*	What are drivers of urban change & uncertainty?
E) Dynamics	define the most significant dynamic cycle effects.	*What are the dynamics of change – growth /decline / restructuring?*	Which urban dynamics? growth/ decline / restructuring?
F) Scenarios	explore alternative futures with 'what-if' questions.	*Which are the main uncertainties & which alternative futures ?*	How could the future city be different from today?
SYNERGY MAPPING	***'EMERGENT THINKING'***	***'What's the potential?'***	
G) Linear - Mode-I	map the system potential which is linear or 'clever'	*Are there opportunities & synergies which are 'clever'??*	What could improve the production of **housing units?**
H) Evolution-ary - Mode-II	map the system potential which is more evolutionary & 'smart'	*Are there opportunities & synergies which are 'smart'?*	What potential for **housing markets and innovations**?
I) Co-evolut-ionary - Mode-III	map the system potential which is more synergistic and 'wise'	*Are there opportunities & synergies which are more 'wise'??*	What are the opportunities in **housing for liveable communities?**
STRATEGY MAPPING	***'CONVERGENT THINKING'***	***'What's to be done?'***	
J) Pathways	Synergistic value-paths, to link present 'syndromes' with future 'synergies'.	*Which combined pathways could realize the synergistic opportunities??*	Which pathways could move towards **housing for liveable communities?**
K) Road-maps	Strategic objectives, resources, actions, enablers to realize the pathways.	*What roadmap could realize the potential of the pathways??*	Who could do what & when to achieve **housing for liveable communities?**
L) Management / Evaluation	Program / project management with assessment & evaluation.	*How to put the roadmap into action & evaluate the results??*	How to manage the co-production of **housing for liveable communities?**

Full citations are in Ch.12 – Annex on https://urban3.net/urban-3-0-the-book/

[1] Loveridge, 2007
[2] Inayatullah xxx
[3] Sharpe 2012
[4] Holling, 1986: Gunderson & Holling, 2002.
[5] Ravetz, 2013a
[6] IPCC, 2001: Piorr et al 2011
[7] At the time of writing there's a whole new twist on the 'intentional design' of vehicle engines, with the VW scandal of the 'defeat' technology which bypassed emissions standards.
[8] Wilson, 1994
[9] Ravetz, 2015 (GO-Science).
[10] Ravetz, 2011 and 2013
[11] Ringland 2011: Georghiou et al 2008: Inayatullah 2011
[12] Roadmapping REF
[13] Duval 2010
[14] Levin 2013: Parkin 2009