SYNERGISTICS – VISUAL PROCESS GUIDE:

'FORESIGHT FOR SCIENCE-TECHNOLOGY-INNOVATION'

08-11-18

Details in the Practical Guide on www.urban3.net and

www.manchester.ac.uk/synergistics

OVERVIEW

Many science technology and innovation (STI) organizations are in a state of flux.

- Research programs are more inter-connected and challenge-driven
- Education and skills training are more demanding, not only of technical but human skills
- Organizational change is more rapid and turbulent
- Government and public services are under pressure to deliver more for less resources

The synergistic approach helps to navigate through this complexity. It offers process tools and techniques, and a framework for analysis and design for collective intelligence: not only to understand the system, but to transform it.

This page contains some outline notes: and the following pages show the basics of the synergistic thinking approach.

PERSPECTIVES ON TECHNOLOGY

For technology fields, there are different modes of system complexity: from technical problem-solving, to human levels of creative strategic thinking:

- ***'clever' technologies*** (mode-I): information processing and 'single-loop' learning, where the problems and solutions are fixed. For instance, a simple thermostat senses the room temperature, and sends a message to the switch.
- ***'smart' technologies*** (mode-II): algorithms for learning and decision-making, for more strategic problems and solutions. A smart thermostat, or a smart retail platform such as Amazon, can automatically 'learn' the habits and preferences of its buyers and sellers.
- ***'wise' technologies*** (mode-III): tech-knowledge combinations which look beyond smart algorithms towards 'wiser' co-learning and co-creation of societal institutions. Wikipedia for example, provides not only a very smart system of co-production in editing, but also a human kind of intelligence for its overall purpose as a non-profit foundation.

PERSPECTIVES ON SCIENCE

As for science: one manifesto calls for "*societal agenda setting, collective problem framing, a plurality of perspectives, integrative research processes, new norms for handling dissent and controversy, better treatment of uncertainty and of diversity of values, extended peer review, broader and more transparent metrics for*

evaluation, effective dialog processes, and stakeholder participation".[1] All looks fine: but the current trend points towards a darker world of 'post-truth', where rational thinking has to compete with other kinds of knowledge, which are tradeable for power, wealth or ideology.[2] This plays out in different fields. For quantum physics there are profound debates on the nature of reality, but the human implications are mostly indirect and outside the frame. For economic geography by contrast, there are human questions on how knowledge is captured by power: and in ecological sciences, alternative ways of knowing are too often excluded from the mainstream.[3]

It seems there's a choice: either science can stay in its citadel, hoping the storm of uncertainty and post-truth multiplicity will pass: or it can look for pathways forward. Actually, post-truth multiplicity is an existential challenge to science, but it's maybe also a recognition of a larger reality, and maybe a possible opportunity. In this way a ***SCIENCE-III*** could look 'wider' for synergies between actors and their different forms of knowledge. It could look 'deeper' for synergies between cultural, ethical, emotional, spiritual or aesthetic intelligence. It could look into 'further' causes and effects, to the uses or abuses of R&I, and towards knowledge for collective intelligence.

PERSPECTIVES ON FORESIGHT

Foresight is a very pro-active approach to exploring the potential of STI. In practice there are different modes, which need to be fitted to the problem / agenda, and the level of technology which is appropriate:

- Mode-I foresight: problem-solving with defined objectives and boundaries
- Mode-II foresight: innovative and entrepreneurial thinking
- Mode-III foresight: collaborative societal learning for collective intelligence.

For example: tomorrow's Low-Carb-City will be different to today's 'hi-carb city', and to get from here to there, needs a major 'transition', and this depends on rapid 'innovation'. Such changes are often framed as energy technology and economic growth, but experience shows that innovation is needed in every domain – social, economic, ecological, political, cultural and so on. Likewise, it's easy to talk and write policy reports on a Low-Carb-City, but reality checks soon arrive. In debate on the UK 'low carbon transition pathways', we looked at the scenario modelling with impressive detail on technologies and costs: then we looked at the reality just outside the door – messy, corrupt, paranoid – not only with technical problems, but social, cultural, ethical and political, all tangled up. Moreover, policy-makers and other interventionists are generally inbuilt, part of the problem as much as the solution.

Could synergistic thinking in general, and Foresight-III in particular, help to navigate this labyrinth? We could start with transition theory and transition management practice, which started in the Netherlands on a similar track only two decades ago. The contribution of synergistics is to help make the cognitive leap: from transitions as blind socio-technical forces, to transitions as conscious strategic actions, based on co-intelligence across the human system.[4] The question is then very practical – how to do such transitions?

The Foresight-III matrix here (Table 9-4), brings a practical focus on the process. As in the graphic this is visualized as a four stage cycle of thinking, which can work in different modes, according to the nature of the

[1] Cornell, S., Berkhout, F., Tuinstra, W., Tàbara, J. D., Jäger, J., Chabay, I., de Wit, B., Langlais, R., Mills, D., Moll, P., Otto, I. M., Petersen, A., Pohl, C., Kerkhoff, L. van, Opening up knowledge systems for better responses to global environmental change, ENVIRONMENTAL SCIENCE & POLICY vol 28 2013: 60-70.
[2] Ravetz, J.R, (2004). The post-normal science of precaution. *Futures*.36 (3), 347–357.
[3] Ravetz, J, & Ravetz, A, (2016). Seeing the wood for the trees: Social Science 3.0 and the role of visual thinking. *Innovation: the European Journal of Social Science Research,* Vol **30**(01):104 - 120.
[4] Turnheim, B, Frans Berkhout, Frank Geels, Andries Hof, Andy McMeekin, Björn Nykvist, Detlef van Vuuren (2015) Evaluating sustainability transitions pathways: Bridging analytical approaches to address governance challenges. *Global Environmental Change* 35:239–253

problem. The key point is to fit the frame of the problem to the foresight, and to keep open the possibility of larger frames. For example, the recent UK foresight on the 'Future of Cities' helped to define these pathways:[5]

- ***Relational thinking*** and systems mapping: from a city as a tangible object (buildings, streets etc), towards a view of a city system as a wider and deeper *connexus.*
- ***Divergent thinking***, trend and scenario work: the pathway here leads from technical trends / scenarios (GDP or population growth), towards wider and deeper shifts (urban socio-political discourse or cultural myths).
- ***Emergent thinking,*** the most crucial stage, is often skipped over. Here we look for pathways from simple measures (urban education or innovation outputs), towards synergistic potentials (levels of cohesion, collaboration and other 'co' words).
- ***Convergent thinking*** covers road-mapping and strategic planning. Again there's a contrast between tangible urban plans or government programs: and a more synergistic pathway, pointing towards the urban *deeper mind*, for anticipatory governance and co-production.

The matrix here is only a rough guide, not to be taken too literally. And for the information needed – in the words of Keynes, often 'it's better to be roughly right, than precisely wrong'. If hard numbers are not available or even relevant, then softer multi-criteria or experiential images, media, stories, conversations, could be much more useful.

Overall, the self-evaluation / summary table here can be used to define the problem - from simple technical issues to societal challenges. Then we discuss the changes in motion, positive and negative. Thirdly, we can use the table to structure discussion on visions and opportunities and synergies: and fourth, the possible pathways to meet them. This method can combine with the visual templates below, and also other tools - hi-tech / low-tech, people-centred / analysis, local / global focus, and so on.

Table 9-4: Foresight-III Matrix

	'CLEVER':	***'SMART':***	***'WISE':***
FURTHER>>>	***Mode-I: Linear***	***Mode-II: Evolutionary***	***Mode-III: Co-evolutionary***
WIDER: (actors & factors)	Elite / expert top-down strategy	Elite / expert centred enterprise	Co-learning & co-production foresight
DEEPER: (social, technical etc)	Technical & functional analysis	Multi-functional analysis	Multi-dimension, multi-valent, analysis-synthesis
CIRCULAR: (process)			
Relational thinking	Tangible system mapping	Systems of incentives, competition, enterprise	Cognitive capital & *connexus* mapping
Divergent thinking	Tangible trends / scenarios	Evolutionary trends / scenarios	Alternative futures & synergistic potential
Emergent thinking	Specific problem solving	Innovation & problem insight	Societal co-design & co-innovation
Convergent thinking	Specific actions / responses	Enterprise strategy & road-mapping	Societal transformation pathways

[5] Ravetz, J, & Miles, I.D, (2016) Foresight in cities: on the possibility of a "strategic urban intelligence", *Foresight*, Vol.**18**(5):469-490

FORESIGHT AS LABORATORY:

The 'users' of synergistic tools are each in their own way, on some kind of journey of experimentation and learning and collaboration, in other words, on a *Pathway*. The setting for such pathways goes by different 'Laboratory' concepts, depending on the focus and the choice of tools.

- ***Mind-Lab,*** for general experiments with collective intelligence;
- ***Scenario-Lab***, with a focus on the future;
- ***Synergy-Lab,*** to explore the co-evolution potential;
- ***Strategy-Lab,*** for practical plans and projects.

If all these are involved in a longer program we have a ***Collaboratorium,*** a 'laboratory for collaboration'.

And a series of *Collaboratoria* then builds up to an integrated ***Multi-Versity,*** a larger organization or community or city, where everyone learns with and from everyone.

In the following pages we set out:

- An overview of the synergistic toolkit and method of use
- A practical visual thinking guide, with templates and worked example.

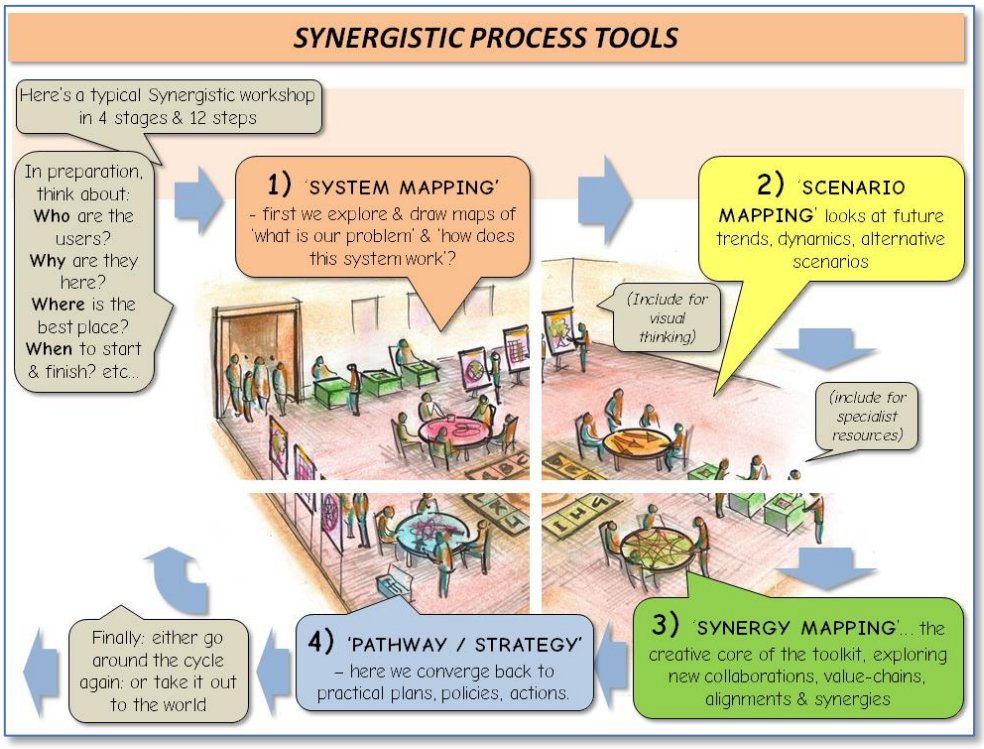
Further detail is in the Practical Guide on http://manchester.ac.uk/synergistics/

'Foresight-III' has to, somehow, connect environmental management with social, technology, ecology, economic, political and cultural issues. Meanwhile, 'grand challenges' such as artificial intelligence or social inequality, are even more 'hyper-complex', inter-connected, and controversial. What can be done?

'Synergistics' – the science and art of working with synergies – has been developed for such challenges. It provides practical methods and tools, to help explore and enable 'collective intelligence'. It can work in organizations, institutions, supply chains or value-chains, business / enterprise models, networks or communities.

To explore the potential for collective intelligence, calls for creative and visionary thinking. For this we use the Synergistic Toolkit, a flexible set of techniques with 4 stages and 12 steps:

a) ***System mapping:*** the baseline syndromes and issues on the table: also includes '*co-learning':*
b) ***Scenario mapping:*** the drivers of change & alternative futures: ('*co-knowledge'):*
c) ***Synergy mapping:*** design of opportunities, synergies, innovations: ('*co-creation'):*
d) ***Strategy mapping****:* design of practical pathways, road-maps, policies & projects ('*co-production')*.



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 very flexible: it can take hours, days, weeks or months, depending on time, people and resources. The cycle can be more interactive, or more about desk-study, data-mining, expert debate, or stakeholder interviews. Overall these tools help to explore 'grand societal challenges': to identify 'what kind of problems' are we talking about: and then explore 'what kind of solutions' are most useful.

Visual thinking is at the centre of the synergistic methods and tools. This Guide provides a series of templates and typical questions, for each of the 4 stages and 12 steps.

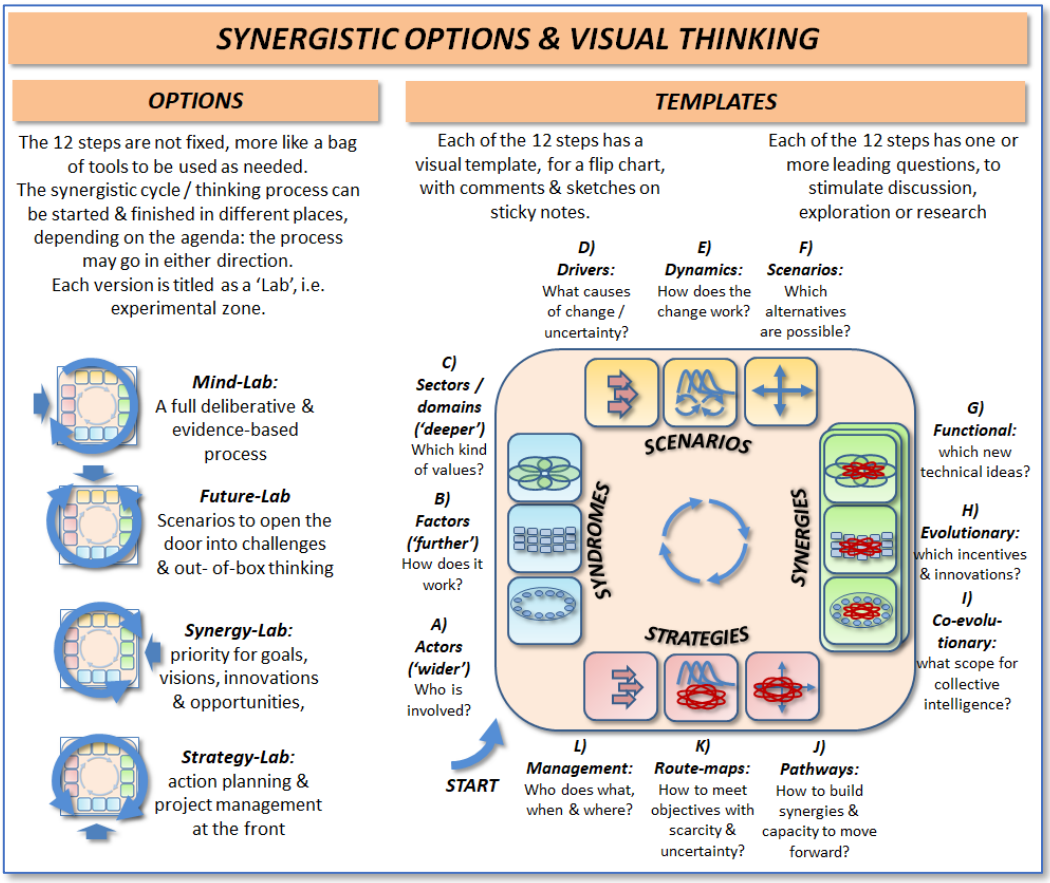
VISUAL THINKING AND VISUAL TEMPLATES

These visual templates provide a easy and practical structure for building and visualizing complex information, i.e. concept maps / systems maps / *deeper-mind* maps. (these are different to *mind-maps*, as they focus on collective intelligence with multiple agendas).

The templates can be easily copied onto flip charts with writing or images on sticky notes. The order of using the templates depends on the theme, the event, the participants etc. Sometimes we start with the Scenario Mapping (D,E,F): in others we start with Synergy Mapping (G,H,I).

Overall, visual thinking is one of the best ways to explore creative, out-of-the-box, inter-connected ideas.

- Participants are asked for visual ideas or small sketches, to be completed by a graphic facilitator.
- Participants can respond to 'future cards', 'scenario visions', or other visual inputs
- Participants are encouraged to draw concept mappings, using the visual templates.
- The templates are very flexible, and can be used in a creative open-minded way.
- If participants don't agree on the images or mappings, each can do their own version.
- The templates in stage 1 & 3 are focused on the development of collective intelligence.
- The templates in stage 2 & 4 fit with mainstream futures / scenario methods: and with standard route-mapping / project management methods.



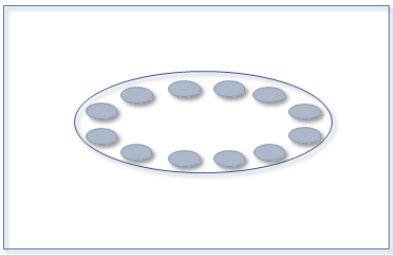
Each of the 4 stages and 12 steps is shown in the following pages, with likely questions to be addressed, and with cues for visual thinking methods. The graphics on the left side are blank templates (to be copied onto flip-charts or similar). The graphics on the right side are worked examples (based on a low-carbon agenda).

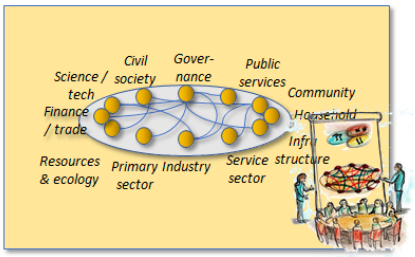
TOOLKIT - STAGE 1: ***'TABLES'*** (SYSTEM MAPPING): *'WHAT'S THE PROBLEM?'*

A) ACTORS MAPPING – ('WIDER' SYNERGIES): ***'ROUND TABLE'*** TEMPLATE

- *Q: Who is involved?*
- *Q: how do they interact?*

Identify the most important people, stakeholders, communities: explore their roles & relations (social, economic, political etc).



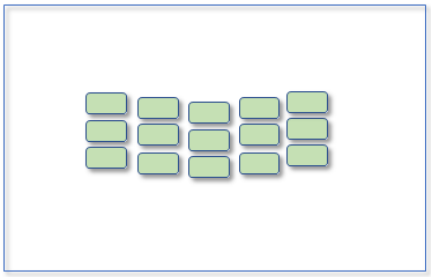


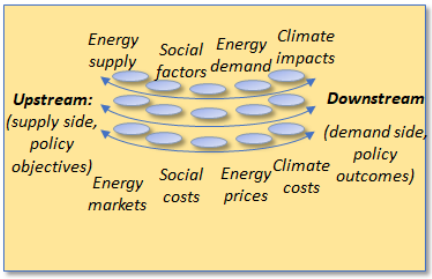
B) FACTORS MAPPING – ('FURTHER' SYNERGIES): ***'BUSINESS MODEL'*** TEMPLATE

- *Q: How does the system work?*
- *Q: Where are the upstream / downstream factors?*

Explore the metabolism or flows (resources, money, policy, labour, social value etc):

Look for upstream causes / downstream effects of the flows, (e.g. ecological / social impacts)



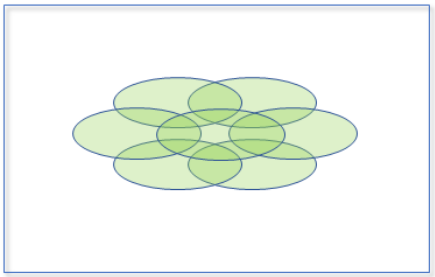


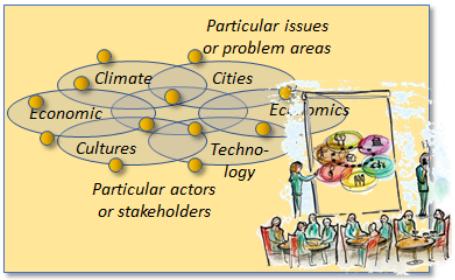
C) DOMAIN MAPPING – ('DEEPER' SYNERGIES): ***'CLOUDY CRYSTAL BALL'***.

Questions to be addressed:

- *Q: Why is this project important?*
- *Q: Which values & domains are involved?*

Explore what kind of problems & what is the scope: which are the goals / visions? (social / technology / economic / environment / political /cultural etc).



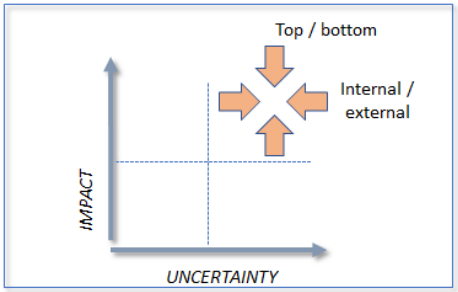


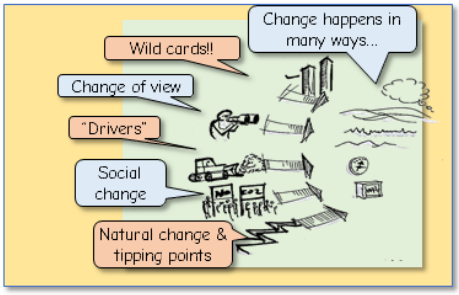
TOOLKIT STAGE 2: ***'CROSSROADS'*** (SCENARIO MAPPING): *'WHAT'S CHANGING?'*

DRIVERS - ***'FORCE FIELDS'*** TEMPLATE

- *Which forces of change?*
- *Which uncertainties?*

Identify each kind of change, for impact & uncertainty. Select the top 2 or 3 most important changes.



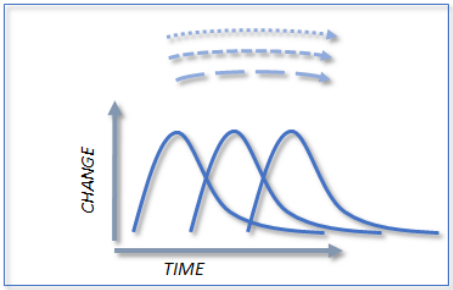


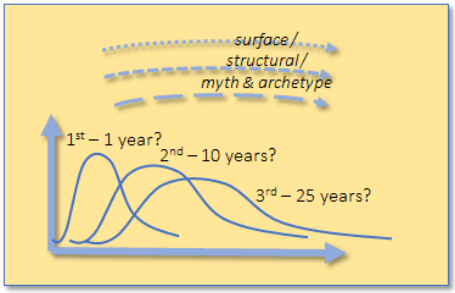
D) HORIZONS - ***'3 MOUNTAINS'*** TEMPLATE

- *When are the horizons of each change?*
- *Which are surface / structural / archetype changes?*
- *When is there growth / decline/ restructuring?*

Explore which are short / medium / longer term changes:

Explore the patterns or cycles of change



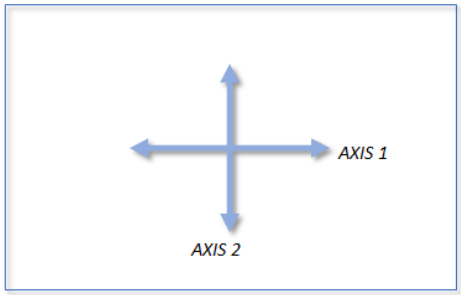


E) SCENARIOS - ***'CROSS-ROADS'*** TEMPLATE

- *What if the best / worst happens?*
- *Which are the most 'interesting' alternative futures?*

Explore 'what-if' the top 2/3 changes are high / low impact, positive / negative.

Explore the scenarios with stories, headlines, images.

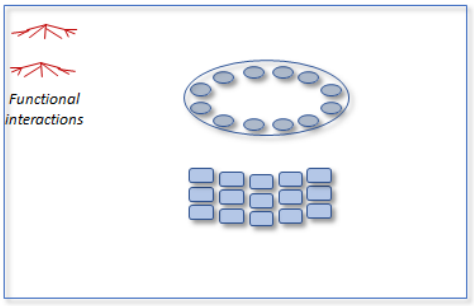


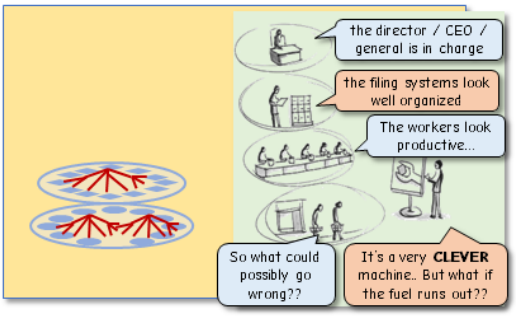
TOOLKIT - STAGE 3: ***'VISIONS'***: (SYNERGY MAPPING): *'WHAT OPPORTUNITIES?'*

F) LINEAR – (MODE-I) - ***'CLEVER IDEAS'*** TEMPLATE

- *How to improve the functions & operations?*

Explore practical ideas & synergies between the 'actors' & 'factors' (social / technology / economic / environment / political /cultural etc). Draw the possible inter-connections.

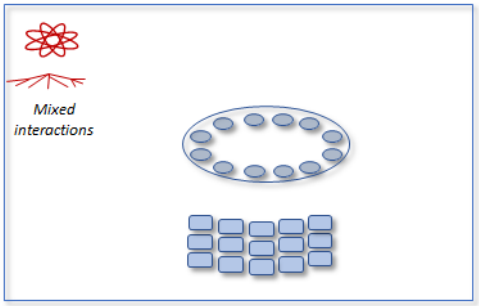


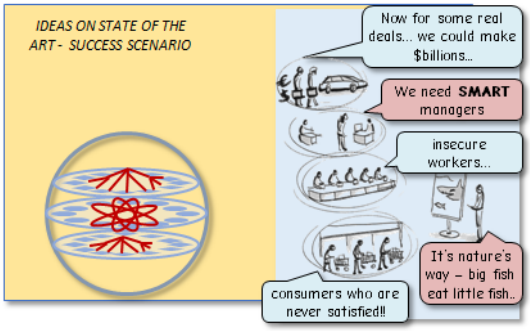


G) EVOLUTIONARY (MODE-II): ***'SMARTER IDEAS'*** TEMPLATE

- *How to make smarter inter-connections?*

Explore the state-of-the-art entrepreneurial ideas & synergies between 'actors' & between 'factors'. Draw the possible inter-connections.

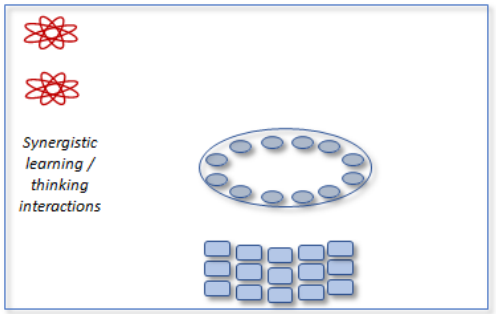


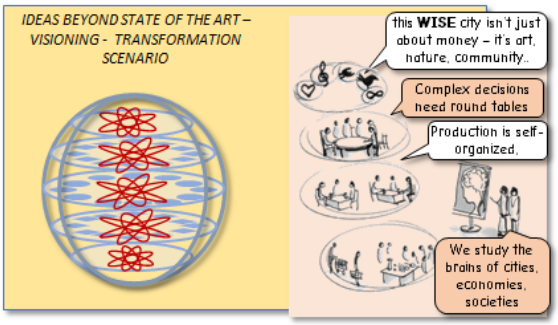


H) CO-EVOLUTIONARY (MODE-III): ***'WISER IDEAS':*** TEMPLATE

- *How to grow a wiser kind of intelligence?*

Explore beyond state-of-the-art 'visionary' ideas & synergies, between different 'actors' & 'factors'. Draw the possible inter-connections, with multiple layers.





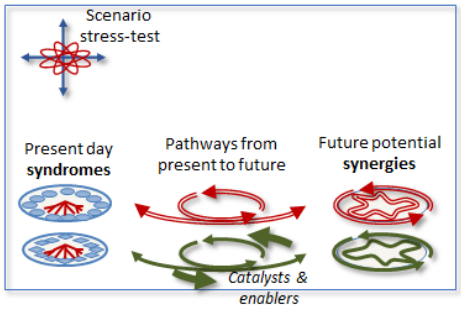
TOOLKIT STAGE 4 - ***'ROUTE-MAPS'***: (STRATEGY MAPPING): *'WHAT'S TO BE DONE?'*

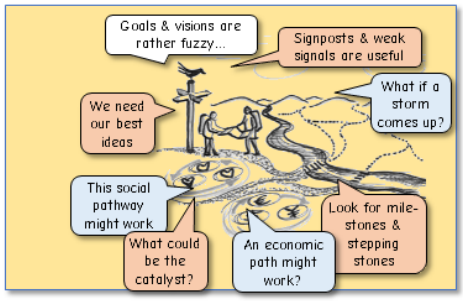
(J) PATHWAYS - 'PATHWAYS'

- *Which pathways could best realize the opportunities??*
- *Are these future-proofed?*

Develop 'pathways' of strategic change, which connect the most robust ideas / synergies (internal / external: short /medium / longer). *(there are different formats to show the pathways)*

Test the best ideas / synergies against each scenario: & select the most robust.

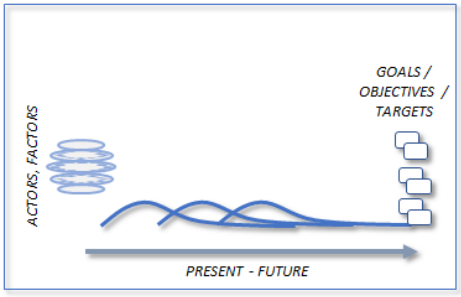


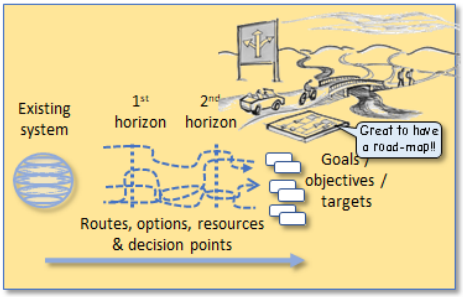


(K) ROUTE-MAPS - 'ROUTE-MAPS'

- *What strategies could turn the pathways into reality??*
- *When are the key stages?*
- *How much resources are needed?*

Identify the goals & objectives: Identify links to plans & actions, actors involved, factors & resources needed. (internal / external: short /medium / longer)

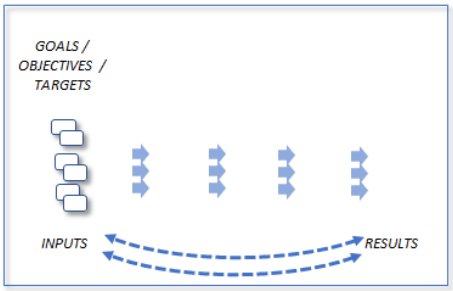


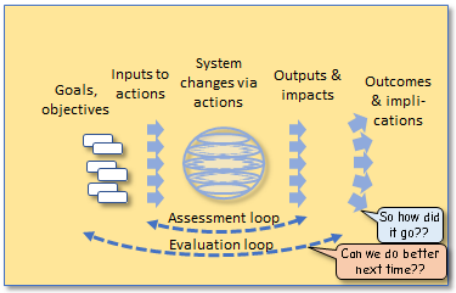


(L) MANAGEMENT/ EVALUATION - 'ACTION PLANS'

- *How to manage the actions?*
- *How to evaluate the results??*

Set up management plan with practical priorities & actions: Identify the next steps with actors & resources: Explore how to monitor performance, evaluate results & feedback.





ANNEX: SUMMARY TABLE

This table is a summary of the 12 steps in the Synergistic Toolkit, with key questions to be addressed, & examples of urban development. Note the steps can follow in different orders (not always A, B, C)

	KEY TASKS	***KEY QUESTIONS***	***URBAN EXAMPLE***
SYSTEM / SYNDROMES			
A) Scoping	Explore the scope of the problem / system /issue / agenda / problematique…	what is the agenda or problem for today: where are the boundaries?	*What is the scope & agenda: housing / infrastructure / public space?*
B) 'Wider' synergies	Explore how the system works, , and the relations of the actors in the system,	how do the actors / factors interact: what kind of system, hierarchical or networked?	*E.g. who are the key actors- investors /owners / developers / designers / residents?*
C) 'Deeper' synergies	Map the overall 'metabolism' of the system, with inter-connections between domains.	Which are the key domains e.g. social / technical / economic / ecological /political ?	*What are the main forces shaping behind the peri-urban syndromes*
SCENARIO MAPPING			
D) Drivers	Explore the forces of change, both external and internal.	what are the driving forces of change, uncertainty, internal / external, near / far horizon?	*What are key drivers of change & uncertainty ('21 drivers')*
E) Dynamics	define the most significant dynamic cycle effects.	what dynamics of change – succession / renewal / tipping points / transitions?	*How does the cycle of renewal work here: (e.g. development / conservation / restructure?*
F) Scenarios	explore alternative futures with structured 'what-if' questions.	which projections and scenarios are most relevant & plausible?	*How could the future peri-urban be different from today?*
SYNERGY MAPPING			
G) Linear mode-I	map the system qualities which are more linear & mono-functional	what opportunities for functional efficiency & performance of the system? Any negative effects?	Is the key peri-urban issue ***linear growth****? (housing, services, infrastructure etc)*
H) Evolutionary mode-II	map the qualities which are evolutionary & inter-connected.	opportunities for creative enterprise, new functions & niches? Any negative effects?	Is the key peri-urban issue ***adaptation / evolution****? (housing, services, etc...)*
I) Co-evolut-ionary mode-III	Map the qualities which are more co-evolutionary & synergistic	how can opportunities emerge via synergistic collaboration, co-learning & social intelligence?	Is the key peri-urban issue ***co-intelligence / co-evolution****? (housing, services, infra, etc...)*
STRATEGY MAPPING			
J) Pathways	look for synergistic pathways, to link between present 'syndromes' & future 'synergies'	which synergistic combinations can form pathways to bring actors/ factors into alignment & added value.	*How to make real positive change in the peri-urban? (housing, services, infra, public realm...)*
K) Road-maps	look for synergistic links between objectives, resources, actions, enablers.	which pathways, actors and factors can be combined into practical strategies & actions? what implications for resources?	*Which resources, actions, timescales to realize these? (housing, services, infrastructure, public realm...)*
L) Management / Evaluation	rational /relational management methods with assessment & evaluation.	how can results be evaluated, with feedback & learning into the next cycle?	*How to learn: before, throughout & following the urban policy process?*