A Complementary View on Complex and Systemic Approaches

Marion Real, Jean Michel Larrasquet, Iban Lizarralde

A complementary view on complex and systemic approaches

Marion REAL, Jean Michel Larrasquet, Iban Lizarralde

In this chapter, we discuss what the theory of complexity can bring to the construction of territorial transitions toward circular economy. *We will first revisit the dynamism of territories within their cultural angle, highlighting the complexity of their metabolisms and the importance of a design with intent. Then, we will introduce in the key notions of the complexity theory, mainly based on Edgar Morin[i]'s philosophy, underlying new attitudes and modes of governance for research and projects' design: the notion of system, dialogy and emergence will be described. As a conclusion, we will propose notes to pay attention to the Retrace project and the use of the systemic design methodology.*

A- Co-construction of territories

#1 Territory as an interface between space, people and the need for a new metabolism

According to Raffestin (1986)[ii], a territory is a notion which refers to a human labor which has been exerted on a portion of space characterized by a complex combination of mechanical, physical, chemical and organic forces and actions. Territory do not have to be seen as a physical space but is intrinsically related to people who belong to a culture. Thus, the design of virtuous loops necessary to create circular economy directly depends on how people are connected to their territory, on how they know its space, its resources and its limits, the metabolism of the ecosystem, and how they are impacting it. Transitions toward zero waste economies impact on social representations and involve decolonizing and recreating new social imaginations (Castoriadis, C., 2010)[iii]. The creation of new myths, new beliefs and new utopias around a new territorial vision generates meanings to people and participates in the construction of new social practices disseminated in all strata of the system. In a practical view, territories need to develop capacities to innovate and create activities around new values that involve changes in the way of interacting with each other and managing the territory.

#2 Softening the discourses on the role of infrastructures, highlighting the power of cultural vibrancy

Many studies and policies support the development of new infrastructures and see them as the most important way to foster the inventiveness and dynamism of a territory. This idea need to be counterbalanced: there are many examples to show that peripheral territories that could be heavily enclaved have been able to develop as richer capacities in terms of technical, economic and social inventiveness as other territories that are perfectly equipped with infrastructure. Indeed, the former may turn out to be monsters of inventiveness, while the latter may sometimes tend to fall asleep.

Let us take the example of the creation of the Mondragon cooperative group (80,000 employees today) in the 1950s: Mondragon is situated in the heart of a highly enclosed valley in the Basque Country. It is through the commitment for training people, by their cultural identity and their dedication to a local project development that cooperative entrepreneurship emerged and that the territory grew rapidly to become today one of the richest of Europe.

This example shows that the creative and entrepreneurial spirit is directly linked with a desire to live together and build a collective future. The same idea could be illustrated in the recent years through the transformation of industrial wastelands, abandoned farms or rural valleys into new social innovation places: the Darwin ecosystem in Bordeaux, creative recycling centers , the Aldudes valley in the Basque region, etc. are examples of how cultural effervescence is influencing economy. Indeed, if a territory is culturally dynamic, it will be open to novelty. It will be able to give the will to launch itself and even to encourage the emergence of disruptive ideas. Shocking, deviating from conformism or breaking ideas enable the emergence of innovations. Cultural vibrancy is the basis for creativity and the development of new innovative avenues.

#3 *A need for co-construction by embracing complexity and overcoming positivist approaches.*

The activation of such social transformations depends on the organizational impulsion present on territories, with their background, the existing structures and involved stakeholders, as well as their modes of management. In fact, the roads to such transformations are difficult, narrow and blocked. They are often barred by the multitude of self-blocking locks that our society has established (all sorts of technical, organizational, social, ideological, political rigidities in place) and by the ambition of the politicians who operate rather in a short term vision. Working in

sharing the intentions and empowering people in the design of collective, sustainable and circular futures remains essential to let the effervescence appear.

Different epistemological approaches could be undertaken to engage territorial transitions.

Classical positivist approaches usually support mid-term and long-term sociotechnical transformations as a problem to be solved by using causal and predictive models. Following these approaches, authorities usually base their decisions on deductive cause and effect logic: building a road infrastructure will increase trade, investing on research will boost innovations, etc. These logics might have been efficient in other territories and contexts but it does not mean that the results will be the same in the applied territory. The positivist paradigm simplifies the concept of 'causality' and rarely takes into account the interrelations and loops between designated causes.

Opposed to the positivist paradigm, the complexity paradigm considers that phenomena emerges from a myriad of causes that are interrelated. During the last century several approaches appeared within the complexity paradigm. On one hand, different techniques to reduce the complexity consider in a determinist way the interrelations between elements. These techniques were supported by the development of computer capacity and the possibility to elaborate models that deal with massive quantities of interrelations between elements. These models allow to simulate non-linear interactions but are often used to perform post hoc analysis or predictive simulations. These simulations, whatever the depth of their uncertainty analysis, will give legitimacy to the best solutions selected within the framework of the model. This approach tends to reduce the complexity of systems and create factual distances between scientists/experts, policy makers and citizens.

On the other hand, a different epistemological approach named constructivism, criticizes this way to deal with complexity and prefers associate these methods to the notion of "complication". For constructivists, such aggregates proposed by experts present the danger of a 'scientific truth illusion' and encourage a "conformist thought" which imposes basic criterions usually used without questioning them. Indeed, we all know perfectly well that we are evolving in the most absolute uncertainty, made up of numerous interdependent factors. These factors that should be taken into consideration are millions, usually interacting in **tight recursion**, with modes of interaction being quasi-unknown and which are themselves unstable. Although constructivist approaches obviously do not dispense with the rigor of reflection, they open the door to relativism and, thus, to new and fruitful paths for human thoughts and actions in complex environments. (Checkland, 2000)[iv] criticizes the tendency where scientists, actors and managers consider systems as 'ontologies' ('hard systems') and proposes an epistemological approach named "soft system" based on radical constructivism and giving its whole place to interpretation.

When designing collective actions for territory, stakeholders have to ensure that the process implemented produces collective intelligence, intelligibility and awareness of what is at stake today, solidarity and reflection on things to do or not to do in both strategical and operational actions. Fighting against complexity is a battle lost in advance. Designers and managers must assume that complexity is irreducible. They must develop "metacognitive" skills and new ways of thinking, conceptualizing and intervening in organizations and projects by understanding and assuming the depth of the epistemological change that this implies. They must undertake the "reform of thought" proposed by Edgar Morin through the theory of complexity.

B- Toward a better understanding of the theory of complexity: key notions.

In this section, we try to explain the main principles that structure the "complex thinking" based mainly on Edgar Morin's work, largely integrating concepts by the 'Soft Systemics'.

Figure 1: Key principles of complex thinking

Mental representations, Soft-systems-thinking and complexity are basic concepts. The accesses humans have to reality are only their senses. From these perceptions, humans build representations in their minds. Representations are the only access they have to reality. Claude Bernard, French medic (19th century), even been a positivist, he once said: "Systems are not in the nature, they are in people's minds". Such representations are therefore evidently idiosyncratic and depend on the values, convictions, habits, methods, situation etc. of everyone. Thus, it is evident that representations that concern a supposed 'same' referent are different from one individual to the others and even in the mind of the same individual at different moments. If the situation is considered as 'complex', it means that nobody is cognitively able to enfold it up completely (Herbert Simon's 'bounded rationality'). Another dimension is about the 'cognitive processes' a person will trigger to build such representations: a person will do it constantly interacting with her environment (perceiving information, triggering complex cognitive processes, and then deciding what to do and acting. Objectivity is therefore a problematic concept. In such a constructivist logic, systems concepts and systems-thinking can only be considered as epistemological tools, proposing good ways for improving intelligibility in complex situations or problems (not building the scientific truth!). They are particularly useful tools for group work. An interesting application of such principles could be found in the ways a community may act to collectively define commons (Ostrom, 2010)[v]. It should be interesting to find out how the evolutions of mental representations under the effect of collective design-thinking oriented methods may lead such a community to social (shared) agreement on the status of a material or immaterial 'good' as a 'common' that will have to be cooperatively managed in the future.

System-thinking provides cognitive tools that allow considering things in their interrelations, how they impact one on each other and how they generate proper effects 'emerging' from these interactions. System-thinking produces mental representations by using systems as epistemological tools! A system must have a boundary (what is in, what is out [its environment]), but generally systems are qualified as 'open systems', which means that they exchange (using different modes) with their environment. Prigogine's finding of "dissipative structures" are good examples of how complex systems can emerge and be in equilibrium exchanging energy and matter with their environment. Inside this boundary, the system is made of elements and relationships (its structure or organization). Also a system may be characterized by its functionalities, goals or finalities, by its history, the way it is evolving and its ability to self-manage itself, as well as autopoietic systems which continue to produce interrelations within the system (Maturana and Varela)))[vi].
The principle of **Emergence** consists in having in mind that system-thinking always tries to anticipate or recognize the new properties that emerge from the fact that we are dealing with a system, i.e. with interconnected elements. In other words, « the whole is more than the sum of its parts ». For instance, specialists in different disciplines working together will be able to find new ideas due to interconnections they are able to generate by their common work. This idea is one of the most important bases of the theory of innovation.

Self or hetero-regulation may be defined as taking into account complementarities and interactions in order to avoid drifts and allow provisional homeostatic equilibria. Self-regulation emerges from the effect of internal forces (inside the boundary of the system) and hetero-regulation is the fact of external forces. Both regulation modes may work interacting together For instance, in a territory, managing differently short term tasks and long term considerations is a way to give its place to regulation. But both notions (short term and long term) must also be related, because if we do not do that, we are missing a good part of the relationships we should have to take into account in order to build 'not too poor' representations of the situation So we have to deal with this double idea of separation and interaction. To understand better, we have to introduce the concept of dialogy.

The concept of a **dialogy** is challenging the binary view of things stating that two contradictory propositions (p; non-p) cannot be true at the same time (p ^ non-p = ⊱). With the concept of dialogy, Edgar Morin proposes to overtake this principle arguing that in real complex situations such two contradictory propositions generally act at the same time and that they are influencing each other. Which means that every basic term (p and non-p) cannot be considered as a constant: it is impacted by the other, which at the same time changes due to the impact of its opposite… It is a fundamental principle of the "complex thinking" that Edgar Morin proposes. A relevant example in our case is the opposition / relation between short term and long term visions. Edgar Morin says that they must be conceptualized separately (in order to manage space to regulation for instance), but at the same time, that they cannot be conceptualized independently, we always have to take their interrelationships into account: as far as our example is concerned, the idea is that any long term situation is necessarily the result of a succession of short terms and, on the other hand, any short term decision should be taken considering long term thoughts.

The **Eco-self-re-organization** concept is about the fact that in complex situations, resulted actions of the system, are mainly issued from the relationships of the elements of the system that are impacting the proper organization of the system it-self. In the frame of ecosystems, it means that transformations may appear due to free or even hazardous shocks between elements of these ecosystems that are able to self- and re-organize the considered system. Another way to express this property is to use the expression: "order emerging out of disorder". Some re-organizations may produce a self-maintained tendency. An example of this principle is how citizenship initiatives may change the referent system: for instance, the development of design thinking places (co-working, fab-labs, social design, innovation…) may reorganize the functioning mode of a small city-center (eco-self-re-organization), and how this new organization will go ahead by itself (auto-catalysis). The point is that it is impossible to specify in advance such behaviors.

The principle called **Ecology of action** is also related to this understanding of complex dynamics as chocks between partially-myopic actions-reactions, between the elements of these ecosystems. Management puts a big stress on 'decision making', but ignores what happens when the decision is taken, about its application. As soon as a decision is taken by a person in charge, this decision enters in this game of actions-reactions (some people will obey and try to do well, others will contest or skirt it, others will reinterpret it, others will wait and let time go, etc.). In brief, it is difficult to understand *ex-ante* what will happen in the phase of application! In the case of territories, the number of decisions taken and that disappear like water in the sands of the desert is incalculable!

The **Hologrammatic principle** states that a system cannot develop a given behavior if its elements are not in tune with it. The whole system's behavior is engrammed in its elements and the elements' behavior, by the way of internal relationships, generates the system's behavior. Another way to state this idea is: the whole is made of its parts and the whole is in each part (like DNA in human cells). An evident example is the ecological transition in a territory. It will be easier if the inhabitants are convinced and act in tune with the main goal. If it is not the case, the battle is certainly lost in advance. The zero waste thinking can be a strategy for a territory, creating materials loops, etc. but it should also be a way of thinking and acting of each inhabitant (reducing consumption and taking into account the existing dynamics in the territory). Nevertheless, our different principles also state that building hologrammaticity must be understood as a process, the question being to reinforce this self-catalytic interaction between individual and collective levels (another complex point treated by the theories of institution. (Lourau, 1970)[vii] and structuration (Giddens, 1986)[viii])

C- Which impacts on systemic design and the Retrace project methodology?

This last part discusses some precaution principles coming from the complex and system thinking that could be applied to systemic design methodology and more particularly to the Retrace project.

 # From one to multiple territories: being aware of the borders while connecting them by actions

Systemic design needs to be applied to territories that are understandable and accessible for humans. Each time the process is engaged, designers must engage an analysis of the good perimeter for action. The Retrace project system perimeter are regions. They are complex systems and are also susceptible to be modelled as a large variety of subsystems such as cities, intercommunities, neighborhoods, as well as household, industrial and agricultural processes… Regions are also an intermediate nodes that acts for and is impacted by European and national policies. With decentralization, they tend to have more autonomous competences for managing innovation, environment and waste, which position them as a good frame to impulse circular economy. However, in some countries, such as in France, the perimeter of regions has been recently redesigned involving a huge growth of the territorial

perimeter. This could provoke more difficulties in implementing collective actions. Thus, the regional actions will have to be re-appropriated by smaller systems which have to be defined. It could be existing boundaries (city, department…) or new perimeters defined around the notion of *basin of life*. Note that a basin of life could be modelled for each individual according to the way he/she lives, behaves and is integrated to networks in daily life.

System designers need to be aware of the different systemic levels, discussing about the perimeter of their actions while systematically looking for bridging the borders and creating synergies between them.

 # Using models as intermediary objects of design

When designing and developing collective actions, models must be used with parsimony and chosen to increase understanding of the system, its metabolism and futures actions.

Two types of models can be used related to two epistemological approaches dealing with complexity that have been explained here above. On one hand, a systemic approach willing to model a territory based on quantitative data. This systems view can deal with non-linear representations but defines in a deterministic way the interrelations between the elements of a territory (materials flow, economic indicators, social effects...) Examples of these models include tools like "system dynamics". On the other hand, models issued from the constructivist epistemology are accessible and adapted for each stakeholder vocabulary. These models are not predictive models nor explanatory models. They are seen as intermediary objects of design that will endeavor the "translation" of ideas (Akrich, 2000)[ix]. In this line, tools like infographics, gigamaps, rich pictures (Checkland, 2000) or videos will be used in the Retrace project to integrate both emotional and technical aspects all along the advancement of the project.

 # Moving the dialogic forces from top-down toward bottom-up approaches: creating conditions for emergence

The top-down operating mode needs to make much more spaces for the bottom-up initiatives. The territory and human community being at the center of systemic design frameworks, fundamental social innovation can only have its roots here. Therefore, territorial governance cannot generate innovation on its own but must prepare the territory and its actors, facilitate possible synergies and meetings, support the development of projects and professionalize the coaching and support actions. In other words, governance should not seek to be itself the creator of innovation. It must create the conditions conducive to the emergence of innovative experiences (modes of financing, evaluation of experiences, etc.) that require a suitable and fertile framework on which innovation can be expressed (promoting creativity, diversity, networking, etc.).

 # Encouraging partners and stakeholders to adopt metacognitive skills when supporting and co-designing circular systems

- In the project, each partner is considered as a systemic designer/thinker of its region. Each one has to be aware of the limits of his/her current actions and must be able to know the gap to reach in order to answer to the ambition of the project. He/She needs to navigate through dialogic thinking, manipulate models, and manage a team by fostering the emergence of collective thought by participating in local networks dynamics.
  The actions in each region shall not be disconnected from existing territorial actions and need to be integrated in a coherent way within the proximity of stakeholders. On one hand, efforts could be done to go deeper in the knowledge of the history of the territory, its evolution, structure, dynamic and regulation modes and build a strong understanding of the recent actions undertaken toward energy transition and circular economy. On the other hand, systemic designers must act as accelerators and change catalyzers by integrating stimulation mechanisms who will impulse new dynamics, detect initiatives, foster creativity and support the development of projects.
- By adopting the posture of action-researchers (Lewin, 1951)[x], systemic designers have the opportunities to access to the intimacy of collective actions. Their attitudes will oscillate between participative observations and actions in order to improve their knowledge and relevance to propose concrete actions. In the Retrace project, the partners of each region will be engaged in different networks and local projects, behaving as bees searching for flowers to forage.

 # Monitoring the evolution of value creation and territorial development

Values behind the transformation realized within territories are multiple and cannot be easily managed or measured as they involve either classic economic aspects like job creation or ROI, or other qualitative dimensions (the degree of livability, social aspects and environmental impacts) over different space-time scales.

Attention has to be paid to methodologies used to follow and assess the value creation in such context: which are the indicators? How to assess the actions realized in different time scales? Who participates to the definition, monitoring and assessment of projects? Which mode of governance could be followed?

- ***Overcome the quantitative reflex***: Managers often enclose their reasoning in quantitative logics, using a determined lexical field (use of term like maximize, minimize…). One advice: try to be able to tame this "obligation to quantify", to take distances, to better know its limits and its dangers and to question when it is useful to use quantitative tools and why.

- ***Use participative management tools to redefine the commons and decentralize decision:*** several tools (OECD, 2010)[xi] exist to facilitate the involvement of people in taking part to the definition and assessment of projects and decisions. Here some examples: self-assessment grids, vote by consent, non-verbal communication, interactive user feedback systems…

---

[i] Morin, E. (2007) On complexity. Cresskill, NJ: Hampton Press.
[ii] Raffestin, C. (1986) "Ecogénèse territorial et territorialité", dans F.Auriax et R.Brunet (dir), Espaces, jeux et enjeux, Fayard.
[iii] Castoriadis, C. (2010) A Society Adrift. Interviews and Debates, 1974–1997. NY Fordham University Press.
[iv] Checkland, P. (2000) Soft Systems Methodology : A thirty yaer retrospective, Systems Research and Behavioral Science, Volume 17, Issue Supplement 1, Version of Record online: 15 Nov 2000
[v] Ostrom, E. (1990). Governing the Commons: The Evolution of Institutions for Collective Action, Cambridge University Press. (see commonstransition.org)
[vi] Maturana, H and Varela, F. (1970) Autopoiesis and cognition, the realization of the living, Boston Studies on the Philosophy of Sciences, D. Reidel publishing Company.
[vii] Lourau, R. (1970) L'analyse institutionnelle, Paris, Les Éditions de Minuit, 1970,
[viii] Giddens, A. (1986) The Constitution of Society: Outline of the Theory of Structuration, University of California Press.
[ix] Lewin K. (1951) Field Theory in Social Science, New York, Editions Harper and Row, 346 pages.
[x] Akrich, M. (1988) A quoi tient le succès des innovations ? Annales des Mines.
[xi] OECD, (2010) Step 4: ensuring stakeholder participation guidance on sustainability impact assessment. http://www.oecd.org/greengrowth/48305795.pdf