DOI: 10.48291/SISA.65.ensup.6 Sistema Salute, 65, English Annual Supplement, 2021: pp.

Systemic and participatory design of socio-ecological and territorial matrices as an interface between human and environmental systems: the (possible) role of an eco-district

Francesco Masciarelli

Architect and independent researcher, Perugia, Italy

Key words: sustainable resilient urban planning; eco-district systemic design; territory-interface; socio-ecological systems

SUMMARY

Problems addressed: the crises of the natural environment and territory are systemic, environmental and social. Indeed, they are socio-ecological systems (SESs), that is, systems in which 'the social, economic, ecological, cultural, political, technological and other components are strongly linked ... emphasizing the integrated concept of the human-in-nature perspective'. These are deeply interconnected and co-evolutive systems, in which the 'ecological component provides essential services to society'. The integrated character of SESs makes the environmental perspective inseparable from the social one and mutually conditioned. Indeed, the approach by which to study, design and govern the natural environment and territory is instead 'culturally' based on the 'values of modernity' and, so far, directed to the exploitation of the natural and human environment in order to seek profits and economic development. In order to be successfully implemented, such exploitation requires processes and tools that can guarantee human beings' distancing and separation from each other and from nature.

Objectives: this research starts from the assumed need for a review of the 'values of modernity' and believes it must question the ways and means through which these values 'create' or modify the SESs we call the natural environment and territory.

Methods: after an examination of innovative and alternative models of design and governance of territory, I believe we can identify in systemic design based on the eco-district concept (eco-district-systemic-design, EDSD) a systemic and participatory tool for a sustainable and resilient requalification of the socio-ecological matrices of the natural environment and territory.

Results: in our model, the eco-district, as a model for territorial primary prevention (MTPP), becomes a structuring element of 'the organization of a territorial cognitive framework, which contains, organises and makes transmissible all the elements that make up the complex urban and territorial space'. Territory is regarded here as an interface between physical-environmental (natural and human-modified) systems and social systems and sustainability integrated by the concept of resilience, while linear economy becomes circular. Training, information and participation processes in decision making and the planning

Corresponding author: info@architettomasciarelli.com

of the transformations of the territory-interface (TI) as a socio-ecological common good (alongside related governance) are extended in the model to all possible stakeholders and take place digitally.
Conclusions: the aim of the model is to help keep 'extended matrices', that is, matrices of social and environmental (natural and human-modified) systems, in balance through systemic, participative and circular approaches, in order to provide a perspective regarding the 'human-in-nature' concept, one which is extremely uncertain today.

1.Introduction and problems addressed

The natural environment and territory are socio-ecological systems (SESs), that is, systems in which 'social, economic, ecological, cultural, political, technological, and other components are strongly linked … emphasizing the integrated concept of the 'humans-in-nature' perspective. Socio-Ecological systems are truly interconnected and co-evolving across spatial and temporal scales, where the ecological component provides essential services to society' (1). Given the dialectical and co-evolutional relationship between the natural and the built environment (2), which qualifies them as SESs, I propose defining territory as an interface (TI) between social and environmental physical systems (natural and human-modified), a definition borrowed from Real, Larrasquet and Lizarralde, for whom territory is 'an interface between space, people and the need for a new metabolism'. This implies a 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' (3). Territory can be regarded as an interface because it acts as 'a common element, partly separating and partly linking' (4) social and environmental systems. It thus serves as the part of the informational flow that the transformation of socio-ecological materials and resources physically takes over and through which individuals and communities come into contact and relationship with natural, artificial and built physical space.
The crisis of the TI, which is also an SES, is therefore caused by the environmental and social unsustainability of the impacts reciprocally generated over time between 'human' systems and the matrices of the 'natural' environmental system, through 'artificial' and 'built' environmental systems: 'there are not two separate crises, one environmental and one social, but a single and complex socio-environmental crisis' (5). According to Alberto Magnaghi, territory as territorial heritage is a 'co-evolutionary historical construct as the result of reifying and structuring anthropic activities that have transformed nature into a territory in which material, socio-economic, cultural and identitarian sediments converge' (6). Its crisis is then not purely 'ecological', but also the result of inadequate planning and organisational models. Such models are subordinated to the values of a society, the 'modern' and especially the western one, which foresees the exploitation of both the natural and most of the human environ-

ment for profit. This makes it necessary to have 'boundaries' between society, nature and a significant part of humanity. As Patel and Moore remind us, 'modern society has a unique counterpart: nature. On the other side of 'society' there are no other human beings but the savage. Before society could be defended it had to be invented. And it was invented through the preservation of a strict boundary with nature' (7). Modern society is thus built on the need for 'distance' between human beings and nature, and between human beings 'aligned and non-aligned' with its ideology (the savages). Indeed, the functional organisation of the territory envisages, encloses and delimits a physical and cultural space as an individual space of 'possession and consumption', a space that we can regard as 'territory of modern society'. The crisis of the TI as an SES is therefore, more properly, a crisis of the 'territory of modern society'. Urban and territorial 'modern' planning - as instruments of the representation, design and control of transformations of the 'territory of modern society' – are, as a consequence, co-responsible for the processes of distancing and separating human beings from each other and from nature, in the service of profit and economic development. It is a service that stands in clear contrast to aims that should instead include safeguarding the quality of the environment and the availability of socio-ecological materials and resources, according to sustainable and regenerative logic, for guaranteeing all people similar living conditions in time and space. Evidence of this contrast can be found, for example, by analysing Italian territories like the Po Valley and the North-East, which are among the richest areas in the European Union and where both economic development and land control exercised by planning and public administrations are particularly strong. These are, in fact, among the areas where natural environmental matrices, particularly air (8) and soil (9), are most compromised. This confirms the dependence and subordination of urban planning and policies on economic development processes. Additionally, the spatial sense of territory in 'modern planning' envisages an organisation that is mainly functional, in that it is complementary to a 'confining' approach aimed at guaranteeing the maximisation of land revenue and which to this end privileges the quantitative aspects of the relationships between people, communities and environmental systems. In order to do so, 'modern planning' follows systematic and analytical approaches to a relational, systemic and complex reality, which is connoted as a qualitative and all-embracing experience: '[t]he functional approach therefore left out the place as a concrete 'here' having its particular identity' (10). It is a discretisation of the territory into zones and functions that fails to fairly represent or effectively manage anthropisation processes. It is a discrimination between natural, artificial and built environmental systems that today is very difficult to accept and recognise, given that these in fact and due to reciprocal multiple interactions constitute a 'single eco-technological system in which there are

continuous exchanges of energy, matter and information' (11). This is a circumstance that confirms our hypothesis of territory as an interface between social systems and physical environmental systems (natural and modified by humans). Therefore, planning eminently constitutes itself as a representation and construction of a territory as 'space' and 'surface', that of dichotomous public and private goods, but not as 'place', that of communities and common goods, of nature and the proximity between it and people. Moreover and above all, as far as this study is concerned, 'modern planning' does not constitute a clear and effective representation of the complex relationships between social and environmental systems that we imagine symbolised in the TI.
Planning shares with the idea of sustainable development a strong subordination to the values of modern society, confirming the need for a reformulation of the concept of sustainability, too, which should be complemented in my opinion by that of resilience. This is in light of considerable practical difficulties in applying the idea of 'sustainable development', for which what would be required is the (unlikely) ability to maintain an SES in a stationary equilibrium, whereas an integrative resilience orientation could instead accommodate imbalances and non-linear changes. These are difficulties that are confirmed by the delays and the poor or absent implementation of the Sustainable Development Goals (SDGs) issued by the United Nations. These difficulties also stem from an inconsistent 'procedural dimension': there is a strong imbalance in the sustainable development agenda among the voices that can effectively intervene in the relevant processes, alongside a lack of participation in planning processes. In both cases, project coherence is a kind of 'a posteriori synthesis', when 'all the games have been played out, and when proposing alternatives is essentially ... impracticable', except for a few. Only a 'truly representative participation of the various stakeholders', implemented upstream of the decision-making processes, is a prerequisite for sustainable, resilient and therefore fair change (12). The crisis of the territory of modern society and the impacts it causes on the social and environmental matrices defined above as extended, is therefore dependent on socio-economic values and techno-political organisational models: the aims and objectives of modern society, together with the methods of urban planning and territorial governance, are the main cause. In order to deal with them effectively, it will thus be insufficient to act 'only' on the (albeit) essential protection of natural environmental matrices, as these are fundamental for human health. Rather, it will be necessary to undertake a radical and collectively shared review of society's aims and objectives regarding the natural environment and territory as well as the very idea of sustainability, together with an equally radical review of the related planning and governance models.

2. Objectives

1. To redefine the territory SES in a systemic perspective, as an interface between physical (natural and human-made) social and environmental systems and as a collective common good.
2. To revise the values and tools of intervention on the TI through a critique of the technocratic perspective of the sustainable development of the linear market economy, towards a sustainable and resilient, circular and community participation approach of SESs as common goods.
3. To create a theoretical model for the systemic design of the TI between social and physical environmental systems, alternative and integrative to the predominantly functional organisation of planning, based on participation, systemic design (SD), social system design (SSD) and circular economy (CE).
4. To create a theoretical model for the structuring, representation and SD of the TI between social and physical environmental systems based on the eco-district (eco-district-systemic-design, EDSD) concept, as a 'minimum territorial module' aggregated in hierarchical articulations and as a model for territorial primary prevention (MTPP).
5. To integrate a digital environmental system, as a common good in itself, to collectively manage the processes of information, training and participation of citizens in choices concerning the TI. A system also able to integrate different categories of stakeholders (public, private, third sector, associations, communities, individuals, experts and academic institutions), so as to make participatory processes operationally feasible, particularly in contexts with large numbers of persons involved.

3. Methods

I consider territory, above defined SES, as an interface between social and environmental systems. This means considering it within a systemic perspective, that is, as an 'environment of other systems'. According to Gallopin, environment in a systemic perspective is not an 'absolute fact'. This perspective makes it possible to evaluate the environment within the framework of systems theory, starting from an abstract, general concept: a concept applicable to any 'real' system through a process of progressive specification of the most significant relationships it entertains with other systems. As an 'environment of other systems', the TI is therefore a system that influences the systems that compose it and/or are influenced by it. We can then say that a system, together with its environment (as TI), constitute 'the universe of objects of interest in a given context', a partition of the universe that can be made in many 'arbitrary' ways, as it depends on the intentions of the person studying that particular universe. That is, it depends on the point of view used (13). We can then define TI, from a systemic

point of view, as an 'integrated interdependent system transformed by the interaction between human and non-human action': a system as environment. However, environment as a system is not only a medium, something in which another system or element is immersed and through which forces and effects are transmitted, but a real functional set of interactions: not as the 'environment of something' but an 'environmental system' 13. Therefore, we can regard the TI as an interface between *human systems* (that is, societies, communities and individuals) and the systemic components that can be defined as the *natural environmental system* (the environment prior to human actions of transformation, which contains the 'life essential natural supports'), the *artificial environmental system* (the natural environment transformed by human action but not 'built' (countryside, landscape, etc.) and the *built environmental system* (the natural environment irreversibly transformed by human action).

The *natural environmental system* is the place where relationships between the biotic community (humankind, animals and plants), the earth (soil, water and air) and 'matter' occur. In Raffestin's reinterpretation of the concept of resource, human action causes utilities to 'emerge' from matter and become resources: 'matter (or substance), being at the surface of the earth or accessible from it, is assimilated to a datum, since it pre-exists all human action'. Without human action, matter 'remains a pure inert datum and its properties remain latent'; there are consequently 'no natural resources but only natural matters' (14).

Human systems modify the *natural environmental system* by extracting matter and creating *artificial* and *built* systems, within which they transform it into resources. *Artificial and built environmental systems* are also, in the forms of countryside, landscape and city, the places of relationships between people and communities. Resources, however, are not just 'objects', but 'a relationship that brings out certain properties necessary for the satisfaction of needs'; in other words, they are the creative product of relationships 14. Relationships are, in turn, systemic exchanges of flows of matter, energy and information, which we can see 'condensed' as forms at the level of the TI: only in a continuous process of confrontation between community and territory is a 'settlement culture' that transforms a territory into a place produced. This is achieved by constructing forms, which the community 'perceptively assesses', and managing flows that the community 'ecologically defines'; 'confronting with a local world allows a community to construct the world that will guarantee its life by triggering a continuous morphogenetic process'. It is a settlement culture that, by responding to both 'perceptual needs and ecological relationships', allows human systems to 'configure' the forms of landscape, countryside and city in a dynamic relationship that makes the world 'ecologically sustainable and perceptually seductive' (15). Forms of the built world and flows of matter, energy and information that mutually influence

and modify social and physical environmental systems, generating impacts that alter the matrices of all those systems, matrices defined here as 'extended'. These impacts are ecologically sustainable and perceptually alluring as long as there are strong relationships between community and place. Otherwise, when these relationships tend to get lost as today, such impacts became increasingly unsustainable and unpleasant.

Analysing 'extended matrices', not only natural environmental ones, can therefore facilitate a more complete and appropriate assessment of the systemic aspects of the impacts that are mutually generated between human systems and physical environmental systems. The idea of 'extended matrices' moreover fits in well with the recognition of territory and the natural environment as common goods, in line with the Italian constitutional dictate, for which these express 'functional utilities for the exercise of fundamental rights as well as the free development of the person' (16). Such recognition implies in fact both the inclusion of the matrices of all environmental systems in the same sphere and the need for an overall analysis of them in order to correctly assess their impact on persons as 'managers' of common goods. However, as the cited text very correctly points out, it is actually the 'community of reference to play a leading role in managing the common good, having first and foremost a constituent role that precedes the activity of management: it has the power to identify the way in which the territorial common good is organised in its circular relationship with the community itself'. In an innovative perspective of community participation regarding the effective management of the territorial commons, this implies the 'emergence of a society that organises itself not only to manage, but to identify those goods' (17). It is a request for participation that we can deem a local response both to the limits of the development of territory as a common good imposed by modern society and to the challenges posed by the Anthropocene, as the globalisation of great inequalities in the distribution of matters, resources and rights.

The classification of our era as the Anthropocene, a term coined in 2000 by the Nobel Prize-winning chemist Paul Crutzen, referring to the symbolic date of 16 July 1945 as the result of a study by the Anthropocene Working Group (18), introduced a radical change in the management of SESs, which are becoming increasingly global. Biermann identifies five elements that define the Anthropocene: it 'creates, changes or reinforces multiple interdependence relations within and among human societies'; it increases their functional interdependence; it introduces 'new intergenerational dependencies that pose novel policy challenges'; it is characterised by 'persistent uncertainty about the causes of Earth System transformation, its impacts, the links between various causes and response options, and the broader effects of policies';

and it is an era in which the human species experience 'extreme variations in wealth, health, living standards, education and most other indicators that define wellbeing'. This therefore requires new perspectives and innovative instruments in the direction of global governance, or 'Earth System governance' (19), not primarily for creating global institutions, but rather for developing socio-economic and techno-political innovation at the local level.

Moving from the values and tools of the neoliberal socio-economic system, which encourage consumerist individualism and discourage collective behaviour that pays attention to common goods and the environment, to other ones that are regenerative and socially and environmentally sustainable, being based on cooperation and participation (20), requires, in our opinion, the overcoming of techno-political models and processes of conception and governance of SESs based on 'planning', towards others based instead on participation, design and CE.
In fact, the success of planning rules and instruments in protecting and guaranteeing a balance in the availability and use of matters and resources and, consequently, in guaranteeing a balance between the quality of extended matrices and the related impacts on social and environmental systems, has been very limited. This failure owes to a lack of understanding of the systemic nature of territory and the natural environment which, although theorised, has remained poorly understood and even less applied. Nevertheless, the 'planning doctrine' is still defined as 'a systematic thought concerning the spatial organisation of an area, the transformation of that area, and the way in which both are pursued' (21). The failure is also due to the lack of management of processes of transformation of territory and the natural environment in a participatory sense, to the lack of measures in favour of the resilience of social and environmental systems, to bureaucratic and technocratic rigidity incapable of accepting the transformations proposed by local communities, to the adoption of only formal processes of participation, and to the (complicit) failure to contrast the phenomena of speculative rent and accumulation. All these elements have made (and still make) planning rules and instruments scarcely effective and poorly operative (22).
However, if the crisis of territory and environment is also caused by the limits of the planning 'doctrine', strongly conditioned by the values of 'modern society' in their management as collective 'common goods', these limits of 'technocratic' planning precisely push in the direction of a participatory one: if the former is supported by government apparatus, the latter must be supported by stakeholders. Therefore, in a theoretical model for the SD of the TI, the participatory approach as an experimentation of new forms of design and governance that counteract the inadequacy of current planning structures (23) will also play a fundamental role in the direction

of sustainability. Nevertheless, it will require the introduction of innovative forms of involvement of as many local actors as possible. This approach, in the current (and growing) conditions of scarcity of matters and resources, will also be more appropriate than the technocratic one in order to 'favour forms of negotiation, broaden consensus on projects, deal with problems in an integrated manner and co-responsibilize the users', that is, in the direction to activate collective decision-making processes (23). It is a practical way of implementing the concept of community empowerment proposed by John Friedmann in the direction of changing the dominant cultural and socio-economic models towards alternative ones, centred on people and the environment rather than on production and profit (24). After this change consistent with the change in values and models advocated above, a radical overhaul of instruments and methods of planning and governance of land transformation interventions will be necessary.

4. Results

It is my opinion we can summarise the 'emerging' innovative models and trends that go towards overcoming the socio-ecological crises and in so doing present a review of values and tools for intervention in territory and the natural environment as alternatives to modern technocratic planning, in the following points:

- City and territory are 'complex systems' characterised by relationships: urban and territorial plans are no longer definitive pictures of their future shape, but continuous processes of monitoring associated relationships. They do not end with approval: after deployment, they have to provide for continuous monitoring and updating. Their study involves physical-formal (structure) and social-economic (organisation) evaluations: monitoring the processes that establish relationships between structure, organisation and environment will make it possible to assess their outcomes;
- The systemic approach emphasises the importance of the design dimension (system organisation) as a configuration of relationships among the socio-ecological elements, a dimension scarcely considered in planning processes;
- The project as a configuration of complex relationships becomes an interactive process, characterised by participation and mutual learning among all stakeholders: its form must be distinguished by 'non-finiteness', so that the collective knowledge inherent in participatory processes can lead to its completion, likewise allowing its level of indeterminacy to be reduced (Heisenberger);
- There is the development of a 'social dimension' of the design, which requires mobilisation, participation and mutual education of administrators, experts and citizens. This is an action to guide society and social transformations starting from

the bottom, from the people;
- There are socially shared forms of exercising democracy, valorisation of local environmental, territorial and cultural heritages, reconstruction of public spaces as places for decision making about the communities' future. This includes the need to recover collective control, not only a public one, of the land regime as a common good;
- There is an in-depth revision of instruments towards flexibility, protection of the identities of places and communities and coherence. To this end a minimisation of the technocratic approach, characterised by control, closure of methods and tools and low transparency and new participatory approaches characterised by involvement, transparency and openness of all decision-making levels towards communities and territorial actors are requested. The involvement becomes foundational and is used to guide the different phases of the design action;
- There is the necessity to overcome the mono-functions of conventional planning and integrate them through the development of communication networks and public spaces, which are the real structuring elements of city and territory. Indeed, it is requested a new balance between the constituent components of the TI that are social systems and the natural, artificial and built environmental systems;
- General and local connections among approaches, choices and instruments in terms of coherence and identity. Empowerment of all actors are requested: the level of coherence between global and local cannot be limited to a confined approach, but has to be extended to the point of relationships among different societies and nations;
- A model based on socially and environmentally resilient sustainability of TI design and governance processes is requested in order to achieve better conditions for the fruition of cities and territories for all people.

The model I introduce is based on participation and SD. SD originates in systems theory and differs from other forms of design 'in terms of scale, social complexity and integration — it is concerned with higher order systems that entail multiple subsystems. By integrating systems thinking and its methods, systemic design brings human-centred design to complex, multi-stakeholder service systems. It adapts from known design competencies - form and process reasoning, social and generative research methods, and sketching and visualization practices - to describe, map, propose and reconfigure complex services and systems' (25). SD can therefore be regarded as an operational, experimental and innovative method to initiate the transition from a consumer economy to a circular one, due to its convergence towards the goal of a fairer and more environmentally sustainable society and economy. It differs from industrial design in its direct relationship with systems theory and for the adoption

of the principles of SSD (26): it originates in the disciplinary field of design, but shifts the focus from the product to the process and, although its aim is to reduce the wasting of material and energy resources, its main result is the creation of (systemic) relationships between processes and actors (27). In other words, it appears to be a suitable instrument for implementing the participatory revision of society's values, as they are necessary to face and overcome the socio-ecological crises of the TI that characterise the Anthropocene.

In the context of SD, studying phenomena that can be defined as eco-self-re-organisation is of considerable relevance: in complex situations, the actions of the system are mainly influenced by the relationships between the elements of the system that affect its organisation. In ecosystems, for example, this means that transformations can occur due to shocks (even dangerous ones) among those elements that are able to self-re-organise the system as a whole, a property that is often defined as 'order emerging from chaos'. Some self-re-organisations may also develop tendencies towards self-maintenance. In this regard, some initiatives of self-organised citizenship are very interesting, as they have proved capable of reorganising the functioning of parts of the city (eco-auto-re-organisation), as demonstrated by the activities of associations such as in Perugia (Fiorivano le viole Association) and Potenza (Italy), or Salvador (Brazil) (22). However, the interpretation of predictive models that anticipate such behaviour is impossible 3 or, in any case, very difficult.

It is precisely this interpretative difficulty that renders the emphasis that planning places on the decision-making part of the process excessive: when the decision is made, there is a tendency to overlook the fact that this is not a point of arrival, but the starting point of the process of transformation of the territory and the environment, because it is subject to the principle of so-called ecology of action. The dynamics constituted by the responses provided to the multiple partially blind 'actions and reactions' triggered downstream of the decision can significantly alter its intended effects: in the context of social systems, for example, some people will follow the decision taken, others will contest it, others will reinterpret it, others will wait without following it, and so on. In order for an SES to develop behaviours that are consistent with the decision-making processes initiated, it is therefore essential that the model is conceived and designed in a participatory form, that it is shared by the majority of the human components of the system and that the majority are in agreement with the model, according to the so-called hologramatic principle: the whole is made up of its parts and the whole is in every part (like DNA in human cells). If one wants to initiate a process of energy and ecological transition through the introduction of the principles of CE, for example, this will only be possible if the inhabitants are individually aware and act collectively in accordance with these objectives. Otherwise,

the result will not be achieved. A 'zero waste' strategy can be implemented through organisational processes of separate waste collection and cycles of re-use of secondary raw materials, but it must also become 'the default way' by which each inhabitant thinks and acts in order to reduce their consumption. The construction of the hologrammatic nature of a social system, in order to achieve common goals or objectives, is therefore a process that must involve the triggering of interactions between the individual and collective levels (3). This is to be achieved by means of educational paths to individual knowledge and awareness and the collective participation and sharing of planning and management choices concerning common goods. These paths must therefore be part of any innovative model that is introduced. However, it is also essential that the systemic design model include control mechanisms based on the presence of continuous feedback loops. In this way, the processes of self-(re-)organisation of the designed system can be improved or corrected; furthermore, it will be possible to improve and correct the decision-making processes on which the design was based. Moreover, it will be possible to support and not hinder the principle of the ecology of action and the dynamics of 'blind' causal responses due to the multiple reactions triggered in the system concerned and in the environmental systems involved by the action activated in the design process. Finally, it will be possible to facilitate the 'emergence' of the new properties of the system imagined during the conception and design phases.

Origins and theoretical-scientific references of the EDSD model

To better introduce the concepts and contents of the EDSD model, I will refer to the work developed in the working paper (Figure 1) by Roland Scholz and Claudia Binder titled *The paradigm of human-environment systems* (28). Here the authors introduce a structural process model that aims to investigate the mechanisms of regulation, feedback and control of human environment systems (HES), understood as 'all environmental and technological systems that are relevant for or affected by humans'. The definition of systems used by the authors refers to J.F. Miller's one, according to which systems can be regarded as 'a set of related definitions, assumptions, and propositions that deal with "cut-outs of" reality as an integrated hierarchy of organizations of matter, energy' and/or organisms. This definition is compatible with the definition of SESs that I use. The HES model considers human and environmental systems separately and assesses their interaction as a consequence of human environmental awareness and the short- and long-term environmental impacts generated, together with the feedback loops considered by human action.

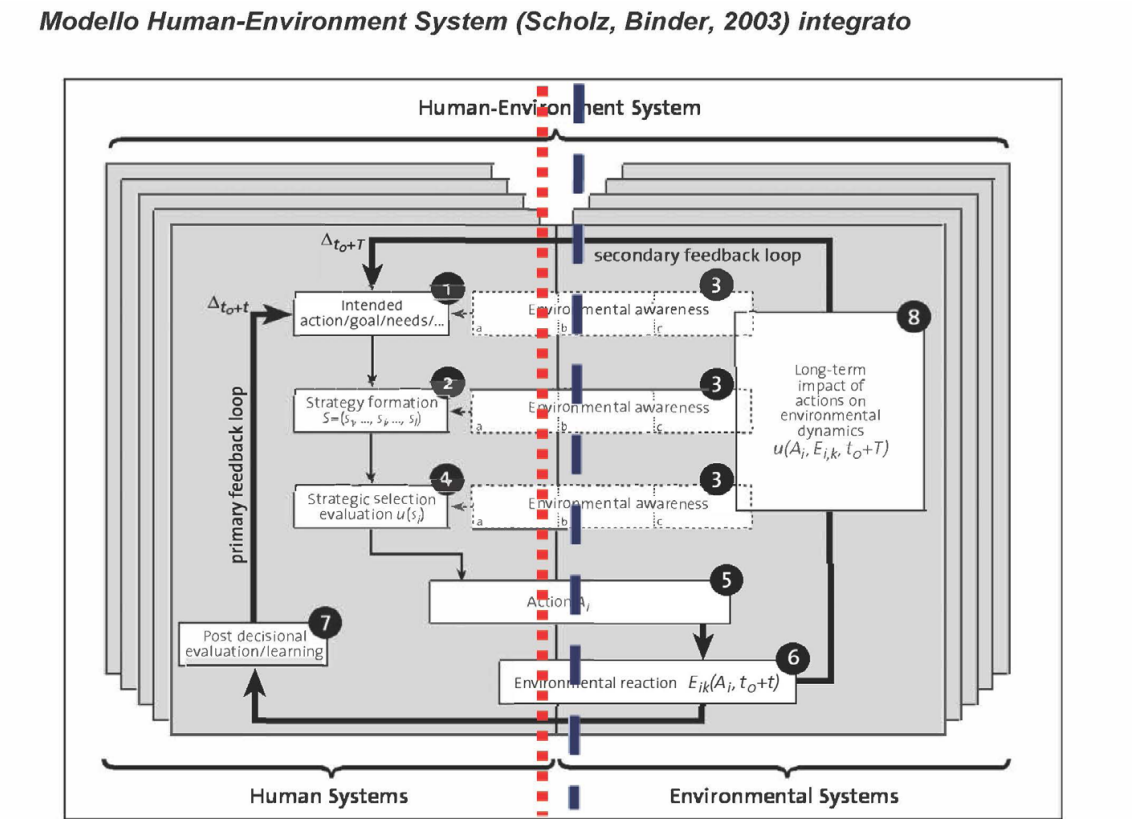

Figure 1: Human-environment system model (Scholz, Binder, 2003) integrated with the plane represented by the TI (long tract line) and with that constituted by the digital environmental system (short tract line).

Human decision making is the 'key factor' and assumes the ability of humans to regulate and control the type of interaction within the socio-ecological system. Human action is followed by the reaction of the environmental system, which generates feedback that should allow human systems the learning and adaptation necessary to fit their behaviour to the responses of the environmental systems. Human environmental awareness due to learning processes is differentiated in relation to the goals it sets, along spatial-temporal lines due to primary (short-term and spatially proximate) and secondary (long-term and potentially distant) feedback loops. Human systems are conceptualised on a multi-level hierarchy that starts with the cell, passes through the individual and ends with society: each level has different options for regulation and control, as regards both the human-environment system and the perceived feedback loops (28). The regulation mechanisms foreseen in the HES model are articulated in the phases of 'definition of aims and goals', 'formation and selection of strategies', 'action', 'environmental reaction' and 'impacts' in the short (primary feedback) and long (secondary feedback) terms. Human learning, resulting from the interaction between

social and environmental systems, is distinguished into post-decisional assessment/learning (for short-term impacts) and environmental awareness (for long-term impacts).

Taking the HES model of Scholz and Binder as a basis and reference, I foresee the following variations and additions (Figure 2).

The first is the introduction of the TI: human and environmental systems are not considered separately but jointly, as a projection on the TI of the respective hierarchical levels involved, a projection that is reflected locally in the ED as a spatial module. Graphically, this places it in the HES model (Figures 1 and 2, long tract line) as an 'orthogonal plane' of interaction between them, rendering the model 'ideally three-dimensional' (Figures 1 and 2).

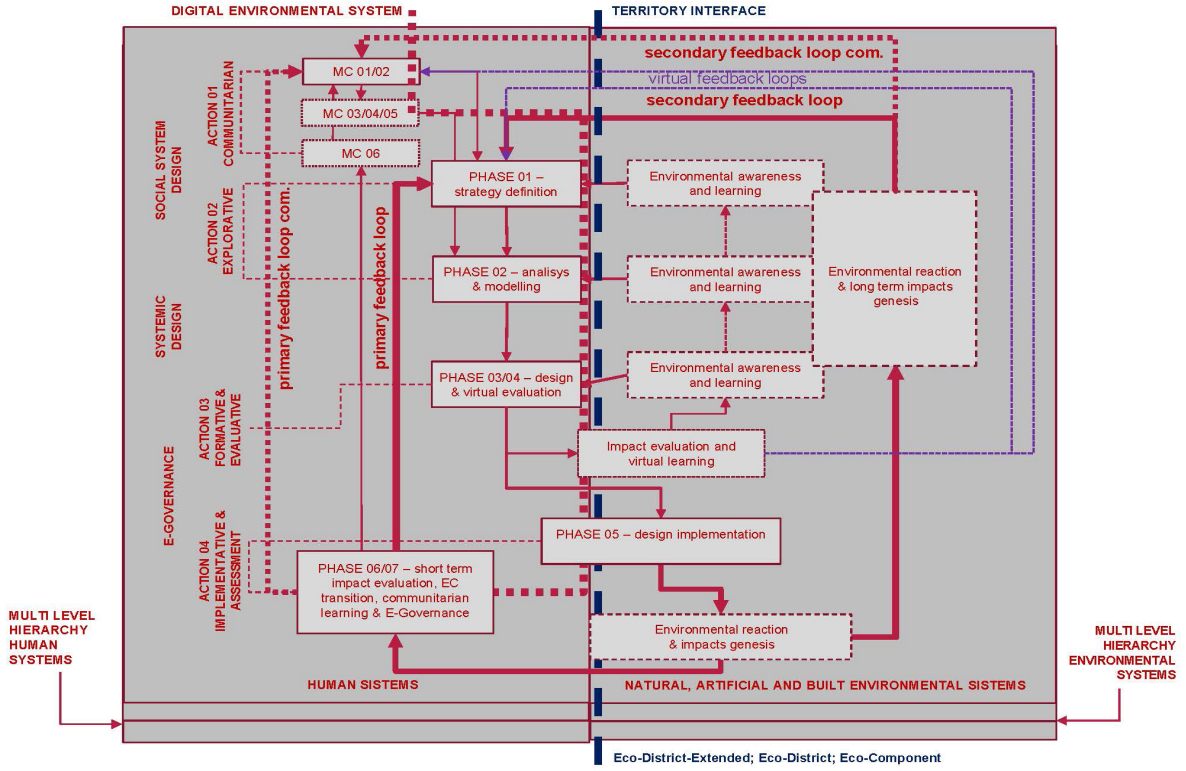

Figure 2: Synthetic graphic representation of the eco-district-systemic-design (EDSD) model; original reworking of Scholz and Binder's HES model by Francesco Masciarelli.

The EDSD model also assumes, as mentioned above, that the TI is organised in EDs, which constitute both 'minimum territorial modules' that can be aggregated into hierarchical articulations and the network structure capable of relating and integrating the different levels of the social and physical environmental systemic components.

This additionally foresees that the plan represented by the interface territory will be overlaid by another one in the form of a digital environmental system (Figures 1 and 2, short tract line), which will have the function, as 'immaterial space', of contributing to representing and making explicit the territorial physical space. Furthermore, the digital environment will have the fundamental aim of enabling the participation of as many social actors as possible.

Indeed, such participatory processes require that people have the possibility of effective access to and interact with the necessary information, presented in an easily understandable way. However, access and interaction are of little use on their own to trigger effectively participatory processes: in other words, innovative and powerful interaction tools are needed to enable people to choose and ultimately decide (29) with regard to territorial design and governance.

The EDSD model retains the hierarchisation of human systems envisaged in the HSE model with the seven levels proposed by Miller in 1978 and/or with others that may be necessary in relation to the requirements of the study: each hierarchical level will have specific human-environment relations with as many corresponding regulatory mechanisms. The aim of this structuring of the HSE model (and of mine as it is derived from it) is 'relating and integrating disciplinary knowledge'; that is, the hierarchisation of systems is intended to 'overcome the disciplinary structure of research', seeking to activate a multi- and trans-disciplinary approach by assigning specific hierarchical levels to different disciplines. Within each level, particular disciplinary insights can then be attained and integrated into the overall model. This is of specific relevance when one intends, as in our case, to promote the design of sustainable and resilient actions: according to Gunderson, Holling and Ludwig, 'one way to generate more robust foundations for sustainable decision making is to search for integrative theories that combine disciplinary strengths while filling disciplinary gaps'. The presence of hierarchical levels for human and environmental systems also allows for the integration of multiple feedback loops among the different systems, which in the development of the EDSD model additionally includes integrative virtual loops during the conception and design phases, as an overall balancing strategy due to the interaction between positive and negative loops. Finally, this presence allows for the activation of 'interfering regulatory mechanisms' which, in ecological or socio-ecological systems, as Hartvigsen, Kinzig and Peterson argued in 1998, help in 'understanding how change on one level of biological organization will alter emergent patterns or mechanisms at another level of biological organization' (28) and/or non-biological organisation.

The EDSD model is articulated in process typologies, action typologies, phases and moments. SD is the central process of the model, which also includes the processes

of SSD, as communitarian action preceding and following the participatory systemic design phase and as communitarian governance following the implementation phase of the territorial design. Actions are inspired according to the model developed by Van Patter and Pastor in 2013 (30) (Figure 3), here defined as exploratory, formative and evaluative, of which a rearticulation and integration is foreseen. In fact, compared to the model presented above, actions of verification and training of the community are added as necessary elements in the aim of any designed initiative linked to the TI. Training and evaluation actions are instead merged, as it is considered useful to carry out (virtual) evaluations as early as the design phase. Finally, a further action, defined as 'implementation and evaluation', is added with the aim of introduce and control the subsequent communitarian governance.

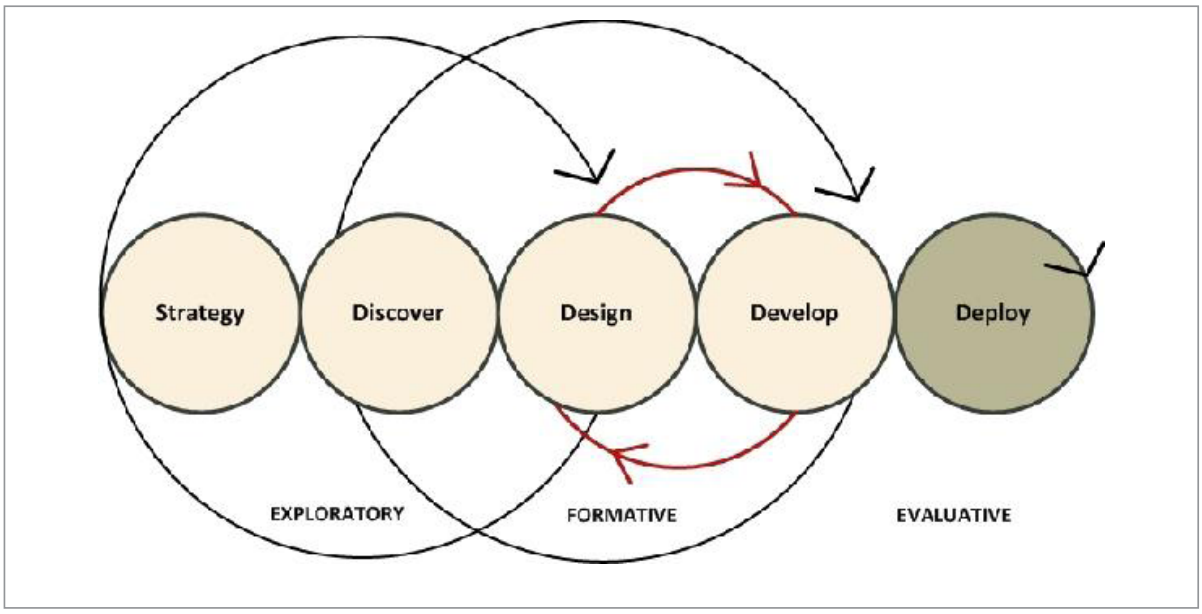

Figure 3: Service system design process model in Jones PH, Systemic design principles for complex social systems, 2014.

In the EDSD model we will have the following action typologies: communitarian, explorative, formative-evaluative and implementation-evaluative. The phases into which the model is articulated are a re-elaboration of the four sets of patterns developed by Van Patter and Pastor in 2013 in the so-called service system design process model (Figure 4), which is regarded as universally applicable to all four processes: discovery and orientation (strategy); concept definition and formation (discovery); optimisation and planning (design); and evaluation and measurement (development). These are followed, as shown in Figure 4, by an implementation phase (deploy) 30. They are also inspired by the methodology applied in the RETRACE project, coor-

dinated by Silvia Barbero. This envisaged five main phases that followed, as in our model, an iterative path, in which each deviation was checked and revised on the basis of feedback loops, which could change many times during the design phases to constitute an evolutionary path. We can summarise these phases as: qualitative and quantitative analysis (holistic diagnosis); selection of best practices; identification of problems; creation of solutions; and implementation of the project (31).

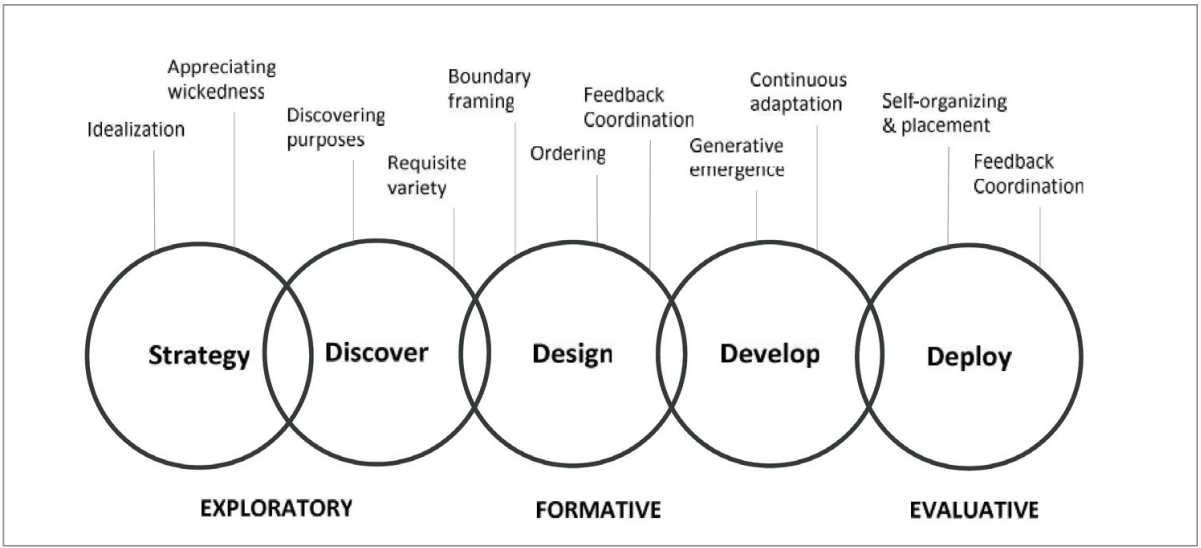

Figure 4: Design principles mapped to the design model in Jones PH, Systemic design principles for complex social systems, 2014.

The 'phases' of the EDSD model are the following: Phase 01, strategy definition; Phase 02, analysis and modelling; Phase 03/04, design (systemic) and virtual evaluation; Phase 05, implementation; and Phase 06/07, assessment of short-term impacts, transition to Circular Economy (CE)), post-implementation learning, communitarian e-governance (Figure 2).

Each of the above-mentioned phases is in turn articulated in moments (M), whose indicators are inspired and partly derived from the 'design principles' described in Figure 4 by P. H. Jones in *Systemic design principles for complex social systems* 30. The moments foreseen in the EDSD model have been integrated in order to facilitate processes of conception, design, implementation and governance of the SESs in which citizens and communities are involved in/are part. In the final part of the model, a verification of the transition of the TI development processes towards a CE is foreseen. This is considered crucial for the correct and complete implementation of the model, because the term 'circular economy', as a neologism combining theory and practice, describes an economic system in 'direct contrast to the symbol of modernity:

the linear economy'. The latter is an economy built around the extraction and transformation of non-renewable raw materials, production and consumption according to the 'cradle to grave' logic, which has devastated land and water by filling them with waste, moving carbon from the subsoil to the atmosphere, consuming soil and destroying forests. 'The circular economy is the natural enemy of this virus' (32). The gradual abandonment of the linear economic growth model – which is wasteful in terms of resources and non-renewable energies and socially inequitable – in favour of a circular economy can therefore have considerable advantages. It presents itself, in fact, as an agenda for a change in values that is not only environmental but also social, a long-term economic model for a more intelligent and effective use of natural materials and human resources. In other words, it is an environmentally and socially sustainable and resilient use that can make the economy stronger in the interests of all and not just a few.

In the EDSD model, the eco-district is the central element that structures the TI among the social and physical environmental systems and is articulated in minimum hierarchical territorial modules such as eco-district-extended, eco-district and eco-component. Being made up of natural, artificial and built human and environmental systems, all or just some, it is in itself, as mentioned already, an SES. Not referring exclusively to the physical, geographical or administrative dimensions of the territory, it is potentially variable in time and space due to the mutating reciprocal systemic interactions among the different physical social and environmental systems and has the task of (helping to) describe in dynamic terms the relationships between the relative local and global dimensions. The ED concept originates in the economic sphere, as the integration in the so-called productive district of 'sustainability aspects related to land protection, resource protection, health, safety, service provision and improvement of the quality of life' (33). First theorised by Alfred Marshall (1842-1924) in *Principles of economics* (1890), it developed around the concept of the 'industrial atmosphere': when a very large number of people doing similar jobs work in a limited area, 'the mysteries of industry are no longer mysteries. It is as if they were in the air, and children learn many of them unconsciously', as if the experience needed to carry out a specific job exists innately (34). It is interesting to note that Marshall (1919) stated that communities can be indispensable for superior economic performance: in his analysis of the Lancashire textile districts, he described them as economically competitive systems in which 'the secrets of industry are in the air', that is, they are collective communitarian resources (35). As a fundamental part of this descriptive element, the community can then be understood through the study of systemic processes related to the ED's interactions with the TI that influence its development. This rather than studying the territorial development focusing primar-

ily, or exclusively as in the case of urban or territorial 'modern' planning processes, on its spatial, structural or demographic characteristics. The concept of ED therefore introduces, from its origin, sustainable and resilient development objectives such as the minimisation of 'environmental, economic and social' costs. It introduces also the definition of innovation objectives through a different organisation (or self-organisation) built around a district's 'own atmosphere', in which social, economic and cultural experiences are common, or in which one (or more) communities are present and active. In this sense, therefore, I define ED as a 'collective commitment that the community of stakeholders of today assumes, with respect to the communities of stakeholders of tomorrow, to take action for the regeneration and preservation of the extended matrices of a portion of TI, and of the related materials and resources, as common goods'.

The EDSD model I introduce is thus based on a participatory-systemic approach and involves a shift from a positivist to a complexity paradigm. This does not imply a use of different models, but rather a different use of models: whereas the former simplifies the concept of 'causality' by taking into modest consideration the relationships among the elements studied, the latter claims that phenomena 'emerge' from multiple interrelated causes. Even in the context of complex systems such as territory, models can be used to reduce their complexity by considering the interrelationships among their elements in a deterministic manner. This is enabled by the growing capacity of computers to process enormous quantities of data on such relationships, making it possible to simulate non-linear interactions (3). Through the integration of computer models, the SD is able to offer cognitive and interpretative tools that, through virtual representations, allow all territorial actors to evaluate the relationships between the elements of a system and the relative effects on the environmental systems with which it interacts. A virtual representation which could also allow to facilitate anticipating, or recognising, the new properties of the system that may 'emerge' from those relationships and that can be predicted by 'interpreting' the models elaborated virtually during the design process.

In consideration of the extreme complexity inherent in the processes of representation, design and evaluation of the interventions on the territory, summarised in the EDSD model, I deem it necessary to integrate into the model what I define as a 'digital environmental system'. This 'immaterial space', a synthesis of the physical space represented by the TI, is created through the use of computer language and is made accessible through fixed and mobile electronic devices. It contains information that expresses a design and creative potential capable of translating the physical space

into a format that can be used and accessed remotely, facilitating participatory forms of experience, training and decision making. Based on Google Maps or geographical information systems, it can make use of specific social WEB platforms designed for participation in decision making and planning processes, such as PlanYourPlace, CitizenLab or QCumber 22. The digitally created immaterial virtual space significantly increases and facilitates the possibilities of interaction and action, by means of training and information processes which can also be easily integrated into it. This is thanks to the alternative possibility of understanding the physical space and to the use of collectively sharable modalities especially, but not only, in the presence of a large number of stakeholders, without encountering the limits posed by the need for physical presence (36).

Among the organised territorial actors, as an alternative to public and private actors only, I believe a prominent place should be occupied by the third sector and associations by virtue of their 'non-profit' constraints, whereby their operations should not become a source of profit but rather a way of collectively redistributing income from economic factors linked to the urban and territorial economy. In addition, the implementation of a social economy, which implies autonomy, participation and diversity, could indeed represent a suitable means to provide financial and operational instruments of participation to local communities, and its potential could be considerably enhanced by the use of a digital environmental system's operational tools. In a previous article 22 I defined this process of widening the space for organised participation, extended to the third sector organisations involved in bottom-up design processes of city and territory regeneration through the management of digital content and the use of participatory web platforms, as 'Digital Social Economy' (DSE), based on the previous analogous definition of Nasioulas and Maris (37) (Figure 5).

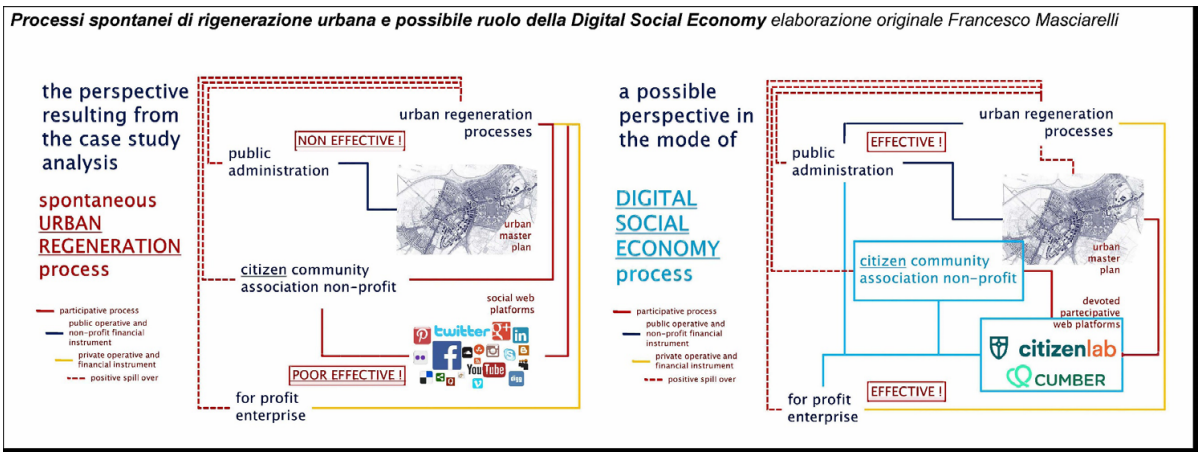

Figure 5: Spontaneous urban regeneration processes and the possible role of Digital Social Economy, original elaboration by Francesco Masciarelli.

The result of this preliminary study on systemic and participatory TI design is the EDSD model, shown in Figure 2, which I briefly describe below. For a detailed and complete description of the EDSD model, which is beyond the scope of this article, please refer to the full text on the EDSD model, currently being revised and soon to be published. In the model there are, as mentioned above, processes, actions, phases, moments and various indicators in a succession that should not be understood, as it is not rigidly determined. Rather, the different modules are reciprocally related to each other and each part can be revised on different scales in relation to the different interactions with the other parts of the model. In essence, alternative uses of the model and of its components can be envisaged along the path from communitarian conception to the implementation of the planned changes.

The model starts with action (communitarian) AC01, with Phase P01 (strategy definition) and AC02 (explorative), which can be ascribed to an SSD process. AC01 (community setting) is articulated in moments communitarian (MC) which, in the setting phase of the process, foresee the analysis of the organisation and structuring of a community in order to achieve common goals and objectives.
MC01: community 'capacity' check;
MC02: assessment of community action characteristics.

The process then continues with P01 (strategy definition) of AC02 (explorative), consisting of:
MI-a: idealisation 01;
MI-b: problem recognition;
MI-c: purpose importance;
MI-d: ED definition first hypothesis: eco-district-extended (EDE); eco-district (ED); eco-component (EC);
MI-e: definition of strategies, processes and tools for sharing;
MI-f: collection and adequacy of resources.

After P01 and before the passage to P02 of AC02 (explorative), a communitarian assessment is planned to activate through further MCs of AC01.
MC03: assessment of what the community 'contains';
MC04: assessment of the sufficient existence of knowledge;
MC05: assessment of empowerment and of the presence of forms of sharing and participation.

Having completed P01 and the communitarian audit, the process continues with

P02 (quantitative and qualitative analysis, modelling) of AC02 (explorative), consisting of:
MII: definition of systemic relations on a quantitative basis in relation to the 'de facto' situation.
MIII: definition of systemic relationships on a qualitative basis and modelling, divided into:
MIII-a: variety of the control system;
MIII-b: definition of problem boundaries;
MIII-c: idealisation 02 (definition of intermediate design models and selection of best practices).

Once AC02 (explorative) and the initiation (analysis) and assessment part of AC01 (communitarian) have been completed, Action 03 (formative and evaluative) is activated, divided into Phases 03 and 04.
The Phase 03 (design) of the AC03 (formative) is articulated in:
MIV: eco-district-systemic-design.
MIV-a: ordering as SES organisation;
MIV-b: emergency;
MIV-c: self-organisation and self-adaptation;
MIV-d: eco-district-systemic-design.
P02 (analysis and modelling) of AC02 (explorative) and P03 (EDSD) of AC03 (formative) can be ascribed to an SD process.

Once P03 (EDSD) has been completed, we move on to P04 (virtual evaluation), for a digital reconnaissance of the 'extended' impacts on all social and environmental systems. This generates a first set of feedback loops (first-order feedback) and learning for the experts, communities and stakeholders involved on a virtual basis, through a custom-designed digital environmental system.
MV: virtual impact assessment at ED level, learning and feedback coordination. MV-a: virtual evaluation of extended matrix regeneration;
MV-b: virtual feedback coordination (first-order).

After the completion of AC03, Action 04 (implementation and assessment) commences. It consists in the implementation of the planned solutions, divided into P05 (implementation) and P06 (assessment, verification of transition to EC and start of governance). Following the implementation of the interventions, feedback loops are activated, resulting in the environmental reaction and the generation of impacts at the level of the 'extended' matrices in the 'short term' (second-order feedback), as-

sessed in P06, and in the 'medium and long term', which generate a further series of feedback loops (third-order feedback) and learning, based on the real impacts found on the 'extended' matrices.
P05 of AC04 (implementing part) foresees the actuation of what has been planned in the previous phases, already possibly integrated with corrections (negative feedbacks) or confirmations (positive feedbacks), deriving from the feedback and/or virtual learning paths activated so far.
P06 of AC04 (assessment in general and specifically of the transition towards CE) foresees the evaluation of the impacts generated on the 'extended' matrices in the short term, articulated in:
MVI: first part, an assessment of the regeneration of extended matrices, coordination of second-order feedback and definition of ED constraints or protection;
- MVI-a: operational assessment of extended matrix regeneration;
- MVI-b: feedback coordination (second-order);
- MVI: second part, which foresees the assessment of the transition towards CE, articulated in:
- MVI-CE 01: soil as natural capital, SDG 15;
- MVI-CE 02: resources as natural capital, SDG 15;
- MVI-CE 03: shared values and territorial communities in the eco-district-extended;
- MVI-CE 04: social inclusiveness;
- MVI-CE 05: reconstituting networks and social capital;
- MVI-CE 06: socio-environmental certification or qualification;
- MVI-CE 07: stakeholder empowerment;
- MVI-CE 08: circular design, eco-design;
- MVI-CE 09: policies, innovations and investments for CE.

P07 of AC04 (governance) provides for the assessment of the impacts generated on the 'extended' matrices in the short term and is articulated in:
MVII-a: (e)governance of common resources following the indications of Elinor Ostrom (38);
MVII-b: feedback coordination (third-order);
MVII-c: confirmation of constraints or protection of the ED.
P04 (virtual evaluation) of AC03 (evaluative) and P05 (implementation), P06 (evaluation of short-term impacts and learning, evaluation of transition to EC), P07 (community governance) of AC04 (implementation and assessment) can be ascribed to a governance process.

At the end of the model, we foresee a referral to AC01 (communitarian verification) as

MC06, whose purpose is to verify, through an indicator partly derived from the previous ones, the development of the community system for the purposes of ED governance. It is an indicator that can be parameterised, in terms of 'observable' results, as the average between the social capital generated by the social networks and the achievement of community results obtained by the formal and informal networks (39).

The constant and continuous presence throughout the EDSD process of feedback loops, which send control information to the previous parts of the process, confirms its 'circularity'. This is also enabled by the fact that it is not intended to be a causal and linear model, but a systemic, predictive and emergent one. The results do not derive from the correct implementation of the model as proposed, but from its correct interpretation, or reinterpretation with respect to common goals and objectives, strategies, design and management models collectively imagined and adopted. All of this has to be suitably related to the different hierarchical levels of the social and environmental systems involved, interacting in the EDs of the portion of the TI being studied.

5. Discussion and conclusions

The socio-ecological crises of our era, defined as the Anthropocene, began with the new role assumed by a part of humanity on the planet: from being a species that underwent and adapted to the changes imposed by the natural environment, it became a species that modifies the environment in relation to its own needs and, therefore, the 'driving force of the planetary system'. The values on which these changes are 'built', values that we have simplified as 'values of modernity', are based on economic development and the growth of accumulation and income processes resulting from environmental and territorial transformations, which have hitherto been regarded by the 'culture of modernity' as endless. These processes required the confinement of nature as an element from which 'modern society' had to be defended and as a premise for its 'invention', a society that is thus built on the need for 'distance' between human beings and nature, and between human beings 'aligned and non-aligned' with its ideology (the 'third world', the 'savages'). The functional organisation at the service of the transformations of the environment and territory, due to the techno-political processes that we define as urban and territorial planning, encloses and delimits the physical and cultural space of 'possession and consumption' that we regard as the 'territory of modern society'. The socio-ecological crises of our era can therefore find, in my opinion, adequate representation in the crises of what I have defined as the 'territory of modern society', as they are social and environmental crises simultaneously. This research work, the results of which are still partial and whose hypotheses are to be shared (in a participatory manner) and verified through fieldwork, has started

from the consideration of the natural environment and territory as common goods and SESs, in order to (attempt to) recover an integrated concept of humans-in-nature. This requires both the overcoming of the so-called values of modernity towards participation, resilient sustainability, equity and regenerative circularity, and the overcoming, through paths of integration as a premise, of the techno-political tools of urban and territorial planning. To this end, I have imagined, starting from the work of Roland Scholz and Claudia Binder (2003) on HES, a re-composition of the human-in-nature perspective as a model (EDSD), in which the interactions and relationships between human and environmental systems (natural, artificial and built) can be represented as a projection in what I have defined as the TI. TI is thus a socio-ecological environmental system and a common good, and it represents the central element of the EDSD model as it is the central element of the graphical representation of that model. Finally, TI becomes the place for representing, planning and preserving interventions on the ecological and social matrices, defined here as 'extended', of the various social and physical environmental systems affected by territorial transformations. I believe that reducing or eliminating impacts on 'extended' matrices means moving towards a perspective of 'resilient sustainability', that is, seeking a re-composition of the socio-ecological crisis not only around the (indispensable) themes of protecting environmental and human health, but also around that of social equity. The SES crises are in fact linked both to the degradation of natural and artificial environmental systems and to the moral degradation of human systems and the built environment, especially in urban areas: the former as 'the relational impoverishment of people among themselves'; the latter as the degradation 'of the everyday living environment, with particular reference to the phenomena of unrestrained urbanisation of metropolitan suburbs, areas of high population density and highly industrialised ones'. The achievement of an effective and equitable ecological balance can therefore only take place by tackling the structural causes of degradation 'extended' to all social and environmental systems on the planet. This requires a change in the 'values of modernity' in the direction of a 'new solidarity' within the various social systems and between these and all environmental systems, thereby finally paying attention to equity, especially in 'the relationships between the developing countries and the more industrialised ones' (40).

The model, articulated in minimum hierarchical territorial modules defined as ED, EDE and EC, is interfaced with a 'digital environmental system' as an 'immaterial space' synthesis of the physical one (represented by the TI), in order to be accessible from electronic devices. It contains information capable of activating the design-based and creative potential of each category of territorial actors, thus facilitating participatory forms of experience, training and decision making in the design and

governance of transformations of the socio-ecological commons.
The model envisages the activation of processes based on systemic and social design, a process that originates in the (ascertained and preliminary) presence of communities capable of personally assuming responsibility for the design and management of the socio-ecological commons. It continues with communitarian, explorative, formative and implementation actions, supplemented by evaluations obtained from feedback loops. It also envisages variously (but not rigidly) structured and configurable phases and moments as well as circular verification paths, with the aim of giving people back their knowledge, skills, design and decision-making opportunities. The final aim is to try to operationally recover that perspective of humans-in-nature, inextricably linked to a collective and circular management of common goods, without which the current socio-ecological crises, including those relating to human health, will be very difficult to successfully overcome.

Reference list

1. Petrosillo I, Aretano R, Zurlini G. Socioecological systems, reference module in earth systems and environmental sciences, Elsevier. 2015 22-July-15 doi: 10.1016/B978-0-12-409548-9.09518-X.
2. Magnaghi A. Una metodologia analitica per la progettazione identitaria del territorio. In: Magnaghi A (ed.) Rappresentare i luoghi, metodi e tecniche. Firenze: Alinea; 2001, p.7-52.
3. Real M, Larrasquet J M, Lizarralde I. A. Complementary view on complex and systemic approaches. In: Barbero S (ed) Retrace + Systemic design method guide for policymaking: a circular Europe on the way Vol. 1. Torino, Italy: Allemandi: 2017. p. 83-90.
4. Treccani. Available from: http://www.treccani.it/vocabolario/interfaccia/ [Accessed 22th June 2021].
5. Santo Padre F. Lettera enciclica laudato si' del Santo Padre Francesco sulla cura della casa comune. Città del Vaticano: Libreria Editrice Vaticana; 2015.
6. Poli D. Il patrimonio territoriale fra capitale e risorsa nei processi di patrimonializzazione proattiva. In: Meloni B. (ed.) Aree interne e progetti d'area. 2015; p.123–140.
7. Patel R, Moore AJ. Una storia del mondo a buon mercato. Milano: Feltrinelli; 2017.
8. Ricapitolando .. l'ambiente, annuario dei dati ambientali 2018. Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA); 2019.
9. Consumo di suolo, dinamiche territoriali e servizi eco sistemici. Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA); 2019.
10. Norberg-Schulz C. Genius loci. Milano: Electa; 1984.
11. Magro G. Open data e ambiente. Milano: Edizioni Ambiente; 2015.
12. Stocchiero A et al. Sviluppo sostenibile: per chi? Una visione critica per la coerenza delle politiche italiane ed europee. Rapporto di monitoraggio sull'applicazione dell'Agenda 2030 in Italia. Global Call to Action Against Poverty; 2018.
13. Gallopin G C. The abstract concept of environment. International Journal of General Systems. 1981;7(2): 139–149.
14. Raffestin C. Per una geografia del potere. Milano: Unicopoli; 1981.
15. Saragosa C. Segnali di uso innovativo dei processi di pianificazione. In: Marson A. (ed.) Urbanistica e pianificazione nella prospettiva territorialista Macerata. Quodlibet; 2020, p.48–49.
16. Commissione Rodotà, Proposta di modifica delle norme del Codice civile in materia di beni pubblici,

art. 3 lett. c", 2). In: Law Clinic, Perugia State University, Relazione illustrativa al progetto di legge regionale 'Norme in materia di partecipazione, ecodistretti, economia circolare e giustizia ambientale'. Perugia; 2020. p. 1-25.
17. Rodotà S, Verso i beni comuni. In: Riv. Critica del diritto civile. 2017; 4: 495. In: Law Clinic, Perugia State University, Relazione illustrativa al progetto di legge regionale 'Norme in materia di partecipazione, ecodistretti, economia circolare e giustizia ambientale'. Perugia; 2020. p. 1-25.
18. Treccani. Available from: http://www.treccani.it/vocabolario/antropocene_%28Neologismi%29/
19. [Accessed 22th June 2021].
20. Biermann F. The Anthropocene: A governance perspective. The Anthropocene Review. 2014;1(1): 57–61.
21. Ricoveri R. Elinor Ostrom e i beni comuni. In: Relazione al seminario promosso dalla Associazione nazionale fra le Banche Popolari e il Centro Federico Caffè. Roma; 2013.
22. Carta M. Teorie della pianificazione: Questioni, paradigmi e progetto. Palermo: Palumbo; 2003.
23. Masciarelli F. Sustainable systemic urban planning: Principles and trends. WEENTECH Proceedings in Energy . 2019;4(2): 196–202. Available from: https://www.researchgate.net/publication/330296859_Sustainable_systemic_urban_ planning_principles_and_trends [Accessed 22th June 2021].
24. Casu A. La partecipazione: "Pubblici plurali" in scena. In: Angelini R, D'Onofrio R. (eds.) Comunicazione e partecipazione per il governo del territorio. Milano: Franco Angeli; 2014.
25. Friedamnn J. Empowerment: The politics of an alternative development. University of California; 1990.
26. Bailey J. Elements of novelty: Designer as policy-maker. In: Barbero S (ed) Retrace + Systemic design method guide for policymaking: a circular Europe on the way Vol. 1. Torino, Italy: Allemandi: 2017. p. 43-50.
27. Jones P H. Design research methods for systemic design: Perspectives from design education and practice. In: Metcalf G. (ed.) Social systems and design; 2014.
28. Bistagnino L. Systemic design: Methodology and principles. In: Barbero S (ed) Retrace + Systemic design method guide for policymaking: a circular Europe on the way Vol. 1. Torino, Italy: Allemandi: 2017. p. 75_82.
29. Scholz R W, Binder C R. The paradigm of human-environment systems, working paper 37, ETH; 2003.
30. Florentino PV, Rocha MCF, Pereira GC. Digital social networks and urban spaces. TeMA, Journal of Land Use Mobility and Environment, DICEA. 2014.
31. Jones P H. Systemic design principles for complex social systems. In: Metcalf G. (ed.) Social systems and design; 2014.
32. Barbero S. Systemic design as effective methodology for the transition to circular economy. In: Barbero S (ed) Retrace + Systemic design method guide for policymaking: a circular Europe on the way Vol. 1. Torino, Italy: Allemandi: 2017. p. 83-90.
33. Bompan E. Circular economy: Definition and evolution. Principles and development. In: Barbero S (ed) Retrace + Systemic design method guide for policymaking: a circular Europe on the way Vol. 1. Torino, Italy: Allemandi: 2017. p. 16-23.
34. Merli R et al. Indagine conoscitiva sull'attuazione di EMAS nei Distretti italiani. II Parte. Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA); 2014.
35. Treccani. Available from: https://www.treccani.it/enciclopedia/distretto-industriale_%28Dizionario-di-Economia-e-Finanza%29/ [Accessed 22th June 2021].

36. Storper M. Society, community, and economic development. Studies in Comparative International Development. 2005;39: 30–57. Available from: https://doi.org/10.1007/BF02686164 [Accessed 22th June 2021].
37. Treccani. Available from: http://www.treccani.it/enciclopedia/ambiente-digitale_%28Lessico-del-XXI-Secolo%29/ [Accessed 22th June 2021].
38. Nasioulas I K, Maris N. Toward the digital social economy: institutionalizing collective action in the ever-evolving web. Sociology Study. 2011;1;5; 340-345.
39. Ostrom E. Governing the commons: The evolution of institutions for collective action. Cambridge: Cambridge University Press; 2015.
40. Hinds D G. Building community capacity: Environment, structure, and action to achieve community purposes. Madison: University of Wisconsin; 2008.
41. Bignami B. La qualità dello sviluppo: L'etica ecologica di Carlo Maria Martini. Aggiornamenti Sociali, February 2020: 146-155.

6. Abbreviations table

- Socio-ecological systems – SESs
- Eco-district – ED
- Eco-district systemic design – EDSD
- Territory-interface – TI
- Model for territorial primary prevention – MTPP
- Sustainable Development Goals – SDGs
- Circular economy – CE
- Eco-district-extended – EDE
- Eco-district – ED
- Eco-component – EC
- Systemic design – SD
- Social system design – SSD
- Digital social economy – DSE
- Human environment system – HES
- Action – AC
- Phase – P
- Moment – M
- Moment Communitarian – MC

Declared conflicts of interest: none