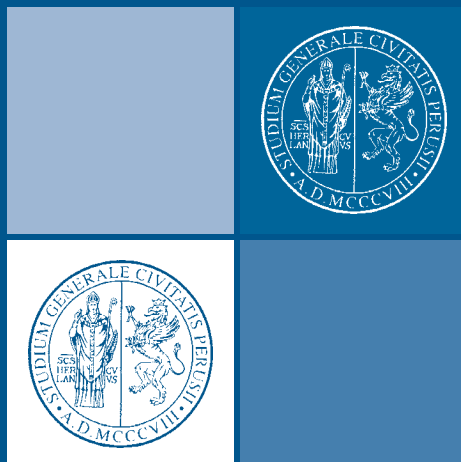


# SISTEMA SALUTE

## La Rivista italiana di educazione sanitaria e promozione della salute

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rivista del Centro Sperimentale per la Promozione della Salute  
e l'Educazione Sanitaria dell'Università degli Studi di Perugia



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# SISTEMA SALUTE

## LA RIVISTA ITALIANA DI EDUCAZIONE SANITARIA E PROMOZIONE DELLA SALUTE

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## Foreword

### *Sistema Salute experiments new editorial approaches*

The editorial board of this journal undoubtedly enjoys a privileged advantage on the production of scientific texts on health promotion, health education, organisation of social and health services, development of epidemiological knowledge and the needs to which public health can provide effective responses.

We now are sharing opinion that society taking place changes profoundly altered the ways these important health functions are developed, documented and then disseminated at health services various levels, institutions, university world and disadvantaged people associations committed into promotion and health and environment protection.

We are witnessing a lasting and worrying decline in receiving scientific articles, implying a proportional decline in their production: probably due to a series of very broad factors, ranging from the disappearance of last century political subjectivities leading to the birth and development of NHS and functions above mentioned as well, reduction in the number of workers engaged actually in NHS, thanks to austerity policies and real assessments by central government on personnel over the short term need, as well as the disappearance of many personalities who contributed with their wealth of proposals to the development of journal covered functions. Further support to the rarefaction of the contributions may derive from a greater overall attention to activities offered at different levels of NHS, to publishing in our journal scarce reward offering authors in impact factor terms, insufficient audience - by only Italian-language readers - from dissemination restriction of content due to the partial indexing on global search engines in turn justified by the prevalence of narrative styles based on personal opinions rather than on properly planned and evaluated experiences, or on scientific literature reviews.

While political subject of twentieth century has disappeared, on a more general level we are witnessing growth of territorial and global disputes for health and



environment in face of the obvious limitations of the current production system and its tendency to propose false solutions to environmental degradation and health problems incessantly produced. These disputes, ranging from struggles seeking to counter the increasingly evident climate change and environmental degradation, produce new power in the promotion and protection of health, in defence of territories from pollution and workplaces from harmfulness, but not always finding space and reasons for interaction in NHS services, either because the companies management prevents operators from freedom of fundamental interaction to dialogue with movements, or because institutions not always perceived as benevolent by movements themselves; either because in many cases the prevention current legislation is more oriented towards the maintenance of defined risk productions, even if they are polluting and harmful to the health of those involuntarily exposed; finally because for many years prevention services have enjoyed a total delegation on environmental prevention being exercised with technocratic approaches; a focus on the health proximal determinants justified as scarce towards the distal determinants, combined with an equally scarce attention to struggles added value of those exposed to environmental pollution bring. In this way, the disputes often remain at the level of the production of “grey” material which is published on social networks without expressing the information potential, interaction with prevention services and wealth of contained issues. Starting from the here briefly mentioned issues, we decided to diversify and enrich our editorial approach by proposing to readers and experts of the subject some experiments providing a new articulation of Sistema Salute as it follows:

- a. an editorial space opening dedicated to health disputes (based on quality of solicited materials whether in the form of an annual dedicated issue either in form of a dedicated column in each issue); to document them, promote their knowledge, refine the arguments, allow them to be read across the board in order to enhance their impact and produce greater osmosis between the needs expressed by those exposed through them and the activities of services, local institutions and universities;
- b. greater interaction with the NHS, universities and local institutions aimed at stimulating production of texts on health promotion related issues;
- c. launch of an annual issue in English in which articles evaluated by the Editorial Committee, among those published in the last year, to be proposed to a global audience as they meet the criteria of methodological quality in text articulation, focused on general interest issues and with significant innovative elements in approach and proposal.

In this perspective this issue contains six articles with following specific contents.

*Milena Vainieri et al.* present tools developed to evaluate chronic patient pathway performance, reiterating need for measurement systems able to assess the organisations ability in decisions making and implementing effective actions.

*Carlo Romagnoli* examines, on research in sociology of organisations basis, health policies, organisational design parameters and criteria inspiring corporatisation of NHS and highlighting how critical economists see in the growing role of the knowledge economy reasons in order to overcome corporate ownership logic.

*Guido Citoni et al.* discuss the SARS-COV 2 pandemic challenges from a health economics perspective, reporting on evidence of income-based equity in health services use and financing. The authors warn the risk of an triggered pandemic economic crisis by the that will increase socioeconomic inequalities and thus further reduce the equity of the public health system.

A model for territorial primary prevention is proposed by *Carlo Romagnoli, Anna Rita Guarducci, Fabio Neri, Lucio Pala and Giovanni Vantaggi*, who reconstruct the process of an eco-district sharing and developing, identified on the basis of careful interaction with the environmental committees in which they participate in various capacities. This operation is developed paying great attention for health, environment and economy advantages, given availability, in the current economic situation, of substantial economic resources for those willing give substance to the development of eco-sustainable innovations and concrete knowledge on the common management of these matrices.

*Massimo Formica*, a medical doctor who reflected for years on agro-ecology potential, explores a territorial primary prevention model characteristics centered on the organic district. He starts from a profound knowledge of the properties, characteristics and specificity of that part of the organic world that comes into contact with the techniques used in agricultural production. He tackles the problem of these practices management characteristics and the consequent production of food in order not to be “disruptive” of the underlying complex systemic balances.

The bio-architect *Francesco Masciarelli* makes a further leap forward of ecodistrict territorial primary prevention model complexification, placing it within a systemic and participatory design of the socio-ecological matrixes as an interface between human and environmental systems. After decades of territories brutalising with policies of pure service to the private sector, *Masciarelli* provides a contribution that is as rich as in-depth to rethink urban planning policies capable of sustaining reality complexity, providing a systemic modelling that fully restores the meaning of the expression “making health in all policies”.

We hope those carried out experiments will stimulate new energies and manage

to interact with those which are now being expressed in society, thus helping to broaden their impact.

We ask readers to offer contributions interfacing new editorial structure, and to develop observations and criticisms allowing us to further improve *Sistema Salute* and overcome the current impasse of the journal.

On behalf of the Editorial Board

Carlo Romagnoli

Lamberto Briziarelli

Filippo Bauleo

## Assessing the performance of the chronic care pathway

Milena Vainieri, Alice Borghini, Sabina Nuti

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*Key words:* chronic condition, performance, pathway, integration

### SUMMARY

*Objectives:* value is a key point in a healthcare system, it can be detected through the implementation of performance measurement systems that evaluate the ability of organizations to take decisions and implement actions aim to create and provide value for the population. To reach this goal are needed performance representation tools that help to read health services in an integrated way. The aim of our paper is to describe the implementation into the performance measurement system adopted by 10 Italian regions a new tool that can assess the value creation process across multiple healthcare organizations adopting the patient with chronic disease perspective.

*Methods:* the article describe the case study of introduction of a new representation tool for the assessment of the chronicity path: the stave.

*Results:* currently, the chronicity pathway includes 22 indicators grouped in 5 phases: prevention, compliance, efficiency, avoidable hospitalization and outcomes. The phase of compliance, related to primary care, is the one with the highest number of indicators, in line with the National Chronicity Plan. The two staves used as examples here show not only the path through the various phases but also the contribution of each provider (in this case group of general practitioners) to the performance of their geographic area.

*Conclusions:* the stave shows the performance of the care pathway through the patient's perspective, overcoming providers boundaries and providing a common reading tool to the professionals involved. The stave is, like the performance measurement system, a dynamic system, in continuous revision and integration to meet the needs of the ever-changing healthcare system.

## Introduction

In recent decades, public organizations have introduced performance measurement systems aimed at assessing their performance usually with 'silos' approach (1-2). This kind of approach fails to capture the public value which is the result of multiple and interdependently actions of several institutions (3-4).

Since 2010, the concept of value has been introduced also in the healthcare context,

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where it was initially defined as the relationship between outcome and resources (5). This definition focuses on the result obtained in terms of health in relation to the resources employed, which is only a part of a broader concept of value for a public health care system. In this case, a population-based approach plays a fundamental role, as suggested by Gray and El Turabi (6).

The identification of value as a key objective of a healthcare system (5-8) requires that performance measurement systems increasingly assess the ability of organizations to make decisions and implement actions that create and deliver value for the target population (9). In fact, value for the population does not correspond to the common way of measuring performance related to the volume of services provided or the outcome achieved and measured in terms of health for patients treated, but is the capacity of the healthcare system to provide the right care to the right person (7). It is not uncommon for healthcare services to be provided to people who do not need them, thus wasting resources, or conversely there are people who are unable to access or receive the most appropriate care for their health conditions. The population perspective allows us to highlight whether healthcare systems are able to deliver value, i.e. deliver services to those who can benefit the most from them.

Performance measurement systems should support this paradigm shift through a new generation of tools capable of integrating different perspectives as well as different dimensions (10-15). In particular, the literature on performance measurement systems in recent years has highlighted some characteristics considered successful in designing tools that support the performances improvement of healthcare organizations:

- Multidimensionality, over the years several frameworks have been proposed to evaluate healthcare services, all of which include multiple dimensions including volumes of activity and financial aspects. Some frameworks group indicators based on the dimensions designed by Donabedian (structure, process and outcome indicators) and others introduce quality of care and equity indicators (12, 16-18).
- Sharing process, the involvement of stakeholders, and in particular of healthcare professionals, is an essential factor to legitimize the measurement tools and their development (e.g. new indicators, revision of existing indicators) that allow to make the evaluation system dynamic in a process of continuous improvement (14, 19).
- Systematic benchmarking of results, comparative evaluation between providers and geographic areas make it possible to overcome the barriers of self-referentiality and to stimulate, through reputational mechanisms, the pursuit of virtuous behaviour and positive emulation (20-21).
- The public disclosure of the results reinforces a responsible use of public resources, also known as public or open accountability (22). Moreover, some studies show that the openness of results combined with systematic benchmarking, makes the

performance evaluation systems even more effective in the use of reputational leverage (21, 23-25).

- Timeliness, the ability to provide results on time increases confidence in the tool used and allows administrators to make decisions based on evidence and up-to-date data (26-28).

However, these factors by themselves are not sufficient if a provider perspective is maintained as different services require inter-organizational relationships (i.e., between the various providers) and thus a system perspective. In particular, for some clinical conditions (e.g. chronic diseases, cancer, mental illness) the value creation process can only be effectively measured by taking the perspective of the value chain that, in healthcare, corresponds to the patient's clinical pathway. Therefore, the adoption of the healthcare pathway perspective is fundamental in assessing performance and, consequently, in guiding the decisions of policy makers and other stakeholders (29).

This new approach implies the need to create horizontal inter-organizational networks that foster coordination among health professionals overcoming the organization's walls. Inter-organizational networks, which may or may not be officially recognized, are usually structured to take care of the patient along the different phases of the pathway. The relationships among network components are characterized by interdependence, complexity and continuous change, and the absence of a clear hierarchy that makes their evaluation even more problematic (30).

Traditional performance measurement systems based on a "vertical" perspective (at both the regional healthcare system and the hospital), may lead to the risk of shifting the attention of professionals towards sub-optimal performance at unit level rather than at patients level (31-32). This leads to the "performance paradox" that means improving performance missing the point (27-28, 31-32).

Therefore, it requires to move towards a "horizontal" view that takes into account the patient's journey and needs not just where services are provided (33).

A key element in addressing this challenge is how performance data is presented in a way that encourages it to be read and shared among stakeholders (34). The use of appropriate communication channels, such as an effective visualization system, is one of the key element to creating commitment to achieving desired performance and appropriate behaviours at all organizational levels (34-35), while also stimulating the commitment of all stakeholders to the achievement of the organization's strategic goals (36). Indeed, because people are guided by limited rationality, evidence-based decision making is inherently mediated by the way evidence is communicated. Moreover, according to Bititci et al (34), effective performance data visualization systems support the development and implementation of business strategies, foster performance reviews, as well as support internal and external communication, collabora-

tion and integration between different units and levels, or even cultural changes and innovation.

This paper describes the musical stave of chronic diseases, that is the more recent tool to visualize the performance of care pathways introduced in the Performance Evaluation System of the Network of Italian Regions led by the Management and Health laboratory, aimed at promoting an integrated care between different providers and between different care settings.

## **Method**

The Performance Evaluation System born in 2004 from the collaboration between the Management and Health Laboratory (MeS) of the Institute of Management of the Scuola Superiore Sant'Anna and the Tuscan Regional Healthcare System and then adopted and adapted, starting from 2008, in several Italian regions is known as the "dartboard system" for its synthetic representation of the performance of regions, local health authorities and hospitals. Currently, the Regions that use the performance evaluation system are Basilicata, Calabria, Friuli Venezia Giulia, Liguria, Lombardy, Marche, Tuscany, Apulia, Umbria, Veneto, Piedmont, the Autonomous Province of Bolzano and the Autonomous Province of Trento, which compare the performances of about 190 healthcare organizations. The Regions belonging to the Network share the same evaluation system, which has about 250 indicators, aimed at monitoring and evaluating results belonging to different dimensions, based on the systematic benchmarking of performances. In most of the Regions of the Network, these tools, are integrated with other regional governance mechanisms, such as, for example, the rewarding system or the budget systems (15, 20, 25, 37- 38). The musical stave was introduced in 2016 to promote the vision of the patient's pathway by breaking down the barriers between the different settings of care and the different professionals involved. The musical stave and the dartboard, should be read together because they provide the same assessments of the performance of healthcare services through different perspectives.

The metaphor of the musical stave is intended to convey the message that healthcare systems should play the patient's music, following step by step their movements within the healthcare system.

The indicators selected and shown on the musical stave came from the indicators already used in the dartboard diagram. The selection of indicators is the result of a shared evaluation process with healthcare professionals and managers.

The musical stave is divided by stages in accordance with the path phases of the patient with chronic conditions in the system, as shown in Table 1 (39). The division into phases is represented through the vertical bands that divide the musical stave

itself, metaphorically simulating the beats that make up a musical verse. This graphic representation allows to focus on strengths and weaknesses of each phase, which characterize the provision of healthcare services for patient.

The musical stave, as well as the dartboard diagram, uses 5 evaluation bands associated to five colours representing the related assessment: red is a very poor performance, orange is a poor performance, yellow is an average performance, green is a good performance and dark green is a very good performance.

Currently the staves developed within the performance appraisal system are:

- maternal and child pathway,
- chronicity pathway,
- cancer pathway,
- mental health,
- emergency services,
- home and residential care pathway.

Concerning the dartboard diagram, the musical staves and the indicators can be consulted on the webplatform: <http://performance.santannapisa.it> platform.

This article analyses the chronic care pathway. Chronic conditions affect an increasing number of the Italian population (around 40%) with a similar trend worldwide(40). The visualization offered by the musical stave can represent a tool that opposes the logic of centrality of services and professionals, exalting the multicentricity and the value of patients proposing a unique graph for the pathway. Thus it propose an integrated perspective of the patient pathway, as suggested by the National Plan for Chronic Care (41).

In particular, the paper reports the results achieved by the Tuscany Region on the musical stave of chronic care at the district level. This musical stave can highlight the performance of the primary care providers working in the same catchment area.

## Results

The chronic care musical stave, as it is currently structured, groups together a set of indicators relating to various chronic conditions characterised by a high prevalence and a high burden of care with the aim to promote a system perspective centred on the person along the phases of the clinical condition. In this sense, as underlined by the National Plan for Chronic Conditions, the formulation of this pathway has the objective of avoiding the discontinuity among the different levels of care (prevention, primary care, specialist care, hospitalisation, rehabilitation) “giving rise to a continu-



um that includes the identification of specific junctions (clinical and non-clinical) by each care actor or team in relation to the prefixed health objective”. The indicators collected here refer to diabetes, chronic heart failure, stroke, COPD. These indicators are divided into 5 phases described below:

- Prevention, which includes both indicators relating to the promotion of correct lifestyles aimed at the entire population, and more specific indicators of the target population of chronic patients relating to two regional strategies for proactively taking charge of chronic conditions, namely the adapted physical activities and the adherence to the Chronic Care Program;
- Compliance, which includes process indicators of some chronic pathways that consider adherence to the main therapies and follow-up, compliance indicators relating to pharmaceutical assistance and indicators relating to the use of patent-expired molecules for some drug categories;
- Efficiency, which is instead summarized by the indicator on polypharmacy at community level;
- Avoidable hospitalization, which includes hospitalization rates for the main chronic diseases and which are considered potentially avoidable hospitalizations with good territorial care;
- Outcomes, such as the rate of major amputation due to diabetes, is reported as a final outcome indicator which reflects the integration of care along the patient's path.

Table 1 shows the indicators currently used to evaluate performance in the chronic care musical stave both at the level of the Network and at the level of the Tuscan Evaluation System.

Indicator	Description	Fase
B26.1	% of population > 16 years old assisted by GPs adhering to the modules of the Chronic Care Program	PREVENTION
C21.2.1*	% of patients discharged for AMI who were prescribed ACE inhibitors or Sartans at discharge	COMPLIANCE
C21.2.2*	% of patients discharged for AMI who were concomitantly prescribed antiplatelet and statins at discharge	
C21.2.3*	% of patients discharged for AMI who were concomitantly prescribed antiplatelet and statins at discharge	
C21.3.1*	% of patients in therapy with beta-blocker (90-180 days)	
C21.3.2*	% of patients in therapy with with ACE inhibitors or Sartans (90-180 days)	
C21.3.3*	% of patients adhering to concomitant antiplatelet and statin therapy (90-180 days)	
C9.2*	Dropout rate of patients undergoing therapy with statins (Hypolipidemic)	
C9.6.1.1	Overprescription of statins	
C11A.1.2A	Heart failure residents with at least one creatinine measurement	
C11A.1.2B	Residents with Heart Failure with at least one sodium and potassium measurement	
C11A.1.3	Residents with heart failure in therapy with ACE inhibitors and/or sartans	
C11A.1.4	Residents with heart failure in therapy with beta-blocker	
C11A.2.2	Diabetes residents with at least one measurement of Glycated Hemoglobin	
C11A.2.3	Diabetes residents with at least one eye examination in the last two years	
C11A.5.1	Residents with stroke undergoing antithrombotic therapy	
C9.10.1	Polypharmacy on the territory	EFFICIENCY
C8D.1*	Std hospitalization rate for pathologies sensitive to outpatient treatment per 1,000 residents	A V O I D A B L E HOSPITALIZA- TION
C11A.1.1*	Rate of Hospitalization for Heart Failure per 100,000 Residents (50-74 years)	
C11A.2.1*	Overall Diabetes Hospitalization Rate per 100,000 Residents (35-74 years)	
C11A.3.1*	COPD Hospitalization Rate per 100,000 Residents (50-74 years)	
C11A.2.4*	Rate of major amputations due to diabetes per million residents (three years)	OUTCOME

Table 1. Indicators present in the chronic musical stave

\* indicators also present in the Network of Regions Performance Evaluation System

Source: The Performance Evaluation System of the Tuscany Region

The musical stave summarizes the results of the quality of the services provided to patients by the providers working in the same geographical area. Indeed, it highlights the contribution of the different stakeholders to the final result. For this reason, different organizations can appear in the same musical stave and, more in detail, the same indicator can be reported several times with different evaluations for each provider within the organizational level considered (Local Health Authority, District area, Aggregation of General Practitioners). What has just been described can be seen in Figures 1 and 2, examples of musical stave of Aggregation of General Practitioners, for the following indicators: C21.2.1 Percentage of patients discharged for AMI who were concomitantly prescribed ACE inhibitors or Sartans at discharge, C21.2.2 Percentage of patients discharged for AMI who were concomitantly prescribed antiplatelet and statins at discharge, and C21.2.3 Percentage of patients discharged for AMI who were concomitantly prescribed antiplatelets and statins at discharge, which are calculated for all providers in the same geographic area (see Figure 1 and Figure 2).

As it emerges from Figures 1 and 2, examples of musical stave of two Tuscan Districts, the visualization tool presented here allows to capture immediately and clearly the performance evaluation of the services provided for a population of patients with the same health needs, taking into account the different phases of the assistance and the different providers that insist in the same geographic area. In the specific examples reported, each provider corresponds to a specific Aggregation of General Practitioners, thus allowing not only to evaluate the work of each Aggregation of General Practitioners but to compare them in terms of performance and therefore of variability of the service supplied to the population who live in the same geographic area.

## Conclusions

The importance to monitor chronic care is progressively growing according with the increasing burden of chronic conditions, both in epidemiological and economic terms. From a performance management perspective it is relevant to develop tools capable to measure the continuity of care and the integration of healthcare services “giving rise to a continuum that includes the identification of specific junctions (clinical and non-clinical) by each care actor or team in relation to the predefined health objective” (41).

The performance evaluation system developed in Tuscany region is an interesting attempt to show information from the patient-centeredness perspective instead of the traditional silos approach. In particular, the musical stave is not intended as a tool for evaluating specific clinical pathway, but as a tool for organisational integration between providers working together in the same geographical area to pursue the health

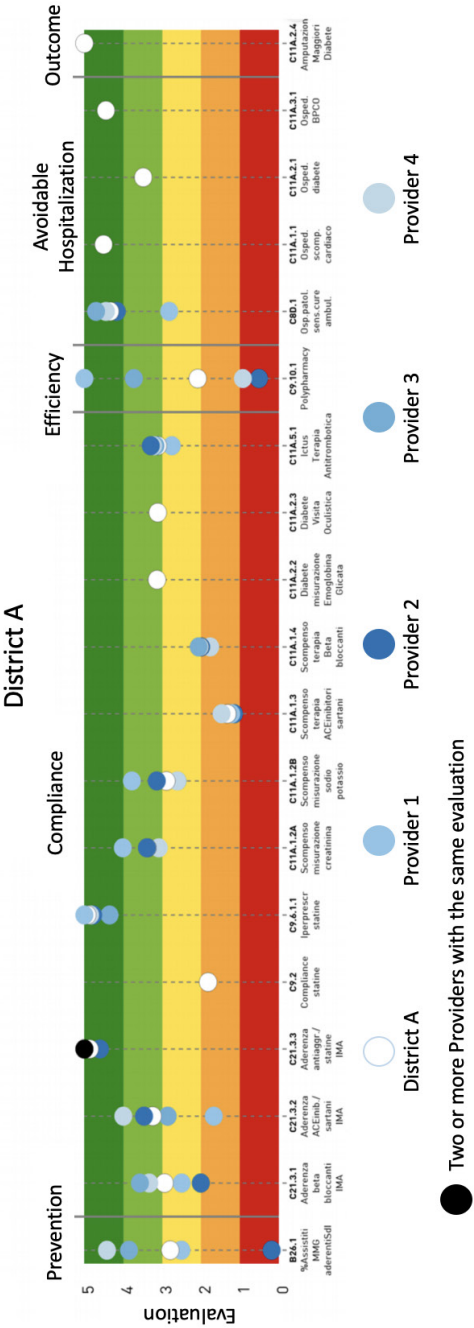


Figure 1. Musical staff District A of Tuscany region

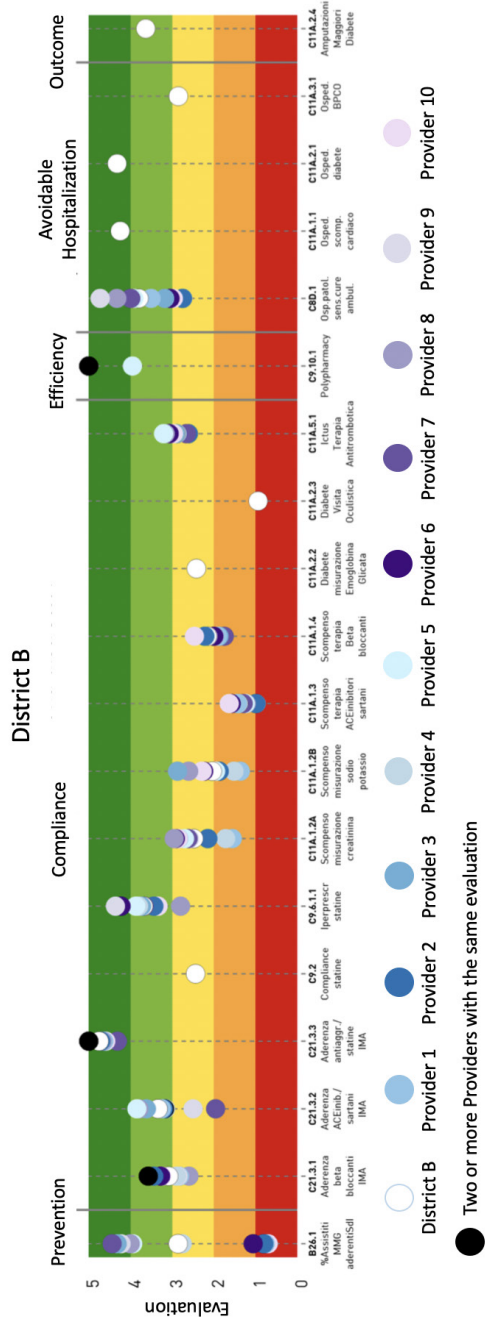


Figure 2. Musical stave of the District B of the Tuscany region

of the population with similar chronic conditions and needs.

One of the main strengths of this experience is the replicability and the transferability of the assessment tool to other contexts, both national and international, thus encouraging comparison and benchmarking between different healthcare systems. Another strength is that the set of indicators currently used can be integrated in the near future with indicators from other sources such as patient-reported experience measures (PREMs) and patient-reported outcomes measures (PROMs). The Management and Health Laboratory is currently studying and testing possible way to integrate the performance coming from administrative flows with the patient's point of view, both in terms of experience and in terms of perceived quality of life, as underlined also by the recent initiative of the OECD through the PaRIS project (Patient Reported Indicator Surveys) aiming at capturing what really counts for the patient (42). This approach, which seeks to promote the point of view of the patient, who is the main actor within healthcare services, is also consistent with the concept of value in healthcare (43). Moreover, this experience suggests how the traditional organizational performance tools aiming at evaluating structures, processes and outcomes through a silos approach, can actually be substituted or accompanied by tools supporting the evaluation of the activities of different providers simultaneously thus promoting inter-organizational evaluation.

A potential limitation that could hinder the implementation of the musical stave and its transferability in other contexts is the unavailability and unreliability of the data. This potential limitation in any case does not invalidate or reduce the innovative approach of the musical stave.

In our opinion, the main challenge that performance measurement systems will have to face in the future is being able to grasp, and therefore measure, the impact that actors belonging to the other systems than the health system, but related to it - such as social assistance -, have on the healthcare system itself, with a view to inter-systemic evaluation. This point, in particular, reflects what has been demonstrated in the literature on the impact that "other dimensions" have on the health of the population. In fact, only 20% of this can be traced back to the quality and services offered by the health system, while 80% can be traced back to other factors such as socio-economic factors (40%), environmental factors (10%) and lifestyles (30%) (44).

Therefore, in order to assess the mutual interactions linking the healthcare system to the surrounding systems (e.g. environmental system) we need to design evaluation systems capable of assessing "collaborative systems", instead of "collaborative organizations". The healthcare systems need to broaden the scope of current measurement systems, by integrating healthcare services with other cross sectoral information.

The musical stave can also reinforce the healthcare professional network through the

provision of information which are, sometimes, hardly to be gathered (45-46).

Further development comes from the fact that the performance evaluation system is a dynamic system, which has sought to modify and adapt itself to the needs and the complexity of the healthcare systems. Thus, the musical stave of chronic care will be revised in the near future, thanks also to the close collaboration with health professionals. Among the revisions that are in progress there are, for example, the reorganization and definition of the phases, or the enlargement of the indicators by including both indicators coming from population surveys and indicators relating to the outcomes of care, such as, for example, the 30-day mortality rate for specific pathologies drawn from the National Outcomes Programme.

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## Proprietary logics, cognitive work, and corporate crisis

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*Key words:* corporatization, proprietary logics, professional organizations, knowledge economy, cognitive work

### SUMMARY

*Introduction:* the impacts of the interaction between Covid 19 and the susceptible population present very marked inter- and intra-state spatial variations, leading to the emergence of the role of impact modifier of national and regional health policies.

*Objectives:* the problem of examining these policies in depth is thus posed, seeking: a) via texts on sociology of organizations, the parameters of organizational planning in general and in health care, and the criteria that inspired, on the basis of the theory of the New Public Management, the corporatization of the SSN (Italian National Health Service); b) interpretations of critical economists who see in the growing role of the knowledge economy reasons for overcoming proprietary business logic.

*Methods:* on this basis, follows the analysis of the response which the SSN, as amended and also regionalized, gives to the complexity of the epidemiological situation, to inequalities in health care and access to services, to the corruptive phenomena in health care and to the presence in its services of cognitive workers endowed with wide professional autonomy.

*Results:* the powerful distorting role of proprietary logics emerges, inspired by the New Public Management that favors cuts in territorial services, privatization, and closure of participatory processes, with the effects of greater regional inequalities.

Particular problems emerge in the interactions with the cognitive work of health care workers, which cause conflicts with the ownership governance imposed with companies, deriving from the role of common good of knowledge and its benefit from the sharing processes, proper to the scientific method.

*Conclusions:* the hypothesis is developed for which current society, based on the knowledge economy, is positively affected by the conflict that cognitive work engages with proprietary logic, both by producing common management methods suited to the specific characteristics of common knowledge, and therefore useful for redesigning health care, as well as effectively contrasting the neo-Darwinian and negationist logics particularly strong among Anglo-Saxon elites, as well as producing promising breaks in the asphyxiating real substation that characterized the last 30 years of the capitalist economy.

## Issues addressed

A lot occurred since the Italian National Health Service, with Law 502/92, was reorganized on the basis of corporate form 28 years ago. It was then considered more suitable, in times marked by the hegemony of the unique neoliberal thought, compared to the participatory and systemic model that inspired local health units. Meanwhile, the world has not stopped changing: not only has there been no end to history, but:

- inequality has increased and complexed in corporate and financial structures aimed at exploiting and amplifying it (1), also thanks to pressing and repeated processes of privatization and exploitation of the welfare systems; although its role as the cause of the causes has been defined and the damage it caused to the quality of life and the health of many has been quantified (2), at present, inequality is structured with suprematism<sup>1</sup> in a political proposal that legitimizes the sacrifice of the most vulnerable, given their social costs, taking advantage of the economic crisis caused by the pandemic;
- a central parameter in the organizational design of health services such as the epidemiological transition<sup>2</sup>, is now fully falsified by the emergence of new and old epidemics and pandemics, making it clear the inappropriate preventive and care settings designed to manage only chronic degenerative diseases under the new conditions produced by neoliberal globalization;
- the climate crisis requires, according to several IPCC reports<sup>3</sup>, the rapid abandonment of fossil-related energy sources and the transition into a circular economy, all of which are in open contrast to the agenda of important countries led by supremacists (e.g. USA, UK, Australia, Brazil, Israel, etc.) which deny its existence, while extreme weather phenomena - heat waves, waterspouts, changes in vector diffusion ranges represent its common impacts in Italy;
- the environmental crisis sees a rapid decline in biodiversity, summary of the

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<sup>1</sup> [https://it.wikipedia.org/wiki/Potere\\_bianco](https://it.wikipedia.org/wiki/Potere_bianco)

<sup>2</sup> This theory was originally postulated by Abdel Omran in 1971 (3). This author divided the transition epidemiological mortality in three stages, in the last of which chronic diseases replace infection as the primary cause of death.

Such a transition assumed that the replacement, over time, of infectious diseases by chronic ones was determined by the increase in life span as a result of improved health care and disease prevention.

<sup>3</sup> The Intergovernmental Panel on Climate Change (IPCC) is an intergovernmental body of the United Nations that is dedicated to providing the world with objective and relevant scientific information to understand the scientific basis of the risk of human-induced climate change, its impacts and natural risks. Established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP) and was subsequently approved by the United Nations General Assembly.

systemic impact of the degradation of environmental matrices polluted by risk producers protected by regulations that are functional to their interests, hence creating an *organized ineptitude* in which environmental prevention agencies are forced to allow the operation of linear and obsolete production systems: such is the case for plastics placed on the market without prior toxicological assessments, or the 6 million Italians forced to live in polluted territories of the SIN (National Interest Sites) where the monitoring of the dead and sick take place but no primary prevention is applied (4), a serious problem for the prevention departments, ARPA (Regional Agency for Environmental Protection) and the national plan of prevention, which, operating according to the above regulations, have difficulty in producing effective primary prevention on collective risk factors, often ending up protecting risk producers rather than the exposed;

- all kinds of conflicts of interest fill the legal chronicles of the health world and fuel both complotism and irrationalism as well as legitimate demands for management models capable of curtating them and making administrative health protection action transparent;
- the development and dissemination of new information and communication technologies have greatly enriched social interactions and knowledge sharing, creating awareness of the power of social knowledge available in general and of the power to solve the problems mentioned above. According to AA, we live in a “knowledge-based economy” (5-7) in which welfare systems (health, education, ...) and research and development have reached dimensions that overdo the production of material goods and would require different productive structures, capable of developing the common good knowledge, now subjected to forced attempts to capture its social value, thus inhibiting the social potential of cognitive work that produces it thanks to incessant processes of sharing and collaboration;
- Similarly, inequalities, precariousness, environmental degradation and climate crisis are subjectivating young and old people all over the world who are now fighting to try to ensure acceptable living conditions for themselves; the combination of biopolitical struggles and proposals carried out by social movements, cognitive work and environmental movements, constitute the main social forces which demand and support new corporate structures and new welfare systems (8).
- This takes place in a context of great uncertainty, determined by the economic effects of the Covid-19 pandemic on globalized production lines, by psychosocial effects on affected populations and strengthened by the presence of multiple crisis factors (environmental, financial, social and geopolitical) introducing a ruthless struggle between states and classes for the hoarding of resources. Positive developments for welfare systems in such a critical and uncertain situation appear strongly linked to

the ability to put in place expert programming systems, participatory and capable of guaranteeing effective and appropriate responses to the needs of citizens on the model of the United Nations millennium development goals (9-10).

It seems the time has come to go back to the basics, to ask whether the design parameters of the health organization support the adoption of the corporate form in health care, and more generally, in the entire welfare state, by beginning to assess the ability of health care companies to provide responses to the crisis factors recalled, and open a process of shared reflection to identify and experiment new organizational forms more suited to the problems of the present and to the complex socio-economic and epidemiological scenarios more likely in the short and medium term.

## Objectives

Hence, the aim is to:

- 1) Recall the main parameters of organizational planning in health care and the explicit aims of the theoretical bases supporting its corporatization.
- 2) Analyze the functionality of corporate logics in reaching the legitimate aims of the SSN in relation to defined emerging problems such as: a) variations in the epidemiological framework; b) the presence of inequalities in health care and access to health services; c) opposing corruption phenomena and confidential associations; d) interaction with knowledge-intensive services and operators.

## Materials and methods

This text is developed from the adoption of two interpretations of the phenomenon investigated.

The first, analytical, aims to define the parameters of organizational planning by referring to texts of sociology of organizations summarizing the main theoretical approaches in sociology of organizations (11-14), while the work of Henry Mintzberg (15-16) has been referenced regarding the organizational planning in health care. This allowed to identify, in the perspective that sees the organization as a machine resounding to proprietary logics, the conceptual bases that lay for the corporate form as a general organizational solution, and that find in the theories called Public Choice (17-18) and "New Public Management" (19) the rational that led to its adoption in health care.

The cited works identify the role to be assigned to *knowledge* and its carriers as a critical element for organizational planning in health care. This has led to the need to develop a second interpretation of the observed phenomenon by carrying out a recognition of the theories (5-7) which analyze its role in the current situation through the categories of:

- "*knowledge-based economy*" suggests that socially produced and maintained

knowledge in education, health, research and development systems, has now become central in qualitative and quantitative corporate development;

- “*cognitive capitalism*” as a set of devices finalized at capturing the value produced in the knowledge-based economy;

- “*cognitive work*” as a social force representing the predominant fraction of “living work”<sup>4</sup> and produces, through its social practices of common knowledge management, conflict and innovation central to social development. In this interpretation, the power of knowledge, exercised by doctors and health workers in the professional organizations investigated by Mintzberg, differs from professionalism and provides prefiguration of the organizational and functional modalities preferred in productive contexts with high density of knowledge, thus becoming, in this sense, a laboratory for the understanding of the dynamics of knowledge-based economy and cognitive work.

On this basis, objective 1 and 2d were investigated and the areas of problems emerging from objectives 2a, 2b, and 2c, were defined.

Concerning the legitimate purposes of the SSN, Article 32 of the Italian Constitution<sup>5</sup>, Article 1 of Law 833/786 and Articles 1, 2 and 3 of Legislative Decree 502/927, were considered as references.

<sup>4</sup> Since the value is the amount of work spent on production (as rightly highlighted by A. Smith and D. Ricardo), goods are worth the ‘dead labor’ (which previously produced the means of production) and the ‘living labor’ delivered to the present by the workforce. This living work is furtherly divided into ‘necessary work’, which is the value of the goods bought via wage, and into ‘surplus labor’, which, made monetarily on the market, constitutes the profit ([http://www.treccani.it/enciclopedia/teoria-marxista\\_%28Dizionario-di-Economia-e-Finanza%29/](http://www.treccani.it/enciclopedia/teoria-marxista_%28Dizionario-di-Economia-e-Finanza%29/))

<sup>5</sup> “The Republic protects health as fundamental right of the individual and interest of the community...”

<sup>6</sup> the Republic protects health as fundamental right of the individual and interest of the community through the national health service.... the National Health Service consists of all the functions, structures, services and activities intended for promotion, maintenance and recovery of the physical and mental health of the whole population, without distinction of individual nor social conditions, and in ways that ensure the equality of citizens within the service...”

<sup>7</sup> “1. The protection of health as fundamental right of the individual and interest of the community is guaranteed, with respect for the dignity and freedom of the person, through the National Health Service, complex of functions and assistance activities of regional health services and of other functions and activities carried out by national institutions, within the framework of the contributions provided by the Legislative Decree no. 31 March 1998, n. 112, as well as the functions of the State by the same decree. 2. The National Health Service ensures, through public resources and in accordance with the principles and objectives set out in articles 1 and 2 of the law of December 23, 1978, n. 833, the essential and uniform levels of care defined by the national health plan, in accordance with the principles of human dignity, necessity of health, equality in access to care, quality of care and its appropriateness regarding specific needs, as well as the cost-effectiveness in the use of resources. 3. The identification of the essential and uniform levels of care provided by the National Health Service, for the period of validity of the national health Plan, is carried out together with the identification of financial resources for the National Health Service, according to the financial compatibility defined for the entire public finance system in the economic and financial programming Document. The health services included

## Results

From the etymological point of view, the term Organization (O.) derives from the Greek term “organon” which means tool/medium. This matrix has long influenced its semantics, in favor of definitions based on purposeful mechanistic approaches. Of course, the concept of O. is also socially determined, and we presently have varying definitions, each affected by the social environment and the historical moment in which it was coined. Thus, in classical theory (20), the O. can be understood as a tool for achieving goals in a *proprietary* logic (rational system that works as efficiently as possible), while in terms of systemic approach, the O. is defined as a system of elements linked via interdependency relations, within processes purposely oriented to the achievement of an objective (21-22). For constructivists (23), the O. is a temporary coalition of people trying together to carry out their activity, to satisfy their needs and at the same time to contribute to the functioning of the O.. Moreover, in a structuralist perspective (13) the O. becomes a social unit (or human grouping) deliberately constructed and reconstructed for the attainment of specific purposes. Now, this multiplicity of definitions is reflected by the existence of numerous theoretical approaches, here recalled to clarify that there are several organizational approaches whose appropriateness within specific contexts must be verified, beyond fideistic or ideological adherence to this or that model, bearing in mind that the choice of a specific approach should take into account both the knowledge of general theoretical elements and the use of available sociological evidence.

### *1) Main parameters of organizational design in health care and explicit aims of the bases theories that justify the corporatization of health care*

For our discussion, particularly relevant is the *situational approach* established from the researches carried out in the second half of the last century by several authors (24-26), according to which the success of organizations depends on the relationship between the task of the O. and the environment in which it operates; therefore, there is no organizational model valid in every situation, but rather the possibility of attaining an effective O. depending on the ability to achieve some sort of balance and form of harmonization between strategy, structure, technology, the needs and aspirations of employees, and the external environment. The revolutionary characteristic of this attempt is the effort to define at each level what are considered to be the conditions for an effective organizational design; in other words, the consistency between organizational variables and situational factors, so as to provide a material basis for the concept of organizational appropriateness.

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in the essential levels of care are guaranteed by the National Health Service free of charge or with an expenditure participation fee (co-pay) in the forms and modalities presented by the law in force.”

Mintzerbg has developed the situational analysis (15) by defining five different types of O., starting from the complex of the modalities dividing labor into separate tasks, thus carrying out the coordination between these tasks and deepening the specific features of professional organizations (healthcare, teaching of different order and degree, research and development), which are characterized by the presence, within the operating core, of professionals adequately trained and “socialized” to carry out tasks in which the standardization and maintenance of knowledge and skills is the main parameter of planning, while the standardization of both processes and outcomes gives rise to dysfunctional responses.

The situational approach therefore involves a vision of organizational variables as a set of formal and informal elements, to be considered unitarily in any process of organizational analysis and in the experiences of design and redesign. These theories, operating in the field of organizational development, have contributed to operationalizing the intuitions of the situational and systemic approach, developing “diagnostic” and “prescriptive” models to identify and subsequently remedy organizational problems, which revolve around 5 central questions concerning the organization/environment relationships:

- 1) **of what nature is the O. environment?** Simple and stable or complex and turbulent? Are there any changes in the economic, technological sectors, in the market, between trade union relations and at socio-political level?
- 2) **What is the applied strategy?** Is the O. lacking strategy and is it limited to reacting to any changes that may arise? Does O. systematically analyze the environment to discover new threats and opportunities? Does it adopt an innovative and active attitude? Is the attitude toward the environment competitive or collaborative?
- 3) **What type of technology (mechanistic or non-mechanistic) is applied?** Are the processes used to transform inputs into outputs standardized and routinized? The technology used allows for tasks characterized by extended or limited areas of responsibility and autonomy?
- 4) **What are the characteristics of the employees and what are the “culture” and dominant ethics in the O.?** Do employees in the operational core have to perform simple tasks or face issues that require discretion and professional autonomy? What attitude do they adopt at work? What are the fundamental values and beliefs conforming corporate culture models? Are organizations informal or confidential?
- 5) **What is the structure of O. and what are its prevailing directional styles?** Is the organization bureaucratic? Is the predominant style of direction authoritarian and based on close control, or does it encourage innovative initiatives, the spirit of enterprise and collaboration between working groups?

These questions are based on the assumption that the O. consists of interrelated



subsystems of a strategic, human, technological, structural and managerial nature, which must result coherent with each other and adapted to the environmental conditions (11).

Based on the observations of Mintzerbg on professional O.s, in addition to other authors who have investigated the material bases of professional autonomy (27-28), the focus seems to shift on the appropriate organizational parameters for health care and its operational subsystems, in the form of a grid, in order to train Hygienic residents in organizational diagnosis (Tab. 1).

<i>Variable under examination</i>	<i>Scale of detection and its attributed value</i>		
1) Capacity to ensure the transition from sick to healthy	<input type="checkbox"/> low	<input type="checkbox"/> medium	<input type="checkbox"/> high
2) Degree of freedom socially recognised by the principle of discipline	<input type="checkbox"/> low	<input type="checkbox"/> medium	<input type="checkbox"/> high
3) Professional autonomy resulting from the evolution of the epidemiological framework	<input type="checkbox"/> low	<input type="checkbox"/> medium	<input type="checkbox"/> high
4) Autonomy in producing guidelines for professional activities	<input type="checkbox"/> low	<input type="checkbox"/> medium	<input type="checkbox"/> high
5) Possibility of procedurisation of the activity	<input type="checkbox"/> low	<input type="checkbox"/> medium	<input type="checkbox"/> high
6) Possibility of direct supervision by the manager	<input type="checkbox"/> low	<input type="checkbox"/> medium	<input type="checkbox"/> high
7) Possibility of standardisation by analysts	<input type="checkbox"/> low	<input type="checkbox"/> medium	<input type="checkbox"/> high
8) Possibility of functional drift (substitution of legitimate aims)	<input type="checkbox"/> low	<input type="checkbox"/> medium	<input type="checkbox"/> high
9) Possibility of organisational drift (use of O for extra-organisational interests).	<input type="checkbox"/> low	<input type="checkbox"/> medium	<input type="checkbox"/> high
10) Anything else?			

\* Elaboration on texts by Mintzberg (15,16) for the course of Governance at the School of Specialisation in Hygiene, Public Health and Epidemiology, Faculty of Medicine, University of Perugia.

Tab. 1: Grid for the analysis of the presence, in specific organisational levels of the NHS, of the variables identified by the sociology of professional organisations as parameters for organisational design\*.

Application to Department/Service

### *1b) Theoretical basis regarding the adoption of the company form in health care*

The “rational” models, better known as the classical Theory of the O., O. Labor Science or Scientific Management, represent the first organic model of organizational theory particularly appreciated and applied in situations where the strategy is centered on *proprietary needs and logics*. They are strongly connotated by a mechanistic conception of the world and by a theory of motivation stating that “man is only moved by fear of misery and the desire for greater earnings” (20); therefore, workers will render to the limit of their physical capacities, if paid exactly proportionally to their effort. As for the operative subsystems: a) the specific technical systems (mediating the central activity of the O.) are based on the parceling of the task (the more a working process is divided into its simplest components, the more the worker

can become specialized and expert in carrying out it (29); b) the rewarding system is based on money, recompense is determined exclusively by the carried out activity, without taking into account other factors (seniority as proxy of competence, etc.); c) staff management foresees salaries on the shortest time scale possible; d) the control system measures individual productivity.

The classic theory of O. has been, and still is, applied in the goods production in the industry - as in the Ford car factories of the first post-war period in the USA - and has characterized the so-called Fordism, in which profit maximization, through economies of scale and strict control over producers, occurred within nation states, while wage policies made it possible to consume the mass goods produced.

When the post-World War II expansion of public services reached conspicuous proportions, driven by workers' struggles and request for appropriate responses to their social needs, James Buchanan (18) and Gordon Tullock<sup>8</sup>(17), two classical theory economists embodying the uniformity of human behavior both in private and public O., began to argue the necessity to homogenize the theory and practice of the functioning of the state and the market. According to these authors, the problem was preventing "bureaucracy" (officials and operators of various public services) from maximizing its personal interest, for the bureaucrat would not work for the general interest nor to respond to social needs, but to increase the credit of their office and the number of subordinates, or, to rise into hierarchy, causing the supply to swell, and subsequently, an impulsive expansion of the demand. These authors seem to suggest a sort of great alliance between bureaucratic officials and middle-class members, who use public services most of all, with an irrational increase in staff numbers and the expansion of public spending (17, 30).

This has given way to a vast reorganization of administrations aimed at "starving the beast". In 1991, Christopher Hood (30) gave the name of New Public Management to this process of transformation of public institutions systematically inspired by the logic of competition and the entrepreneurial methods used in private enterprises: "competition, downsizing, outsourcing, auditing, regulation through specialized agencies, individualization of compensation, staff flexibility, decentralization of profit centers, performance indicators, and benchmarking are tools to adapt the public sector to the reality of the market and globalization" (30). Management techniques, following

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<sup>8</sup> Buchanan and Tullock are the main theorists of the School of Public Choice, whose historic center is the University of Virginia in Charlottesville, has produced an analysis of public services by taking an interest not in the nature of the goods produced, but in the way in which they are produced. James Buchanan in his "the limits of Freedom" (18) advocates the suppression of the welfare state and its replacement by a new social contract, in which the rich would pay financial compensation to the poor in exchange for the benefits they had suppressed.

proprietary logic, are based on objectives and resources assigned to executives and workers so that the performance evaluation weighs the alignment with the company strategy and the subjugation to its values, and the rewarding/sanctioning system aims to reward the obedient employees and punish those who are non-performant and not subjugated; within the corporatized public, similarly to private industries, proprietary logics do not include significant roles for participation, while corporate networks emphasize customer satisfaction following the received performance. This way, “the bureaucrats” of the public - the beast - are subjected to the same conditions as the wage worker in the private sector, and the logic of competition pervades both welfare institutions as well as the action of the State itself, which in turn competes with others worldwide.

## **2) Analyzing the functionality of business logic in reaching the legitimate goals of the National Health Service in relation to defined emerging issues**

In summary, we can say that the corporatization of the SSN has been depicted as the introduction of proprietary logics in the SSN in order to increase its efficiency, subsequently handing over health care companies to public managers - the regions - identified as administrative levels capable, compared to the municipalities that had managed local health units, of avoiding incongruous uses and substitution of ends, while financial economic programming (DPEF and financial laws) on the one hand and sector programming (national and regional health Plan) on the other hand, should have ensured adequate policies and resources, and their use in appropriate frameworks consistent with the institutional aims of the SSN, by governing the excessive variability of specific regional policies and ensuring equal access to a basic package of services of known effectiveness (Essential Levels of Assistance).

Beyond the narrative, lacking the assumptions and explicit aims of the previously mentioned theorists of Public Choice and New Public Management, our SSN has been exposed since 1978, its year of birth, to a dual management line, designed to distinguish it, on the one hand, from the programmatic inputs envisioned on the formal level - the first PSN will only be officialized in 1992 with the signature of prisoner Minister De Lorenzo – and, on the other hand, to subject it to a progressive and immobilizing restriction of financial resources and personnel<sup>9</sup>.

<sup>9</sup> In 1984 began the “economic maneuver in health care” with the separation/severance, by the Craxi Government, of social and mental health expenses, maneuver whose financial laws have since then deepened and developed brought and levels of application, thus extending it up to our days and carefully disarticulating the financial resources of the SSN. Among numerous measures, emphasized are the cuts taking over the National Health Fund, the elimination of the share in capital for structural investments, innovations and maintenance; the introduction of tickets that have created, maintained and expanded convenience niche in the private sector; the outsourcing of the support functions (canteens

Considering that political choices of a defined administrative level have, among other impacts, the function of “effect modifier” of health determinants, enhancing or reducing their consequences on the health conditions of the population resident in the area where these policies have effective application (2), the combination of the introduction of proprietary logics into health care, the approval of federalism in health care with the V Reform of the Constitution, and the multiannual economic maneuver in health care managed by the precursors of the present Ministry of Economy and Finance, had the overall effect of disarticulating the action of our SSN, thus creating 21 regional health services with a general weakening of the functions of prevention and assistance, with a capacity to adequate response to emerging health problems in different contexts. Let us analyze some concrete examples.

### *2a) Variations within the epidemiological framework*

Infectivologists and virologists’ reports regarding the possibility of emergence in the short-medium term of new zoonoses (32) did not affect the belief in the substantial long-term centrality of chronic degenerative diseases as a parameter for the design of health services: the occurrences of the HIV epidemic, at the end of the 20th century, and the emergence of SARS, MERS and Ebola epidemics at the beginning of the 21st century, although representing the tip of the iceberg of about 200 new emerging infectious diseases, has not led our national programming to take on the complexity of epidemiological scenarios, nor has it seen to prepare plans for the upcoming new pandemic and epidemic scenarios (33-34); moreover, regionalized health has continued in certain important regions to accentuate territorial weakening, reserving investment mainly for the hospital function alone, or for the development of the

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and kitchens, laundry, warehouse, etc.); the outsourcing of important prevention quotas (e.g.: health in factories discouraging workers toward the SSN, to which they had greatly contributed), territorial health care/assistance (e.g. dental health, home care, instrumental and laboratory diagnostics, specialized outpatient care ....), hospital health care/assistance (regarding the sections related to elective interventions) and most of rehabilitation. Besides the financial cuts, the interventions on cognitive workers in health care with long-term turnover blocks have been devastating, mostly weakening territorial services, the stability of new employees, and the introduction of the limited entrance number for the Faculties of Medicine. These policies have represented the lowest common denominator of all the financial laws approved since 1984; moreover, they find ensuing applications in the other few States possessing an SSN, voicing a supranational occult programming designed to disarticulate health services applied by national government sectors.

In Italy, in recent years, the weakening of the SSN has created room for policies of both explicit fragmentation of the SSN, such as the removal of the national plan of prevention and the marginalization of general medicine, as well as the explicit allocation of assistance quotas to private individuals through the creation of the so-called second pillar, while the third pillar, resoundingly union-supported, aims to provide “additional” benefits through “supplementary” funds (31).

private sector. In this context, the Covid 19 pandemic has functioned as a litmus test: the available data mainly reports **strong spatial inequalities in the infection and mortality rates**: Lombardy, presenting all the variables that epidemiological studies have so far identified as determinants of the disease by Covid 19 (35) has, as of May 15, 2020:

1. a cumulative rate of infection of 8,3 per 1.000 residents compared to an average Italian value of 3, 7, 12 times higher than the Italian region with fewer cases, Basilicata, where there have been 0,7 cases per thousand residents up to that date;
2. a cumulative mortality rate of 155/100.000, three times the Italian one (55 out of 100.000) and 32 times higher than that of Basilicata, equal to 4,5 out of 100.000.

These inequalities confirm the role of effect modifiers by variables such as:

- a. the health policies concretely pursued over the years by the national and regional governments, which have in turn conditioned the concrete response given to the pandemic: when comparing the data recorded by OMS database (36) as of May 15, 2020 for two countries that have an SSN inclusive of proprietary logics, such as Italy and Great Britain, with those of the People's Republic of China and South Korea, we observe cumulative contagion rates from 17 to 60 times higher, and cumulative mortality rates that are between 102 and 154 times higher in the former: the exposure to risk and damage in the Covid-19 pandemic, more likely for economically disadvantaged people (37, 38), shows significant effect variations depending on the policy adopted by the government of the state/region in which one resides;
- b. the *"political response of the administrative level"* variable also includes the quality of the *preventive* and distinctly *welfare* setting offered to infected and sick people, strongly conditioning taking charge, the seriousness of the clinical course and the probability of dying for all citizens, even more so for the economically disadvantaged, while delays in the providing health workers with adequate personal protection devices have led to significant rates of infection and mortality, highlighting the inadequacy of the hospital segment in dealing with the pandemic and, more generally, the subordination of corporate management and corporate prevention services to the inappropriate inputs of regional governments.

## *2b) Inequalities in health care and access to health services*

Numerous reports by global, European, and national public agencies (2, 39-40) document the rise in inequality at the global level and, given its already-mentioned role of cause of causes, inequality regarding risk exposure, health and access to health services.

In Italy, ISTAT (41-42) records a difference in healthy years of life between regions,

with delta of more than 17 years among those with worst data (e.g.: Calabria) and those with best data (e.g.: Bolzano) with a clear gradient linked to income, socio-cultural levels and geographical location.

This data would indicate the failure of national equalization policies were it not for the chronic lack of PSN, the understanding of prevention plans, and the decisions of the Conference of State Regions, attesting that the problem is not perceived as a priority, for not only does it not spur effective equalization policies, it also drives demands for differentiated autonomy from the economically stronger regions, which want to achieve greater control over the taxes paid in their respective territories by subtracting resources from the rebalancing of the system.

### *2c) Contrasting corruption and confidential associations*

In 1918, Charles Bettelheim was warning the newly-born USSR of the problems that, even in a context of socialist management, could arise from the fact that the possession of goods by specific apparatuses and officials could give rise to phenomena of substantial appropriation, distracting them from social uses, thus reproducing new classes and new forms of class conflict (43). The problem originated in-depth discussions and tough political battles aimed at keeping active the chain of meaning between the formal belonging of goods and their substantial use for social needs. In capitalist states, it is the force exerted by subclasses, securing income and responding to social needs, that has imposed the development of welfare and the establishment of national health services, and has modulated, through various historical phases, the private use of the public: during Fordism, the nation state represented a favorable environment for public control over institutions by reducing the scope of privatization processes; in post-Fordism, neoliberal globalization has redirected these conditions in favor of capital owners, and ubiquitously introduced proprietary logics, explicitly aimed at optimizing the growing shares of capital even in public welfare sectors. In particular, health care is assaulted on several levels, as testified by countless acts by both parliamentary committees (44) and accounting judiciary<sup>10</sup>: focusing on pharmaceutical assistance alone - though the same logic applies to procurement sector, purchases of goods and services, authorization and accreditation processes, and so on - the assault on common resources by pharmaceutical multinationals is wide and articulated, and goes from disease mongering to the corruption of officials

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<sup>10</sup> According to the second paragraph of Article 100 of the Constitution, the Court of Audit is required to exercise prior control of legitimacy over the acts of the Government, and the subsequent one regarding the management of the state budget; in addition, it participates in inspecting the financial management of Entities receiving ordinary state contributions, reporting directly on the outcome of the check performed, thus favoring a rich production of acts, reports, and records [www.corteconti.it](http://www.corteconti.it)

of various state, regional, and corporal administrative levels, to the point of involving significant percentages of hospital doctors, mmg (Doctors of General Medicine), pls (Pediatricians of Free Choice) and pharmacists, sometimes massively represented as happens in Sicily and other regions in private associations (44). If, in the face of corruption, one can always argue that “evil” comes from outside health care forces that manage, in various ways, to prioritize the extra-organizational interests over the legitimate ones of the SSN, considerable concern is raised by cases where corruption is exercised by the political and administrative levels tasked with the institutional function of combating it. With increasing frequency in the last decade, the SSN shows the growth of processes of institutional corruption, in which the “regional administration - corporate management - staff apparatuses and administrative offices” complex produces a management of public services consistent with the extra-organizational interests: Lombardy, Calabria, Basilicata, and Umbria are an approximate list of systemic corrupting processes, in which regional and corporate officials, engaged in strategic management activities, were caught collaborating with specific types of private use of the public approved by regional political leaders of the various SSRs. In Umbria, it has reached the point where the investigating magistrates had to detect the crime of “criminal association”, given the cohesive behavior of regional, general, health and administrative councils, in addition to staff and corporate administrative offices of AOPG, in applying extra-organizational political input from Regional Council, freemasonry, curia and trade unions. If everyone results certainly innocent until convicted in Cassation, the matter has to be examined under the specific assumption made in the article, that is, evaluating the role of proprietary logics constituting the company as a condition without which the criminal association could not have been constituted, nor would have been able to impose its command line on an organization with different purposes approving business plans consistent with the national transparency regulations.

This also proved possible because over time, thanks to the proprietary logics regulating the functioning of health care companies, a ruling class was selected based on the principle of obedience, chosen to hegemonize its operation at the expense of both the principles of competence and ethics, in order to render public management proprietary, bending it to a complicated management of various types of extra-organizational interests.

The issue at hand results relevant and consistent, for the simple substitution of the political color of the forces administering the Region could not give sufficient guarantees to produce the necessary realignment between administrative action and institutional purposes.

Essentially, the proprietary logics applied improperly in health care, as documented

by the sociological evidence briefly mentioned in previous sections, produce significant substitutions of the purposes, documented by abundant and substantial cases of sentinel events, also definable as cases of avoidable corruption, which reinforce a careful reorganization of the company form according to the parameters of organizational design.

*2d) Interaction with knowledge-intensive services and operators*

In the SSN prevails a section of organization, called professional, tasked with applying clinical knowledge and skills under conditions of wide discretion regarding the use of resources, given the substantial uncertainty surrounding two central processes of cognitive work in health care: diagnosis and therapy (27). Professional autonomy (meaning: “assigning one’s laws oneself”) is a privilege that society grants to professionals who possess clinical knowledge and skills capable of re/giving health, who can guarantee the transition from sick status to a healthy one, which represents both the material basis of the power of knowledge (28) as well as deficiencies in bureaucratic power, thus creating a substantial imbalance of power for the benefit of cognitive work.

We could periodize the interaction between cognitive work and proprietary business logic in:

- a first phase (the first ten years since the 1992 reform) examined eventual benefits effectively caused by the programming and control systems (the budget), tariff payment systems, and from the managerial function - all graduates had been reduced to managerial roles - discovering, within the daily work field, underlying rhetorics and substantial limits;
- a second phase - from the beginning of 2000 until the global financial crisis of 2008 - whose cognitive work has tried to transform the proprietary governance of ASL and AO into clinical governance aimed at improving assistance quality (45) on the levels of effectiveness, appropriateness, safety, fairness in access to care, efficiency, and user involvement, all difficult to achieve through the exercise of administrative power along hierarchical lines; appropriate operational tools for cognitive work have been proposed and put into practice (problem approach, clinical and evaluative epidemiology, scientific method enhancement, financing systems in which “health pays” -global budget, capital share,...- clinical audits, peer reviews, Evidence Based Medicine, transparency on conflicts of interest, continuing education of doctors and other health workers, shared evaluation of outcomes between workers and users, etc.), colliding with regional and corporate directions placed in the hands of officials by federalism, often expressed by territorial clans selected on the principle of obedience, while governance needed, in order to develop, coordination capacity strongly based on the principle of competence (46);



- a third stage, in which austerity programs, forced to settle public debts looted to support banks and financial markets in the 2008 crisis, closed spaces for governance and imposed a proprietary governance that produced drastic cuts in financial resources, health personnel and facilities, impoverishment of territorial assistance, emphasis on behavioral risk factors, development of the private sector, etc. that have created those effect modifications for which the pandemic was able to cause world records damage, right in the territorial contexts advocating and applying proprietary logics in health care.

The demand for cognitive work to change corporate governance in clinical governance has been addressed by proprietary logics supporters (bipartisan governments, corporate management schools, technicians obeying regional and corporate management...):

**a)** on the one hand, by rewarding the share of profession more attentive to utilitarian behavior by granting ample space for the private use of the public, of which free profession is clear expression;

**b)** on the other hand, the following have been implemented:

**b.1)** a whole series of measures aimed at producing control over cognitive work by attempting “to use direct supervision, standardization of work processes or standardization of outputs.

The insertion of intermediate levels of direct supervision derives from the hypothesis that professional activity can be controlled, like any other activity, in a top-down way, a hypothesis that has repeatedly proved wrong. Forms of standardization other than standardization of skills, rather than allowing for control of professional activity, often discourage and hinder professionals: complex work processes cannot be formalized through rules and norms, and vague and indeterminate outputs cannot be standardized through programming and control systems without misleading effects.

By programming incorrect behaviors and measuring wrong outputs, professionals are forced to play the game of mechanical bureaucracy; to meet standards instead of serving citizens, by operating within a medium-goal reversal. While rationalization makes low-cost output available to customers in mechanical bureaucracy, in professional activities it spurs ineffective and impersonal services” (15).

**b.2)** attempts to reify knowledge and capture professional knowledge through artificial intelligence. Knowledge can be reified when:

- cognitive processes can be transformed into procedures, which, in turn, can occur when the skills founded by knowledge are the fruit of elementary cognitive functions proper to convergent thinking (memory, calculation, deduction...) and

- useful for dealing with *known* problems, yet not when higher cognitive functions of divergent thinking are involved (induction, creativity, imagination, etc.), the latter useful when dealing with *new* problems;
- there is a clear correspondence between a given contingency and a given procedure: part of the conditions leading to chronic degenerative diseases (type 2 diabetes, hypertension, hyperlipidemia, etc.) could fall into this condition, while the complexation of the epidemiological structure, referred to in the introduction, invalidates it;
  - the object to which the procedure applies does not have any symbolic value;
- b.3)** long term planning through the limited entrance number in the Faculties of Medicine thus the pruning of professional roles, otherwise leaving unexplainable the organized ineptitude with which it was chosen to do nothing in the face of the aging of the prevailing share of professionals active in the SSN, already evident at the end of the century, when its demographic data were examined: the twenty-year turn-over blocks, derived from the non-explicit programming of all bipartisan governments over the last 20 years, are only understandable from a perspective of disarticulation of the power of knowledge.
- b.4)** by increasing the swelling presence of precarious staff, who, by renewing their precarious status, has been forced to work in conditions of organizational marginalization, existential insecurity, compression of real and deferred remuneration; the norms that followed over the years have insisted in consolidating, within the cognitive precariat of health care, the conviction that its presence was inessential for the SSN - or marginal at best, thus negatively affecting its guidelines concerning the deepening of professional backgrounds: it would make little sense to maintain and deepen one's clinical knowledge and skills if the probability of continuing to practice one's career is low or, in any case, full of uncertainty.
- b.5)** Universities, research, and in-service training have in turn been subjected to the torsions that policies serving neoliberalism have imposed on the entire public administration: new knowledge is fenced off by the emergence of "service providers" (Wiley, Elsevier, etc.) who appropriate themselves of works, merit of the scientific method, and impose artificial ledges to freely access such information; the drive to patent scientific discoveries has sought to pass them on as fruit of individual knowledge, when none of us would be able to learn language without social interaction, let alone add a further constituent to the enormous accumulated social knowledge; in general, resources are becoming increasingly scarce and allocated outside a time frame that allows for strategic investments planned in some sensible direction, hence making the researcher's

life increasingly difficult, considering the existent precarious employment condition as well as the meager low income. When all this happens in university polyclinics, the socialization of future professionals takes place in a context in which it is the “non-norms” of utilitarian behavior giving meaning to professional action, thus dissipating the cognitive patrimony acquired in long years of training, as well as creating deep dissonances with the conditions that in the past have led to the delicate balance on which the social recognition of professional autonomy has been built; all aggravated by the caste filters that regulate access to the university.

Overall, there was a planned and multi-level divestment in cognitive work in health care, intentionally creating dysfunctional conditions for the maintenance and development of knowledge and skills, amplifying schizophrenia among the official purposes of the SSN, trends inherent in its nature as a professional organization with a high density of cognitive work and business management.

## Discussion and conclusions

The term “crisis” comes from the Greek crisis, meaning separation, choice, judgment, which in turn derives from the verb *crinein*, which means to judge. The Covid 19 pandemic, amplified by defined government policies based on proprietary logics in society and health care, has put before our eyes the need to judge the holders of these logics.

The conducted analysis showed the legitimacy of a discourse concerning the crisis of the company form in health, inasmuch:

- the parameters of organizational planning in health care underwrites the need to rethink the organization of our SSN and welfare, since we are in the presence of a complexation of the operational scenarios to manage the pandemic and the associated global environmental disorder;
- the pandemic must be effectively faced with proactive territorial policies of tracking and non-pharmacological intervention (47), while the centralized hospital functions, targeted by the model of university hospital of DM 70 and the hypertrophy of the hospital field characterizing certain regional policies, must be re-thought in depth;
- the pronounced health differential between north and south highlights the limitations of regionalized health care, which plasters inequalities in health care and access to effective services for both chronic degenerative and infectious diseases, as indicated by the substantial and unacceptable spatial differences between regions, and calls, on the one hand, for strong equalization action by the central state, and, on the other hand, for the responsibility of local communities, which must be able

to participate in the management of services in order to highlight real health and care problems;

- inequalities in involuntary risk exposure require a strong role for territories in primary prevention policies concerning collective risk factors, as well as primary prevention models capable of protecting air, water and soil matrices from risk producers (4);
- the ethical contribution of the SSN shows how the proprietary logics operate in the corporate strategy and transform the O. into a weapon serving few territorial clans, which in turn use it to favor extra-organizational interests both heterogeneous and dysfunctional for the general interest: the politician's recommended x, the contract to the firm managed by y's wife, the convention with clinic managed by the adept of the Masonic lodge z...;

The elephant in the room results, therefore, the inappropriateness of business models centered on proprietary logics in managing welfare, research, and development systems.

Since all this takes place around a social process called "knowledge", for the absence of society implies lack knowledge, and since AA have argued that knowledge is a common good (48), it should be remembered that:

- if in general common goods are understood as "goods which are property of a community and of which the community can freely dispose" (commons of the Anglo-Saxon juridical tradition), Hess and Ostrom<sup>11</sup> provide a more problematic definition, identifying a common good as: "a resource shared by a group of people and subjected to social dilemmas (i.e. inquiries, controversies, doubts, disputes, etc.)"; for these authors, "a common good is free from values: its outcome may be good or bad, sustainable or not, and to ensure lasting and stable systems we need clarity, good decision-making capabilities and collaborative management strategies";
- in the case of "subtractable" resources, such as fishing grounds, the use by one person reduces the benefits available to others, so much so that high subtractability is generally a basic feature of the common "natural" resources;
- almost all ramifications of knowledge, on the contrary, are relatively non-subtractable. On the contrary, the value of a resource is directly proportional to the amount of people using the resource and joining the community of users: we therefore speak of "cornucopia of common goods": the value of scientific literature or open source software actually increases as the number of people participating in the enterprise increases, a phenomenon defined by economists as "network effect"; when knowledge is coordinated as a common good, the efficiency of sharing

<sup>11</sup> Elinor Ostrom received the Nobel Prize for Economics in 2009.

is greater than that of competition.

- Hardin (49) argues that “failure is the inevitable fate of all those who pursue their own interest in a society that professes free access to common resources. It is a freedom heralding general disaster.” While this thesis is known as the “tragedy” of common goods, Ostrom and Hess retorted that, while the Hardin model often proves applicable in situations, it is also true that many groups, local communities or professional associations, have proved able to effectively manage and support common resources, provided that appropriate conditions are available: appropriate rules, effective conflict resolution mechanisms, defined limits of use, guaranteed by third parties.

To these qualitative statements are added the already-mentioned analyses developed by some critics of the political economy for which, in summary, the knowledge-based economy has undoubtedly developed in the last 50 years within health care, education, and research and development sectors (5) which, linked to welfare systems, take on a biopolitical role, where cognitive work producing knowledge for life clashes with power structures (biopower) seeking to profit from such productions by imposing proprietary logics. The increasing centrality of knowledge economy is influential enough to change the type of configuration of capitalist society, leading it to become cognitive biocapitalism (7).

During Fordism, the social production and reproduction of knowledge originated organizational typologies affected, within their functioning, by the particular nature of knowledge as a nondeductible common good, where sharing, rather competing, creates development and well-being, producing advantages primarily for professionals, as well as a whole range of operating systems that are completely heterogeneous from those used in the manufacturing of material goods. Following Fordism, the development of knowledge economy has prompted biopower to try to impose control and value of this economy through proprietary logics that have not been able to subjugate the social practices of professionalism: in the new conditions of this phase, professionalism has merged into living cognitive work, battling biopower repeatedly expressed:

- in the dispute concerning neoliberal governance, where living cognitive work has requested and practiced clinical governance when facing specific counterproductivity in the economy of knowledge by corporate governance, as well as its dysfunctional proprietary logics;
- the richness of the operational instrumentation put into place by the cognitive living work is impressive in terms of concreteness and superiority in allowing the use and development of knowledge with respect to proprietary devices: problem approach, clinical and evaluative epidemiology, scientific method enhancement,

health promotion, financing systems in which “health pays” -global budget, capital share - clinical audits, peer reviews, evidence based medicine, transparency on conflicts of interest, continuous education of doctors and other health workers, shared evaluation of outcomes between workers and users, etc., represent a partial list of the powerful operational tools implemented by cognitive work in order to continue to develop the knowledge economy, bringing out the disconcerting shortage within proprietary operating systems: in the much-vaunted “management by objective” alone, problems are subtracted from the collective discussion because selected by owners, nailing the workers to achieve objectives assigned to them by others, easily recognizable, once unmasked the rhetoric front, as owners messing proposals in areas where proprietary logics produce enormous damage to health and knowledge, as shown by the Covid 19 pandemic.

The risk conditions produced by the pandemic have highlighted the divergent interests between population and cognitive workers, who demand centralization of everyone's health, exploiting for this cause tools intended for the common management of knowledge and proprietary logics of biopower, which, in turn, aspire to impose continuity in the production processes of cognitive biocapitalism, though left without arguments, crushed by unsustainable negationist positions, in the impossibility of silencing and firing all the cognitive workers of the world; a contradiction well exemplified in the clash between evidence and ignorance mass mediated through the figures of Dr. Antony Fauci<sup>12</sup> and OMS on one side, and US supremacy administration on the other.

In summary, living cognitive work in knowledge economy, contrary to biopower, is engaged in breaking the disjunction between power and experience (50) that characterized the neoliberal thirty-year period. If the production of knowledge is a process universally recognized as social, it emerges that in the economy of knowledge the power of living cognitive work is breaching, unexpectedly and concretely, in true subsumption<sup>13</sup>, even spurring management methods superior to corporate proprietary logics, since deemed more appropriate for the social development of the cornucopia of the commons knowledge. This conflict is unfolding now, under our very eyes:

- in Italy, the breaking of the real subsumption and/or the disjunction between power and experience has been expressed in the capacity of the multitude to favor health over economy, a demand for which cognitive work has offered and keeps

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<sup>12</sup> Anthony Stephen Fauci is an American immunologist who has remarkably contributed to the field of AIDS research and other immunodeficiencies, both as a scientist and as head of the US National Institute of Allergy and Infectious Diseases.

<sup>13</sup> Marx defines real subsumption of labor to capital as determination of the very way of being of work by the capitalist social relationship that incorporates it.

offering substantial contribution;

- the political heart of Anglo-Saxon elites, the US Republican Party, is committed to trying to impose organized ineptitude in the management of the Covid 19 pandemic, arguing that the sacrifice of the weakest is a worthy price to maintain the economic system funding their unmeasured wealth;
- around the world, seven billion seven hundred million people are waiting for an effective vaccine and/or treatment to be made available to all, meaning that they want to benefit from the fruits of the common good knowledge.

In conclusion, we can remark that, if presently faced with overwhelming scenarios such as the growing inappropriate management of the pandemic, the environmental climate crisis, and the economic crisis deriving by breaking the long lines of globalized production, the biopolitical energies, that unite under the SSN the struggles for the right to health and cognitive work, are precious to supply flesh and blood to the possibility of finally expelling proprietary logics from our SSN, and not only.

If corporatization represented the poorly failed attempt to impose these logics aimed at rendering diseases and health capitalist, cognitive biocapitalism produces with increasing difficulty command and capture of the knowledge produced by cognitive work. It is therefore possible to experiment with corporate and organizational models suitable for knowledge economy and able to guarantee adequate development to the enormous existent social knowledge. Entrusting to the peace of the archives the models of proprietary organizations yearned by the New Public Management.

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## Equity in the delivery and financing of health care and the SARS-COV-2 pandemic in Italy: where next?

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### SUMMARY

*Introduction:* the Italian National Health Service (*SSN-Servizio Sanitario Nazionale*) is characterised by growing socioeconomic inequalities in health care use and financing. Over the years, these have increasingly translated into tangible violations of the equity principle, which characterises the SSN, based on the idea that the public health system, according to the Constitutional dictation (art.3) should guarantee equal access to care for citizens based on healthcare needs regardless of their ability to pay.

*Objectives:* to discuss the main Italian evidence available concerning income-related equity in the use (horizontal) and the financing (vertical) of healthcare services from a health economics perspective; to describe the main challenges posed by the SARS-COV-2 pandemic.

*Methods:* the main evidence for Italy from the economic literature on the measurement of both horizontal and vertical equity is discussed and recent trends in healthcare expenditure are reported before and during the SARS-COV-2 pandemic.

*Results:* before the outbreak of the pandemic in Italy, there were equity problems both in the use of services (horizontal) and in financing (vertical). Pre-existing socio-economic inequalities between individuals are increasing as a consequence of the economic crisis triggered by the pandemic. On the one hand, public health expenditure increased to counteract the consequences of the pandemic and, after years of cost containment policies, there has been a general awareness by the public decision-maker of the importance of public investment in health. The financing, on the other hand, does not seem to have altered its composition and at the moment no specific additional sources have been introduced.

*Conclusions:* the economic crisis triggered by the pandemic is likely to increase socio-economic inequalities and to negatively affect the equity of the public healthcare system. Despite remarkable increases in public health expenditure introduced during the pandemic, the interregional structural gaps remain, which are sources of inequality and inequity. There is the need to define the criteria for the allocation of the increased public funding, which should be based on equity and not only on efficiency and appropriateness.

#### Authors' contributions

The drafting of the work is the result of the joint contributions of the co-authors. In particular, GC edited the part on vertical equity (par. 4), DD edited the bibliographical review, the introduction (par. 1) and the review on the empirical part on vertical equity, and MG the part on horizontal equity and health expenditure (paragraphs 2 and 3). The conclusions are common.

## 1. Introduction

We performed a narrative review on the evidence on equity in the Italian National Health Service (Servizio Sanitario Nazionale -SSN; National Health Service -NHS), to analyse the main challenges posed by the SARS-COV-2 pandemic from both an economic and health perspective.

In this review, we will analyse equity both in the use of services and in health financing. These are essential dimensions of the performance of the SSN, whose high equity levels led in 2000 to the Italian health system being evaluated by the WHO as the second most performing healthcare system in the world after France<sup>1</sup>.

Economic theory assesses the fairness of a health system using two fundamental concepts. The first is horizontal equity, which implies that individual citizens who have the same health needs should receive the same amount and quality of care regardless of their socio-economic status and their ability to pay for such services (1).

The second is vertical equity, requiring different treatment for individuals with different characteristics, which is typically used to assess the funding of health services, whereas in practice the concept implies that individuals with different incomes should be called upon to contribute differently to SSN funding [2]. We want to analyse the state of the art before the pandemic, in order to understand whether over the last twenty years the fairness of the NHS has stood up to the challenges posed by the continuous cost containment policies, that were introduced due to the growing public budgetary constraints imposed at the macroeconomic level (most recently by the global recession of 2008) and by the growing regional decentralisation resulting from the implementation of fiscal federalism after the reform of Title V of the Constitution in 2001. Moreover, we will try to understand how the pandemic and its management could impact on the fairness of the system. The first wave of SARS-COV-2 pandemic has had a devastating “horizontal” effect in Italy both on the health of the population and the economy. It has taken some citizens, mostly the elderly and those in the northern regions, and left others; it has had a profoundly dissimilar economic impact

<sup>1</sup> The issue of socio-economic inequalities and equity in the state of the health of the population will not be dealt with in this contribution as its examination would require a specific contribution, which can be produced later as the pandemic is still occurring and the evidence and data available at the moment are limited.

between economic sectors (it has flooded tourism and cars and favoured insurance, for example), between companies of different sizes (the most affected seem to have been micro and small enterprises), and between territories (north vs. south). The pandemic also had a “vertical” impact on individuals, companies, regions, and inequalities in incomes and wealth worsened. It has put health systems around the world in difficulty, including Italy. Here, in particular compared to other countries, there have been strong variations between regional health systems in the management of the pandemic; one example is the case of Lombardy and Veneto which, despite having identified the virus at the same time, have different systems and have used distinct ways to manage their health services, with consequent varying evolutions of the contagion (3). Since March 2020, Italian policies implemented to counter the negative impact of the pandemic on health and the economy have followed each other at an increasing rate, also predicting significant increases in public spending on health (4). It therefore seems useful to mention the evolution of public health expenditure before and during the pandemic and trying to evaluate how the increases in public spending recorded as a result of the interventions are compared to the pre-pandemic situation. The question that arises is if the increases in the NHS budget, could also help to protect the fairness of the system from further deterioration.

In the light of these considerations, the work is structured as follows. The first part of the work reports evidence on horizontal equity and analyses the trend of public health expenditure both before and during the pandemic. The next part contains evidence on vertical equity and considerations on the possible evolution in the times of the pandemic and later. The last part concludes.

## **2. Horizontal equity and SARS-CoV-2 pandemic**

Over the last three decades, the NHS has been characterised by growing and persistent socio-economic inequalities in health and access to health care. However, differences exist in the socio-economic determinants of inequalities in access to and use of health services. Both the epidemiological and economic literatures primarily indicate differences such as the income and level of education of an individual (5). These inequalities have increasingly translated over the last twenty years into real violations of the principle of horizontal equity that has characterised the NHS since its foundation, namely the concept that the public health system, according to the Constitutional dictate (art.3) must guarantee access to care for citizens based on their need for care regardless of their ability to contribute to the cost for such care.

The Italian case has the peculiarity that the region of residence is a source of inequality both in health (6) and in the use of healthcare services.

Horizontal equity in the use of health services is measured in economic theory with

indicators comparing the concentration of incomes in the population concerned with the distribution of utilization across income groups (1-2).

The indicators estimated for Italy indicate problems for specialist and diagnostic visits, but a substantial equity in the use of hospitalisation and basic medicine services (7-9). When dealing with territorial inequalities in access to services, reference can be made to the Eurostat indicator measuring the average levels of unmet needs for medical care. Although in Italy only 2% of the population has unmet needs, mainly due to costs and waiting times, the value reaches 5% for the lowest income class (quintile), while it falls to 1% for individuals belonging to the highest quintile; moreover, values in the poorest southern regions are almost twice as high as in the richer regions of the North (10). The economic literature has traditionally pointed out that horizontal equity is difficult to define and measure. The main limitations of the poor attempts to measure it systematically in health systems are based both on theoretical considerations (what to measure, what equity, with what methods/indicators) and on the empirical difficulty of measuring reliable indicators that need to be based on income data, individuals' socio-economic conditions, data on utilization (1-2).

Another problem is access to health care in fragile population groups, such as immigrants, which once again shows variability between regions (13) and appeared to be critical across Europe during the pandemic (14). The elderly are severely affected by the pandemic in general, particularly if they have chronic health conditions [4]. Treatment for chronic diseases was delayed during lockdown with the consequent difficulties of access due to extended waiting lists [3]. According to a survey by The Bridge Foundation, 55% of chronically ill people had difficulty accessing visits as a result of the pandemic and 65% said they had longer waiting times. It therefore seems to be crucial to monitor the situation of all fragile population groups during the pandemic as this could exacerbate existing disparities<sup>2</sup>.

### 3. Public health expenditure before and during the pandemic

A main feature of the Italian health system over time has been its ability to improve the health of the population at a relatively low cost (10).

In 2019, health spending per capita in Italy was about 14% lower than the OECD average (\$3,649 versus \$4,224) (Figure 1). Over the same period, the share of GDP of total health expenditure (excluding investment expenditure in the health sector) was 8.8%. When this share eventually reached the OECD average, however, it remained below the levels of European countries such as France (11.2%), Germany (11.7%), and Portugal (9.6%), although it was close to Spain (9%) and higher than

<sup>2</sup> See <https://www.ilsole24ore.com/art/effetto-coronavirus-55percento-malati-cronici-ha-difficolta-ad-accedere-visite-ADvTcvT>, last accessed 17/7/2020.

Greece (7.8%) (Figure 1). The value has remained consistently below the OECD average, mainly due to slow GDP growth since the start of the global recession in 2008 (15); 74% of health expenditure is financed from public funds; the rest consists mainly of private household expenditure (called Out-of-Pocket - OOP) (23%). Several cost-containment measures were introduced after the last global recession in 2008 to reduce public spending, with the result that the burden shifted from the public sector to households, setting tighter budgetary constraints on public spending; for example, by increasing the ticket on medicines and specialist and diagnostic services (16-20). In addition, there has been the partial use of standard cost financing and the imposition on deficit regions of heavy re-entry measures (19)<sup>3</sup>. In Italy, private OOP expenditure is significantly higher than in other Northern European countries such as France (9%), Germany (13%), and the United Kingdom (16%), although it remains below some other southern European countries such as Greece (35%) and Portugal (28%) (Figure 1).

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<sup>3</sup> On the evolution of health expenditure over the last twenty years and the ensuing debate, see Gerotto, 2020 [17].

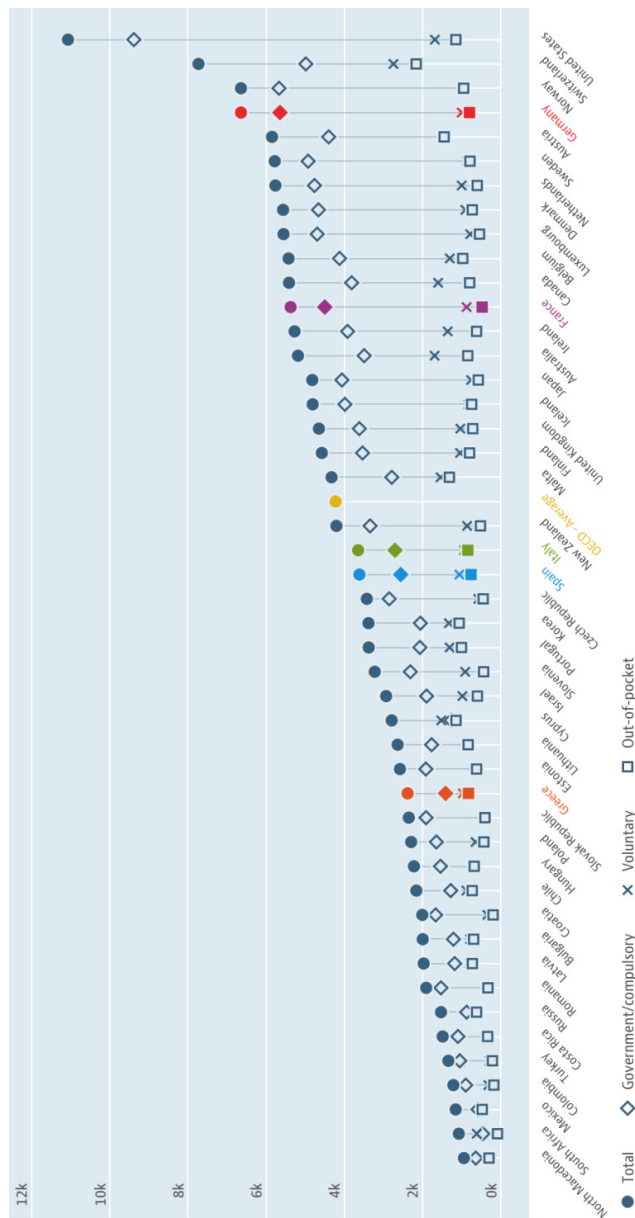
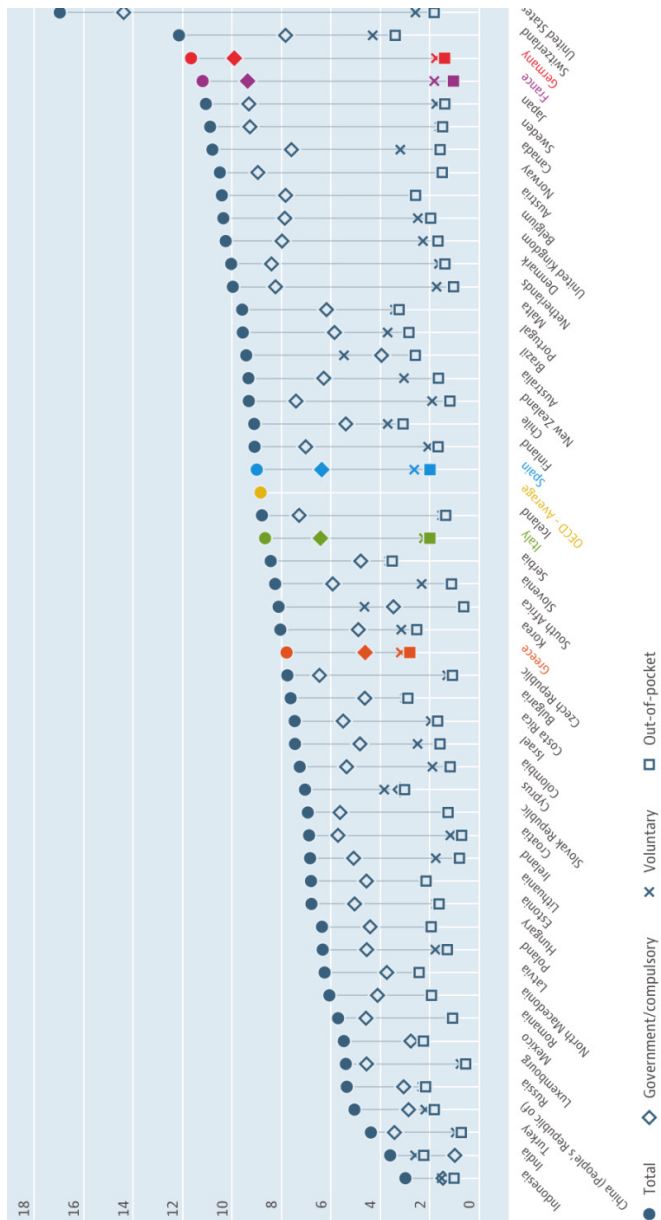


Figure 1 - Health expenditure in OECD countries and its components (public, private, and voluntary insurance OOP) 2019 or last available year  
(a) Per-capita healthcare expenditure (US dollars)  
Source: Corte dei Conti (30).



(b) Healthcare expenditure - % on GDP (Gross Domestic Product)

(\*) 2019 data or the latest available year

Source: OECD (2020), Health spending (indicator). doi: 10.1787/8643de7e-en (Accessed on 19 July 2020)



After the outbreak of the health and economic crisis, the government approved a further set of measures aimed at distributing resources to many sectors, including health care. The economic measures aimed to support both workers and businesses, as well as aggregate demand (3-4). The main measures concerned public transfers, labour, loans, tax concessions, and tax credits aimed at increasing the liquidity of enterprises (21). In 2018, forty years after its foundation, the NHS was substantially under-funded, with staff shortages and structural north-south supply gaps (17, 19). Shortly before the outbreak of the pandemic, the government had begun to increase NHS funding with the 2019 budget law<sup>4</sup>. The state's contribution for health spending was increased by 7 billion euros for 2020 to 84.6 billion<sup>5</sup>, with further increases expected for the following years (0.60 for 2021 and 1.609 for 2022) (22)<sup>6</sup>. Moreover, business competitiveness and development spending forecasts in 2020 rose from € 22.6 billion to €127.8 billion<sup>7</sup>.

Since the 1990s, and up to the pandemic, public health spending has always been conditioned in this country by the need of complying to the macroeconomic constraints imposed by the European stability mechanisms on public accounts. Nevertheless, the pandemic has reversed the situation: new resources to give oxygen to public healthcare. However, many questions remain unanswered. Tax breaks, such as those provided for IRAP - Regional Tax on Productive Activities - are likely to have a negative impact on equity in financing. This because IRAP is one of the main sources of funding for regional health care and it is progressive. It is also expected that health care financing will be reorganised (22). Moreover, one of the main persistent problems of the health system is that public health expenditure shows significant variations between regions, reflecting the historical socio-economic disadvantage of the southern regions. Since the 1990s, the policies of the Italian Government for the rationalisation and containment of the growth of health expenditure combined with decentralisation in the administration and provision of health care have led to growing interregional inequalities and to the creation of twenty-one regional health systems (23-24). There is debate surrounding the role of tax decentralisation reforms that have devolved financial responsibilities to the regions. Whilst evidence reveals a reduction in expenditure on certain services provided to citizens and that disparities in the health of the population have not increased (25), the pandemic has highlighted

<sup>4</sup> The budget for 2019 was €114.474 million, with an expected increase of € 2,000 million for 2020 and a further increase of €1,500 million for 2021. See Ragioneria Generale dello Stato[20], UPB (2020) [22]. Law no. 145/2018.

<sup>5</sup> On the details of the measures and appropriations provided for, see UPB (2020) [22].

<sup>6</sup> Ragioneria Generale dello Stato data (<https://openbdap.mef.gov.it/BdS/Scopri>, data published 8 July 2020)

<sup>7</sup> Ibidem

the different ways of managing the health services in the various Italian regions. This triggered a debate on the effectiveness of regional decentralisation in pandemic management (3). One of the advantages of federalism lies in the empowerment of local authorities, which could imply in principle a greater attention to the needs of citizens. At the beginning of the pandemic, the lack of a national plan of immediate effectiveness coupled with a relatively high regional autonomy likely allowed some regions to adapt their response more quickly and probably often more effectively.

However, there is a lack of up-to-date evidence, to inform this debate and to ascertain how the different regional pandemic management policies have led to regional inequalities and inequities and, by this means, to a deterioration in the NHS equity. Moreover, resources must be prioritised even when, as in the case of the extraordinary interventions planned for the pandemic, healthcare expenditure increase in order to set need criteria that do not perpetuate or, even worse, increase existing inequities. The Parliamentary Budget Office considers it essential for the public sector to be able to allocate additional funding by setting priorities in terms of cost-effectiveness and appropriateness in order to cope with increasing pressure from service providers, in particular from the private sector [22]. This will hold even more if the resources allocated at the European level will be used in order to increase health expenditure. The Board of Governors of the ESME (European Stability Mechanism) and finance ministers from the 19 Euro-area countries agreed on 15 May 2020 to make pandemic crisis support available to Member States. Although an examination of the issue goes beyond the scope of the work, a country with support for pandemic crises may require a drawing of a precautionary credit line. The requirement for obtaining access to the planned credit line for EU Member States requesting assistance is to use it to support the internal financing of direct and indirect health care, as well as the costs related to treatment and prevention due to the pandemic. Although the stated objective is to minimise the costs of supporting pandemic crises by financing at lower costs than the usual precautionary credit lines of the EU, there is a debate on whether or not to apply for EU funding, since the latter represents an additional source of indebtedness [26].

#### **4. Vertical equity and SARS-CoV-2 pandemic**

Vertical equity concerns the different treatment between individuals; in the health care field, it has been mainly applied to financing. It suggests that the rich should contribute more to the financing than the poor.

The leading concept is that of “progressivity”, which is usually measured in graphical terms (Gini curves and the concentration of payments for health services), although when curves cross it may be difficult to ascertain their meanings. It can also be measured synthetically

with indexes; the most frequently used for progressivity is the Kakwani index, assuming values ranging from -2 to +1, with negative values representing regressivity and positive values progressivity (27).

To study the progressivity in the financing of health care, we need to take into account all financing sources used to fund health care services. Some of them are compulsory, such as general taxation and payroll taxes; others are voluntary, such as insurance premiums and OOP expenditures.

The method used to measure “vertical equity” in the financing of health care, that is to identify if the financing is “fair” because the burden falling on the richest is greater than that falling on the poorest, is based on the estimate of the “progressivity of the whole financing system”. We measure the progressivity of each source of financing and calculate an aggregate index weighting each source with its share in the whole financing of health care in Italy. In practice, we calculate Kakwani indexes for each source and we weigh them with the aggregate financing mix of Italian health care. Such a methodology is accurate and difficult to apply, though it is open to criticism. The first critique points to measurement problems. When administrative data are not available, we need sample surveys to determine who pays and how much. In a paper submitted for publication (28), we tried to overcome these difficulties by “merging” two different surveys: the household expenditure survey, allowing the measurement of “private” health expenditure and the amount of VAT paid out for health expenditures, and the SILC survey for income and fiscal payments to measure the financing of a portion of public health expenditure. At the end of our measurement exercise, we unfortunately concluded that in Italy the financing of health care expenditures in the 2010s was globally “regressive”; that is, damaging the poorer. This was not true before the reform introducing regionalisation/federalism (29).

The second criticism is the low information content of the final aggregate index stemming from the analysis, representing either progressivity or regressivity. There is the risk that aggregation entails “compensating effects”, namely that specific regressivity components are cancelled out by contrasting progressivity effects, preventing researchers from disentangling where and why we should intervene. We have discovered the progressivity/regressivity of each source of financing, we can thus conclude that if certain sources are too regressive, we must act. Nevertheless, an important issue is hindered and coming to the fore due to the shifting of our health care system towards federalism aiming at less solidarity; put simple, this is because of regional differences. If, then, in a specific region we discover regressivity problems – having understood if the regressivity is due to the financing mix or to specific sources of financing – we should intervene in that region and not at the country level. The question is if the redistribution of resources among regions, today still in place, helps in reducing regressivity. In our study, we believe that the Italian redistribution system, far from being ideal because it neglects many “need” factors in allocating resources to regions,

nonetheless lowers the regressivity of health care financing.

The third problem surrounds the “meaning” of progressivity and regressivity if applied to specific sources of financing such as OOP expenditures. For compulsory sources of financing, in fact, the financing of health services is never directly linked to benefits obtained by using services; we must pay independently from usage. In such an eventuality, the meaning of progressivity is sound because it is not linked to use. For OOP expenditures, instead, we pay for what we use; greater payments for the richest (progressivity) also imply greater use by the richest. Does progressivity now represent “equity” in the financing? The international literature, having noticed the issue, has largely preferred to overlook this, because of hard to solve measurement problems. Which sound equity concepts could we apply to OOP expenditures? We could measure either the “price subsidy” or the “income support” to guarantee to the poor; the first requires that, given equal needs, the poor pay the same private health care service less than the rich. The second should measure, given the same price of private health care services for everybody and that the poor face higher health risks than the rich, the income support necessary for the poor to face such higher needs. As mentioned previously, both concepts are thus very difficult to measure.

Having discussed the three major criticisms to the empirical studies aiming at progressivity measurement, we can summarise the main results of our study [28]. In Italy, there are five major sources of health financing: VAT, IRAP, and Regional IRPEF surcharge are the public sources, while private insurances and OOP expenditures are the private ones. Table 1 shows the composition of the financing mix in 2015:

	Regional tax on production activities (IRAP)	Income tax (IRPEF) Regional surcharge	Value- Added- Tax (VAT)	Out-of- pocket (OOP)	Private insurance
ITALY	14.80%	6.30%	52.30%	24.00%	2.60%

Source: Corte dei Conti (30).

Table 1- Financing mix (main sources of financing ) in 2015

A recent study using 2015 data showed that, because the bulk of health care financing comes from VAT, its regressivity also forces the aggregate index towards regressivity, leading to an Italian equity index equal to -0.099, representing low regressivity[28]. Moreover, we estimated that the public component of financing has a slightly smaller regressivity index of -0.090 [28]. Regressivity levels, though, are very different among Italian regions; the poorest southern regions, assuming that they should face all financing burdens for their inhabitants (ex-ante), would overburden their poor citizens

more than the richest northern regions [28]. Such a result is mainly due to the higher regressivity of VAT in the southern regions. In our work we also show that, due to the redistribution of VAT resources for public health care financing from north to south, the lower regressivity of northern VAT reduces the ex-post regressivity of financing in the south: the redistribution leads to an overall regressivity equal to -0.024 [28].

This result highlights the value of solidarity among regions, often not sufficiently emphasised because of complaints about the higher levels of inefficiency in public healthcare delivery of southern regions (which are undeniable); the poor therefore suffer less than without redistribution. Loosening solidarity implies damages to the poorest population groups. This is not only or not mostly a geographical problem, but a "vertical equity" issue.

Bearing this in mind, we try to scrutinise both the main policy options in the discussion and the plausible consequences, which remain unmeasurable due to the pandemic still ongoing.

The increased risk of horizontal inequities in the utilisation of health services, together with the worsening health care in the south of Italy due to the regionalisation of Italian public health care, has been pointed out elsewhere [31]. The total amount of financing for the Italian NHS and the essential levels of care Italians are entitled to, would be decided by politicians no longer considering the "Italian" median voter, but sticking to the preferences of median voters of northern regions; because voters of the north redistribute resources to the south, they are also given the task of deciding the public/private mix in health services financing. This shift has consequences for different age and income groups, too.

What we are interested in now, is not the global amount of financing but its composition by sources and the ways they are collected. We faced a shift from general taxation financing, based mainly on progressive income taxes such as IRPEF, to a financing mainly based on more regressive indirect taxation such as VAT. Moreover, the remaining progressive sources of Italian financing (Regional IRPEF surcharge, IRAP) – due to both economic crises since 2008 and to the unwillingness, by industrial associations, to maintain the IRAP source deemed to be illegitimate and burdensome – have reduced their revenues and may, eventually, be abolished.

The Italian shift from direct to indirect taxation is in line with trends in many other countries, and is also coherent with the increasing concentration of income and wealth in recent years as shown by Piketty [32].

The existing North-South divide ("Questione meridionale"), i.e. the socio-economic disadvantage of southern regions, can be worsened from the shift to a financing rooted on VAT. In the poorest regions, the ratio of consumption to own income is greater than in the richest regions, due to public transfers and subsidies. On the one hand,

VAT tax rates are different for different goods, and lower for necessities, which are more represented in the consumption basket of the poorer south, being "progressive" with respect to "consumption". However, on the other hand, VAT tax rates are more regressive with respect to earned incomes in southern regions because of such a high consumption/income ratio. Consequently, it becomes crucial to reduce regressivity in financing and to keep the redistribution mechanism among regions; while lowering the redistribution among regions would be detrimental to southern regions.

Linked to these considerations is the current discussion about the importance and social utility of the third financing pillar, made up of Supplementary Funds (Fondi Sanitari Integrativi).

The existing evidence shows that the recourse to supplementary funds is not homogeneous in Italy, because the members are concentrated mainly in the north (where the firms/economic categories that promote them are based), in the active age groups (i.e. not among the elderly), and among those with lower health "needs"[33]. A progressive "emptying" of the NHS, to delegate previously public tasks to supplementary Funds, could deteriorate equity, while increasing the North-South divide. It would be interesting to analyse whether the "progressivity" of the financing system is at risks of worsening. Unfortunately, due to a lack of data, we are unable to answer this question because the existing sample surveys do not allow us to distinguish between supplementary funds and the traditional private insurance. However, we know from previous studies that the tax benefits – i.e. the reduction in taxes due to the deductibility of premiums/contributions paid to supplementary funds - are largely concentrated in favour of the richest; this may signal a serious indication of the regressivity of the supplementary funds financing "system" [34].

The pandemic is part of this scenario. On the one hand, it has brought the NHS, doctors, nurses, and all other professional categories to the centre of attention, as these individuals have worked much more (and with greater risks) than contractually envisaged, highlighting a spontaneous attachment to the system that goes far beyond the typical behaviours of contracts of a private nature. This holds even more if one considers that the negative incentive typical of the private sector, i.e. the dismissal, is missing here. On the other hand, the supplementary funds sector, in most regions, seems to have mostly played a residual role compared to the public sector in covering Covid-19 patients.

A first consideration is related to the sources of health financing. In the period following the pandemic, it will be necessary to reconcile, on the one hand, the economic interests of entrepreneurs, who are calling for the abolition of IRAP, as well as considerations of vertical equity in the financing of health care, for which IRAP should remain among the sources used.

A second consideration is related to the resources available to the NHS. How should they be used in order to achieve better health? Fiscal federalism by its nature can improve efficiency but can also challenge equity. Italy has moved over the years 2001-2008 to a much less stringent budget constraint than in the past, making possible to better satisfy the needs of all regions, including those in the south. The latter, while losing resources in relative terms, received more funding in absolute terms. The 2008 recession made it possible to highlight what happens when budgetary constraints become stringent, beginning to reveal equity problems associated with the federalist approach.

Indeed, given the problems that emerged due to increasing divergence among regional healthcare systems and policies, often determined by the evolution of the regional healthcare "model" adopted, political forces debate the hypothesis of a greater centralisation of decision-making through a further Constitutional Reform. Establishing greater centralization in decision-making, where the main problem is not the treatment of chronic conditions but that of pandemics, can make coordination easier. The decision-making centrality does not necessarily require greater centrality in financing. Moreover, the return of a greater role for public financing, using direct rather than indirect taxes, does not appear on the political agenda at the moment this article is written.

## 5. Conclusions

It seems crucial to monitor the situation of all fragile groups during the pandemic as this could further aggravate existing disparities. One of the main consequences of the lockdown was to decrease the provision of medical services not addressing the treatment of Covid-19, resulting in worsening treatment for chronic diseases or any other non-Covid-19 condition. Furthermore, further disparities may have arisen between those who could afford private assistance (including publicly located private provision – called “intra-moenia”) and those who relied solely on public assistance. Such conditions, have a non-homogeneous concentration horizontally and vertically. How Italy will emerge from the health and economic crisis is also relevant, i.e., either with own resources or with the financial support of the European Union, the latter implying higher levels of public indebtedness. Whenever there is public debt, the refund mechanism no longer passes through the specific tax sources designated in the federalist system, but it follows the entire structure of public tax collection, where the weight of direct taxes is higher. Paradoxically, debt financing should lead to greater progressiveness and to higher levels of vertical equity. A positive consequence of the pandemic is the softening of the macroeconomic budget constraint imposed on public health care for a decade in our country by the European mechanisms of stability of public financing with a reversed situation: new and unconditional resources for the



health budget available, with a renewed emphasis given to the fundamental right to health both at the national and the European level. Better late than never, one might say. However, it will be crucial to define the allocation criteria for the new resources that will be made available for the NHS. This should be achieved by taking into account both efficiency and appropriateness and, above all, equity criteria. Monitoring health equity is even more necessary than in the past. The ghost of health systems in which too many citizens still have no form of coverage and lack access to essential health services is still appearing in the industrialised world, posing a further threat to the health of the population in times of pandemics. Attempts to measure horizontal and vertical equity based on income have so far been sporadic and unsystematic in Italy. However, with the increasing availability of administrative data in real time and thanks to the development of information technologies, with the new techniques of big data analysis (e.g. through machine learning), real-time monitoring of equity is no longer a fantasy, but a concretely achievable goal. In times of pandemics, health equity monitoring is no longer an option, particularly if one considers that in history the growth of socio-economic and health inequalities has often been followed by a crisis in democratic institutions.

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## Sharing and developing a Model for Primary Territorial Prevention: the Ecodistrict

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**Key words:** models for primary prevention, environmental determinants of health, reappropriation of environmental matrices, common management, negative externalities of environmental pollution

### SUMMARY

**Introduction:** the Models of Primary Territorial Prevention (MPTP) and environmental legislation in force do not protect environmental matrices (air, water, soil) from linear productive activities that do not separate the technical and biological cycles. Hence, they introduce pollutants that increase disease risk, alter and subtract the matrices from the common uses of the inhabitants and damage the homeostasis of ecosystems and habitat of other species.

**Objectives:** activate a shared process for defining and experimenting a MPTP that:

- a) safeguards environmental matrices from pathogenic and unsafe uses;
- b) rebalances the related power asymmetries;
- c) has positive impacts on health, environment, the economy and territorial management.

**Materials and methods:** Creation of meaning, meta-organization, investigation/with research, are used to activate a process of shared development of a MPTP which include territorial committees of the involuntarily exposed, environmental associations and local authorities as well as motivate present social knowledge to participate in the enrichment of the model.

**Results:** A first set of results concerns:

- 1) shared conceptual bases (systemic approach, circular economy, criteria for effective management of the commons) and 1.2) analysis of processes connected with linear production activities (risk production, disposals and negative externalities) that base nominations (risk producers, involuntarily exposed) more suited to the real impacts produced and 1.3) the constitutive characteristics of a MPTP capable of preventing them, *the ecodistrict*;
- 2) a second group of results documents 2.1) application developments (first activation of the ecodistricts

in defined territories, law proposal for the ecodistrict, audit characteristics on the state of the matrices); 2.2) potential emerging obstacles and 2.3) implementations in place.

*Discussion and conclusions:* concern the methods aspects connected with the sharing processes and the impact of the ecodistrict MPTP on health, environment and economy/management of the territories.

## Addressed issues

*“To repair is twenty times more difficult than to prevent!”* A quotation by the Swiss philosopher Henri-Frédéric Amiel (1821-1881) is given at the opening of the European Parliament *“Endocrine disruptors: From Scientific evidence to Human Health Protection”* (1). The quotation serves to arm the reader from the possible increasing concern that she/he may have after reading the publication. The latter points out the effects of endocrine disruptors and ways of reducing their spread through a much hoped-for improvement in European legislation, which has so far been distracted or absent. A concern possibly consolidated by reading reports on the state of environmental matrices, such as ISPRA (Higher Institute for Protection and Environmental Research) *2018 Environmental Data Yearbook* (2) where - taking stock of the quality of air, water, soil, built environments, etc. in Italy - a complex situation emerges in which there is no lack of a realistic representation of environmental degradation affecting our peninsula in general, the shallow and deep slopes, as well as specific contexts such as the Po Valley. A territory among the richest and most developed in Italy where environmental and health protection are implemented by the best national public administrations - and where the complex of environmental matrices is so heavily polluted that it is difficult to think of a path of *restitutio ad integrum*. Romagnoli, Neri and Pala (3), in a case analysis on the Sites of National Interest (SIN) Terni Papigno, show that, while respecting the integrated environmental authorization, in the Terni Thyssenkrupp Steel plant, every year from 2007 to 2015, between 1 and 1.5 tons of IARC (International Agency for Research on Cancer) Group 1 carcinogens, epigenotoxic compounds, endocrine interferers and substances with proven multiorgan toxicity, have been issued. So much so that in some international scientific publications dedicated to innovative environmental characterization systems, it is stated that the city represents an excellent context for experimentation, being *“one of the most polluted cities in Central Italy”* (4-5). On a global level, things do not get better. In a recent Lancet report (6), an alarm is launched regarding delays and disapplications of the Sustainable Development Goals (SDGs) (7-8). Despite rhetorics of the big decision-makers, the 17 areas of intervention concerning important variables to govern - in turn divided into approximately 170 targets monitored for application in more than 190 countries around the world -

show decisive delays and often substitutions or reversals of the objectives with respect to the policies indicated as necessary. The 2030 SDGs will not be achieved, which, given the devastating effect of the negationism promoted by US supremacists, also questions which methodologies can ensure sharing processes that create meaning for long-term commitments by all involved.

The National Plan for Prevention 2020-2025 (9) contains a series of merit indications that are fully acceptable with environmental prevention even though the level of sharing reached with polluted and local authorities is unknown. The multiplicity of programmatic instruments proposed could thus suffer in the application phase, invalidating the conditions for effective intervention in degraded and/or risk situations (SINs, large cities, territories with unhealthy industries or agricultural or industrial specializations with high environmental impact, ....); in addition to a lack of assessment of the effectiveness of this approach in previous years. Our territorial experience, especially in polluting activities carried out by stakeholders with considerable economic power, are floundering because unable to produce significant documented reductions in risk exposures and could benefit from the availability of a Model of Primary Territorial Prevention (MPTP) that involves positive impacts on health, environmental and economic management plans.

This article aims to contribute in resolving this problem and is the result of several years of work carried out in Umbria, to develop a shared MPTP.

## Objectives

- a) activate a shared process for the definition and experimentation of a MPTP;
- b) safeguard territorial environmental matrices as they are distal determinants of health, from careless uses;
- c) rebalance the power asymmetries among polluted and polluters;
- d) guarantee advantages of the model in both health and environmental plans as well as the economic management of territories.

## Methodology

The International Society of Doctors for Environment<sup>1</sup> (ISDE) advocates exhibits by producing research and guidelines on health and the environment based on the best scientific evidence and produces appropriate declinations of the precautionary principle without conflict of interest. The methodological indications of the World Health Organization, with particular reference to those relating to health promotion (see Ottawa Charter (10) and subsequent developments) and primary environmental prevention (Ostrava Charter (11)), as well as evaluations by related research entities

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<sup>1</sup> [www.isde.org](http://www.isde.org)

such as IARC, are taken as reference.

On this basis, advice is offered to citizens, territorial committees and local authorities, as well as interactions with national and supranational institutional levels that intervene in the field of environment and health, aimed at representing risks and benefits of individual choices.

The advocacy activity planned by the ISDE statutory, in view of the numerous challenges found in the regional territory (SIN Terni Papigno, presence of unhealthy Group1 industries - classified under Italian standards in the 'most pollutant industries' category - or polluting in other territories, energy production challenges, waste cycle management, pesticide use in agriculture, forest/woods exploitation...) has been interpreted and developed in a range of methodologies aimed at:

- "sensemaking" for the proper activation of citizens against polluting activities, following the indications of Karl Weick (12), for which the external world, although it exists in itself, does not have its own intrinsic meaning but only what we attribute to it; therefore it is not possible to know the outside world and interact with it except within our processes of creation of meaning, based on normative cognitive maps. If "sensemaking" means creating a mutually validated grammar for reducing ambiguity, processes of creation of meaning can be developed through: the activation of an interpretative context, also based on shared practices of nomination, aimed at identifying structures and connections; the selection of many ambiguities, confusion and interpretative uncertainties; the retention of information centered on new cognitive maps, redefining the pre-existing ones;
- to make use of available scientific evidence on health and environmental effects of polluting substances and installations with a view to health promotion and primary prevention;
- develop initiatives targeted to create conditions in which citizens are more likely not to be exposed to risk through approaches based on "co-research" (13) and "meta-organization" (14) meaning priority acquisition practices and potential solutions shared with those experiencing health problems related to alterations in environmental matrices (air, water, soil). Aiming not to tell the polluted what should be done but rather create cognitive and operative conditions in which they could permanently, well-manage the activated disputes therefore protecting the territorial matrices in which they live and work.

At the operational level, the development of the model has been concretized as an open process which, for descriptive purposes, has developed in several phases:

- a)** in phase one, together with the provincial sections of Perugia and Terni, a network of relations with local committees and environmental associations has been built;
- collaborating in risk and epidemiological analyzes connected with the manage-

ment or activation of specific production activities evaluated with high environmental impact;

- conducting bibliographic research, ad hoc studies and surveys at different structural levels (3-15, 16) to gain knowledge about the concerns and experiences of the citizens;
- producing content analyzes aimed at bringing out shared visions, orientations and assumptions, as well as related problems and models useful both for the proper conduction of specific disputes and for finding overall solutions to the management of health, environment and economy, in defined territories.

In this phase, particularly structured interactions were developed with the Umbrian Zero Waste Regional Coordination. In 2017, the need to work on the definition, experimentation and implementation of a primary territorial prevention model centered on a shared definition of clear fundamental characteristics emerged unanimously.

**b)** in phase two, up to the present, work has been done to refine the characteristics and functions of the model during interactions with the various environmental disputes, depending both on the evidence produced by the studies mentioned above and on the indications that gradually emerged on the characteristics and functions of the model recognized as productive in real contexts. In addition to the enrichment and knowledge of the citizens involved (doctors, teachers, architects, agronomists, lawyers, chemists, systems engineers, sociologists, journalists, local administrators, ecologists, eco-feminists, people with a strong civic sense and environmental sensitivities, etc.).

During this period:

- an important interaction took place with the University of Perugia's Law Clinic (17), and produced, by popular initiative, a regional law proposal for the activation of the ecodistrict MPTP;
- the first experiments carried out - with different levels of interaction - from opposition to collaboration - with the local authorities, of the model in relation to the activation of moments of consultation (audit) from a particular structure, of which will be referred to in the results (Terni, Borgoglionne, Gubbio);
- implementations of the model have been developed relating to urban contexts, agriculture, methods for measuring the costs that polluting activities produce both in direct terms (costs of lost health and polluted matrices) and indirect terms (costs to be incurred for territorial reclamation and redevelopment), evidence of effectiveness of defined solutions (e.g. actual micro-organisms) in difficult decontamination activities.

Overall, the combination of these methodological choices in the two phases briefly described, has led to a first level of definition, experimentation and implementation

of the ecodistrict MPTP, as described in the Results section below under the three key sections of health, environment and economy. The Discussion section addresses both the methodological problems connected with the sharing processes and integration between environmental characterization and inferential epidemiology, and the expected performance of the model.

## Results

### *1) The “Ecodistrict” Model of Primary Territorial Prevention and its current characteristics*

This section summarizes the results of the processes of observation, interaction and sharing. Conceptual and observational bases that have founded the name of the proposed MPTP, nomination of main stakeholders and functions as well as the operative articulation identified to ensure positive impacts on health, environment and territorial economy and management.

#### *1.1. Shared conceptual bases*

The complex of the supported interactions brings out a substantial shared view on the criticism that numerous authors (18, 19, 20), even belonging to heterogeneous disciplines, have developed on the limits of the current vision of “linear” economies. The latter would have in common the assumption that an objective can have, as an effect, only that for which it was conceived to be. It is a mechanistic vision in which the different components in the real world are assumed as being separate and independent from each other. In this regard, there is a growing convergence in considering the assumption of systemic models as more adequate (19, 21-22) in foreshadowing the impact of human actions, since they take into account the interactions and feedback that are given in real life, shed light on the heterogeneity of the results and, above all, impose particular precautions in choices that concern actions in the production of goods.

The two climatic and environmental crises (23) are, in fact recognized by supranational scientific organisms as a consequence of the prevailing of these linear visions in production activities (fossil energies, intensive farms, plastic production, use of pesticides, extractionist approach in the management of territories, etc.).

In light of this, since the 1970s, the international scientific community has increasingly accepted the concept of a “circular economy” (24-29) which implies, unlike that based on linear visions, the need to aim in production activities having a separation between the technical and biological cycles, which is supported in redesigning them so that cycles and products are thought of from the “cradle to the cradle” versus the current “cradle to the grave”. Since the goods produced, once their value of use has been exhausted, become waste that is added to the much more abundant and



dangerous waste connected with the productive cycles of the linear economy, with a subsequent effect on the environment, health and economy. On the other hand, in the first case, the result would be goods and products characterized by a radical sustainability designed on the basis of separation between the technical and biological cycles. They would be immediately reusable as a secondary material in the case of goods, and the production cycles thus conceived would not have negative effects on health and the environment.

Separation between the technical and biological cycles advocated by the theorists of the circular economy sees its application in a real world where the organized interests of risk producers are represented preferentially where all life-important decisions are taken. This gives rise to a range of positions ranging from a non-existent problem (strong Negationist suprematist in Anglo-Saxon elites and in Persian Gulf theocracies) to a pragmatic one that is applied within the “Green New deal” where everything is entrusted to the “green” sectors of the capitalist economy (US democrats, platform capitalism and the European Union). Comprising the ambivalent development proposed by the European Union by making important financial resources available as well as experimentation in specific territories in the people’s Republic of China (30-31) to the systemic globe programming proposed by the UN with the SDGs (7). If the transition into the circular economy is generally viewed favourably by those exposed to the increasing and catastrophic damage to the environment and health caused by linear productions, it has been observed that most of the implementation policies, at this stage, come from above. It is necessary to develop and test approaches thought and wanted by those at the bottom that take into account the specific characteristics of local contexts. Without an adequate role, there is a high risk of substitution and reversal of ends.

To this avail, the indications produced by economists of the common goods, and in particular by the 2009 Nobel Prize winner Elinor Ostrom and her colleague Charlotte Hess (32), who have analyzed a wide range of situations in which local communities have successfully managed common goods, ensuring effective maintenance in the long run, are considered highly remarkable. If, in general, common goods mean “goods which are property of a community and of which the community can freely dispose” (commons of the Anglo-Saxon juridical tradition), Hess and Ostrom provide a more problematic definition of the common good: “a resource shared by a group of people and subject to social dilemmas (queries, controversies, doubts, disputes, etc.).” For these authors, “a common good is free from values: its outcome may be good or bad, sustainable or not, and, to ensure lasting and stable systems, clarity is needed, good decision-making skills, and collaborative management strategies” which are summarized in a series of “rules” that are correlated with the outcome described.

In addition, for our purposes the commons' discourse assumes importance because connected with a series of important social values related to innovations that they can support since:

- firstly, a descriptive value because they identify models of government which would otherwise not be examined;
- secondly, the language of common goods is a way in which people can claim a personal bond with a set of resources, as well as social solidarity with one another;
- thirdly, a constitutive value because, by providing us with a new language, they help us establish new levels of common management based on principles that allow maintenance and maintenance over time (32, op cit.).

### 1.2. *The nomination of stakeholders and impacts of linear productions*

The observations that we have gathered investigating many environmental disputes converge in indicating that *it is precisely the productions that do not separate the technical and biological cycles* - because they are *linearly* conceived - that represent the end of the skein because:

**a)** they produce risks and damage to the environment and health, creating the unenviable condition of "*involuntarily exposed*" (Fig. 1) in people living and working in the *spillover emissions area*. *Involuntary exposure to risk* is, in itself, *a damage* to mental health and the quality of life, whether or not there are appreciable effects on physical health. An important point that results from this acquisition is that we can now define "*risk producers*" as productive activities that do not separate the technical and biological cycles, giving this category an objective dimension based on the risk that those activities determine, thus avoiding judgmental terminology;

**b)** *risk production* is always associated with *dispossession* (16), since the failure to separate the technical cycle and the biological one implies that common goods such as air, water and soils are subtracted from common use, expropriated and contaminated; as if they were "*res nullius*" in a practice that exceeds both the constitutional provisions (art 42) and the "*bundle of rights*" - however limited in relation to the general interest - that property is seen everywhere to confer by regulations (33).

### So, who's going to think about the environment and our health????



Fig.1: Naive depiction of the concerned exposed

Source: Manifesto of the Environment Committee "Molini di Fortebraccio" (Ponte Valleceppi-Pretola (PG)) January 2013.

Dispossession connected with risk productions is not limited to environmental matrices only, but also concerns:

- asset value of the involuntarily exposed who live in a spillover area of emissions since real estate value is lost (houses, land, cars, ...) creating differential hierarchies in ownership rights. Properties of the exposed are not safeguarded as those not living in spillover areas. Clearly, there is a disjunction between owners' rights, legality and environmental justice;
- the effects of partial prevention measures (prohibiting garden cultivation, farmyard animals, regulation of school accesses or accessing public spaces, ...) in spillover areas consist of further dispossession of the involuntarily exposed;

c) *risk production and dispossession* also give rise to numerous *negative externalities* which should be well calculated when assessing the costs and benefits of new production activities:

- the suffering inflicted onto the involuntarily exposed by living in an environment at risk;
- the consequent damage to health;
- the degradation of the territory which loses its landscape and its cultural-historical characteristics, as well as its environmental quality which enhances

- residency and founds the complex cultural processes that nourish the ‘anthropological specificities of communities’;
- the negative impact on other productive activities (tourism, agriculture, construction, etc.);
  - ‘biodiversity reduction’, which is too often overlooked. As many naturalists point out that it is important to counteract indifference to the costs imposed on the various forms of non-human life, both because of their value as such, both for the negative feed back that the impoverishment, or more often, destruction of other life forms, also determines the conditions of the prevailing species, ours;
  - the enormous difficulties and costs that arise when the polluted matrices are to be cleaned up, an operation referring to more than 40 SINs whose linear productions have created health (34-39) and environmental damages. The interventions are then not implemented, leaving more than 6 million Italians living in a state of chronic risk exposure and protracted dispossession, while, for local administrations, the costs and problems of reclamation are very difficult to face.

The authoritative authors (40) consider, moreover, the term *negative externalities* gives a shroud of occasionality to the negative effects of risk production when, in fact, these effects are not only systematic, but also important in increasing the value obtained with the specific productive activity, considering it more appropriate to say that risk production is always connected with value extraction. The linearity of risk production allows to formally ignore the damage to the environment and health, in order to avoid necessary planning and operating costs which, if not addressed, guarantee a substantial share of the profits.

### 1.3 Model designation and distinguishing features

It is on the three pillars of the systemic approach in the reading of reality, of the circular economy in productive activities, and territorial governance based on appropriate management of the commons that we have founded the proposal (41, 42) of activation of a MPTP, the “Ecodistrict”. A device for primary prevention, territorial reappropriation and valorisation. This is based on four key factors (Fig 2):

- a)** taking charge of air, water and soil matrices as common goods by the community living and working in them;
- b)** the detection/search of substances which contaminate each matrix so as to have an adequate representation of their overall quality (characterization) and knowledge of the activities which adversely affect this quality (pressuring factors);
- c)** the creation of favorable conditions for the redesigning of production activities

and the utilization of each pressure factor so as to achieve separation between the technical cycle and the biological cycle, using the funds available at the European and national level;

**d)** conducting audit cycles in which the community is made aware of:

- the limits and potentialities of territorial matrices;
- the integrity/contamination status of each matrix;
- the state of adaptation of each pressure factor to the principles of the circular economy.

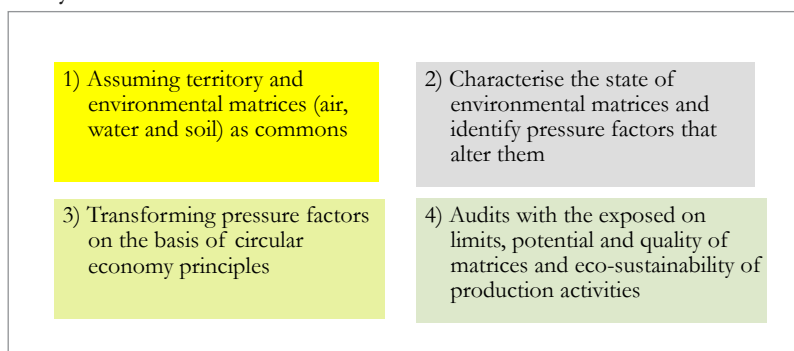


Fig. 2 Constituent elements of the "Ecodistrict" Territorial Primary Prevention Model

## *2) Application developments, potential obstacles detected and expected implementations*

**2.1. Application developments.** The Model of Primary Territorial Prevention in its essential characteristics referred to above, was presented (41, op cit.) at the ISDE Italia National Congress "Ecology and Prevention: It is not too late to learn to live better!", in Arezzo, in April 2019. To date, work is being done to test the activation of the ecodistricts through interaction with territorial committees, environmental associations and local authorities. While many territorial committees and some local authorities (mayors of Montegabbione and Citta' della Pieve) have shown interest in the proposal, major application developments have occurred in three territories with high environmental damage and with a strong mobilization capacity:

- the municipality of Terni, which coincides with the SIN Terni Papigno and houses, besides the plants (steel works and special waste landfill) an incinerator, and presents profiles of environmental pollution from old industrial activities (ex-chemical plant), urban traffic centered on private transport and from domestic heating. The local No incinerators Committee which has a considerable capacity for mobilization, inclusion and proposal, organized an Audit on the "Limits and potential of the environmental matrices of the Ternano ecodistrict" in January 2019 (43). It is

now working on a shared definition of an environmental prevention plan as the operative link for our MPTP as well as critical issues of the SIN:

- in the Borgogiglione landfill and in the quarry of inert materials of Monte Petroso, which occupies parts of Perugia, Corciano, Magione, Passignano and Umbertide. Localities where the Borgogiglione Observatory is active and working on the involvement of local producers in the transformation of activities in accordance with the principles of the circular economy. In addition to carrying out careful monitoring of landfill management and other common goods in the area;
- Gubbio, where there are two cement factories that have requested the use of Solid Recovered Fuel (SRF) and numerous territorial committees (at least five) have organized a no SRF Gubbio Committee that has obtained, unlike the other two territories, the involvement in the dispute of the municipality of Gubbio, and has had the dexterity to create a national coordination of the active territorial committees in which Colacem Group cement factories (Gubbio, Galatina, Caravate ...) are located. As well as with other territorial committees in which other cement factories are found.

These major application developments have enabled:

- to censor a first series of potential obstacles in the activation of the ecodistrict;
- to experiment the implementation of an audit in collaboration with a local authority which represents a qualitative leap in the process of sharing and experimentation of the Model of Primary Territorial Prevention.

*2.2 Potential barriers.* At present, the following factors are potential obstacles for the activation of the ecodistrict:

**a) Legislation in force** since it bears the imprint of what Ulrich Beck (44) defined as the risk society, assuming values and parameters that protect the productions based on the “linear” approach. As demonstrated by the self-declared data in the European Pollutant Release and Transfer Register (E-PRTR) by a local cement factory, it is legal to introduce into a defined matrix of a defined territory significant quantities (in the order of tons per year) of substances already known for their carcinogenic, mutagenic, epigenotoxic, toxic to various organs as well as harmful to other living species and to the environment.

In the northern part of Perugia, four authorization procedures relating to the Borgogiglione landfill (review/renewal of AIA and VIA for a LNG plant) and the nearby Monte Petroso quarry (VIA and PAUR use of explosives in the work process and variant authorization for safety), are currently under way in the Umbria Region and the Municipality of Perugia, advancing separately and without any overall evaluation concerning the interaction and cumulation of impacts on the environmental matrices

and the life of those exposed.

The ecodistrict aims to highlight the irrationality of these regulations that leave the exposed at the mercy of the risk producers and creates collective pressure both for the transformation of linear productions into circular ones and for the local assumption of management methods based on the circular economy already available in the waste, heating, local transportation and food sectors.

One should not forget that the pressure that environmental movements have developed across the world for climate and environmental crises to be effectively addressed, is creating special conditions, such as the “Declaration of the State of Environmental Emergency” adopted before the covid-19 pandemic. This can lead to profound innovation in global and local regulatory systems. Along these lines, in 2019, the Law Clinic of the University of Perugia produced, in agreement with ISDE and with the Zero Waste Regional Committee, a proposal for a regional law of popular initiative which represents a first step towards the legal formalization of the principals of the ecodistrict (45).

**b) Risk producers** in Terni (Thyssenkrupp), Gubbio (Colacem and Barbetti cement factories) and Perugia, have a remarkable formal and informal power and could resist our proposal of redesigning the production cycles. It is hardly worth noting that the circular economy does not foresee expropriation, although there are examples of far more circular management elsewhere, of steelworks and cement factories (46). Moreover, the “unhappy” urban locations of such Group 1 unhealthy plants can be an important topic for opening a productive negotiating table, since recent case law (47) highlights the power of the mayor as a local health authority, who can revoke authorization to operating plants who are detrimental for health and the environment;

**c) Local authorities:** if current legislation has cornered the municipal and district level, the proposal of an ecodistrict could give the territory and municipality greater responsibility in management of the commons, and constitute a point of convergence in order to initiate a necessary action of rebalancing local powers;

**d) Regulatory agencies:** ARPA (Regional Agency for Environmental Protection) and ASL (Local Health Authority) express opinions on the regularity of emissions according to the current legislation in the defense of linear production structures, while the Regional Authority on which they depend, has unfortunately, over time, taken over the management of what we define as being “linear”. We have observed that this has had disastrous outcomes for our Regional Health Service. The latter implies that normally, these agencies issue opinions authorizing polluting activities,

generating strong distress in the involuntarily exposed. Moreover, without having any significant participatory role in the Department of Prevention and the ASL. The “characterization” that is required in the activation process of the ecodistrict consists not of an opinion of conformity to legal parameters, but in the description of contamination levels produced by each pressure factor which can be supplemented by parallel studies conducted by university institutions (4-5)) and the “crude” assessments of citizens’ committees, contributions which are strengthened by a possible converging role of the local authority. During the many disputes that have involved us over the years, it became apparent that appropriate levels of pressure by community participation can impress the role actually played by these agencies.

**e) Opposition of the exposed sectors:** a further potential obstacle can be represented by the presence of substantial exposed sectors that lose the adjective “involuntary” in that they accept, as a lesser evil, exposure to risk because they fear unfavorable economic and employment consequences, and because they carry the imprint of processes of social construction of the threshold of pollution tolerance. Anthropologist, Lorenzo Alunni (48) wrote powerful and influential pages about this device analyzing its characteristics in the Upper Tiber River in relation to tobacco production. The audit also aims to deconstruct this threshold of pollution tolerance by providing, in a transparent and conflict-of-interest free process, adequate knowledge and interpretation frameworks to develop the opinions and convictions of these areas of exposure.

### *2.3. Audit in the ecodistrict MPTP*

If the ‘ecodistrict’ is a MPTP and a process of community reappropriation in decision-making as well as a device of subjectivation of the involuntarily exposed, it moves its first steps with the audit, in other words, with a public meeting in which the available knowledge on the state of environmental matrices, the pressure factors which alter them, and the state of transformation of these are examined from the point of view of the exhibits<sup>2</sup>, on the basis of circular economy principles. In Gubbio, the municipality’s attention for environmental and health problems determined by the request of the two cement factories to burn SRF and the huge citizen activation and local committees to protect the territory, create an innovative and potentially

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<sup>2</sup> The Encyclical *Laudato Si* (18, op cit.) in verse 183 recites...”it is always necessary to acquire consensus among various social stakeholders, they can bring different perspectives, solutions and alternatives. Local residents must take a privileged place in the debate, questioning what they want for themselves and their children, taking into account the aims that transcend immediate economic interest.”



productive situation.

Along these lines, the audit provides for a development based on the defined roles of the main stakeholders:

- the involuntarily exposed, through committees or directly, play a central role in defining priorities and assessing the impacts of common management;
- risk producers are called upon to propose credible, realistic and effective programs for the reengineering of production cycles aimed at separating the technical and biological cycles in their activities;
- the local authority - and their territorial associations - play the role of: “guardian” of the air, water and soil commons; - “guarantor” of their maintenance and of transmission to future generations in the best possible conditions; - “facilitator” of the criteria that can make common management sustainable.

## Discussion

Basic characteristics and application developments of the ecodistrict MPTP have been exposed, considering its absence, and more generally, the absence of any MPTP provided that it is sufficiently structured to be evaluable in its impacts, a serious problem for the resulting non-prevention and, urgent because every day of non-prevention creates damage and indicates that one continues to delve into error when it is necessary to experiment new, effective solutions.

### *1.1 Aspects of methods*

Overall, the documented process has several limitations and method problems, some of which have emerged in section 2.2, regarding the results dedicated to potential obstacles. Henceforth, problems connected with the participatory approach underlying the ecodistrict MPTP will be discussed briefly.

Leone and Prezza (49) classify methods for decision-making into three large groups - rational synoptic, concertative and heuristic - depending on whether elements of “pre-structuring” prevail in their methodology and therefore opt for a technocratic approach or, contributions of participation are prevalent, and therefore opt for an approach centered on sharing and taking on the needs of those living in the problem. In the technocratic approach, it is assumed that the environment is stable, the problem is clear and the objectives are transparent and desirable by all. However, often, interventions fail not because the project was technically not valid, but because insufficient knowledge or exploitation of the context leads to underestimate the presence of non-shared values or non-recognition of conflicting visions within the collectivity which should transpose and sometimes participate in its implementation. This implies boycott of the project, demotivation of the realtors and waste of money and time.

The technocratic and proprietary logics that innervate the operation of regulatory agencies (ARPA Umbria and the prevention departments of the two Umbrian ASLs, do not provide structured moments of participation of the exposed in their programming cycles, if these are actually produced and explicit) due to the twist that public policies have undergone in the last 30 years until becoming explicitly private service policies, are fully within the interpretation criteria recalled and lead to the failure/disempowering of the planning and design work that falls within these approaches. Lancet's aforementioned editorial (6, op cit.), which comments on the serious and profound delays and backlogs in the process of achieving the UN's 2030 Sustainable Development Goals, poses the dramatic problem of the structural weaknesses of the technocratic approach and highlights the distance between real and rhetorical processes. The idea that market and competition produce solutions thanks to invisible hands that actually produce real advantages in complex processes such as climate and environmental crises, that they have also determined, is not based on any evidence and should lead risk producers to come to terms with the fact that von Hajek<sup>3</sup> is dead. Rather, we need to focus on the meta-organization of shared approaches, especially when preparing to develop and test the MPTP locally and globally.

## *1.2) Aspects of merits: Impacts on health, environment and economy*

### *Impacts on health and the quality of environmental matrices*

The ecodistrict MPTP assigns great centralness to the laboratory chemical analysis of the matrices phase, which, by some, could be confused with an underestimation of epidemiological studies.

De facto:

- the model valorizes all knowledge of inferential epidemiology having solid bases in scientific literature, assuming, beyond the threshold values defined by the regulations, that if a substance (or a production cycle) is known - on the basis of available epidemiological studies and without conflicts of interest - for its negative effects on health and the environment, it must no longer be introduced into the environment, thanks to the circular transformation of production. Therefore, the evidence available in inferential epidemiology is valued in the ecodistrict approach since it is in itself

<sup>3</sup> Friedrich August von Hayek (May 8, 1899 March 23, 1992) was an Austrian-born British economist and sociologist. A liberal and liberal thinker, he was one of the highest exponents of the Austrian school and critic of the state intervention in the economy that criticized, on the basis of the impossibility - at the time when he wrote, no longer true today - to have mathematical models and the necessary computing power to take into account the many variables when programming, which led him to exploit the allocative capabilities of the capitalist market.

sufficient to avoid emission on a given territory. While it is not ethical to activate studies to see whether, in a territory, the involuntarily exposed to a substance with known harmful effects become ill and die in such quantities as to produce significant “statistically” risk excesses;

- on the non-neutrality in the way in which statistical significance is built in environmental epidemiology studies, see section “Discussion” of 3, op cit.
- recent developments in environmental characterization activities involve the possibility of having assessments of the risk - carcinogenic and non-carcinogenic - of a defined territory reflecting the present risk: in Terni, The Department of Chemistry of the University ‘La Sapienza’ of Rome has measured, through numerous air pollutant analyzers, suitably located in defined city areas, the contribution provided to the pollution of this matrix separately for the emissions produced by steel works, incinerators (at the time of the study there were two), traffic and heating (4, op cit.) in the different districts of the city. Subsequently, a development of this study was published in which the detection of pollutants present in each district was followed by the estimation of the carcinogenic and non-carcinogenic risk, distinctly for children and adults, present in every district of the city, making it clear that the risk for children, carcinogenic and non-carcinogenic, is high everywhere – compared to European standards – while for adults it is higher in two districts of the city (50).

This would mean that:

- the population of an entire city is suffering the effects of a (non) MPTP which produces an impact on health that is difficult to be proud of. Children in all neighborhoods are exposed - even more involuntarily than adults - to a high carcinogenic and non-carcinogenic risk;
- the characterization, - carried out appropriately and aptly valorised by a meta-organized self-defense action of the health of exposure, no longer involuntary - produces estimates of the *current* risk - carcinogenic and non-carcinogenic - demanding proportionate and immediate interventions of primary prevention.

Descriptive epidemiology studies detect patients and deaths from exposures that have occurred, depending on the disease models, about twenty years before, for the carcinogenic risk, even in the gestational age, consistent with epigenetic studies (51) for the non-carcinogenic one. Moreover, associations between exposure and damage that descriptive epidemiology produces can never be causative, so that further analytical studies are needed to establish cause-effect relationships for exposures that have started at an earlier point in time.

Hence:

- the advantages offered by high quality environmental characterization, such as in the ecodistrict MPTP, is available current risk estimates, a clear advantage with

respect to descriptive epidemiology studies, which, in any case, retain their value in describing the population's state of health;

- the systematic analysis of the contribution that each pressure factor - which is such until finally governed in such a way as to separate the technical and biological cycles after which it can become a factor of well-being - gives rise to the increase of carcinogenic and non-carcinogenic risk, represents a rational approach with an expected favorable environmental impact.

### *Impacts on management of the territories and the economy*

In addition to what has emerged on negative externalities currently determined by risk producers, a territory that equips itself with a MPTP, like in the ecodistrict, investing knowledge and resources in the transformation of pressure factors on the basis of the principles of the circular economy, becomes an innovative territory on the economic ground as well since it:

- adopts and governs technological innovations which give rise to productions and activities for social purposes:
- a. is finally sustainable because based on non-polluting production cycles, which also puts an end to the grievous search for buffer solutions consisting in the removal from a specific context of risk production, transferring it to another without substantial improvements in the production cycle;
- b. is of interest to a large number of other producers and to the community;
- c. can count on substantial funding both at the European and national level, bringing together investments, resources and knowledge which are essential to bear the necessary conversion costs in the circular economy;
- d. is where produced goods have additional values of use besides that specific to each one: a) environmental sustainability because they do not give rise to waste when they no longer work; b) recycled materials immediately reusable in further cycles of the circular economy.

This in turn involves important transformations:

- in the quality of life, because living in such a territory guarantees integration between human beings and the environment, giving profoundness and substance to existence, elements of beauty and enhancement that needlessly smoking chimneys do not offer;
- in culture as it represents a new way of living and thinking in a social context experienced on the soil of sustainable innovation, which involves the liberation of desires and the flourishing of deeply-felt, more profound practices and proposals;
- in the sense that living and working on that territory takes on, breaking with the dystopias that crowd our future.

Finally, involves the municipality in the protection of the commons, experimenting with models of common management together with citizens who take their destiny into their own hands and are no longer involuntarily exposed.

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## The Organic District: a cultural turning point

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*Key Words:* soil, microbiome, epigenetics, nutritional quality

### SUMMARY

*Objectives:* this article aims to show how an erroneous concept of agriculture based on a proto-scientific knowledge of the sixties, founded on chemical synthesis and forced mechanization, has been crushed by the knowledge we have since gained but which seems to have been culpably concealed and/or underrated in terms of ecosystems and of its implications on the basis of epigenetic, biomolecular analyses. The delayed discovery of 1. the need to measure ourselves with a closed system of reference 2. the dependence, even genomic, on an invisible and omni pervasive microbiota 3. the reliance on a fluid genome that duly registers epigenetically within us the outside world 4. the need to give value to, to emphasize and protect the integrity of our natural air-water-soil matrices. All existential preconditions which oblige us to totally reframe the mechanistic, linear algorithms that pervade the present, but which prove to be anachronistic and unscientific.

*Methods:* the available data invoking a change in paradigm has been taken into consideration. The starting point is the orientation and the logic inspiring the European Community's legislation on organic districts.

*Results:* a case is made for the interconnectivity that inhabits us, the relationship between the context and the genetic-epigenetic-microbiome triad, the imperative to substitute an epistemic of predictability which is fallacious on account of the reductive variables considered, the hyper complexity of the infinite variables in a biological system based on creativity and autopoiesis, on serial and interim adaptations in dynamic evolution. The results speak unequivocally of a necessary and rapid conversion to agroecology to avoid the definitive destruction of our matrix that would lead to an unamendable process of multi-species extinction.

*Conclusions:* there is evidence beyond any reasonable doubt of the need for a rapid assumption of political ethics and leadership to control and marginalize the risk producers, to reestablish the right to health, environmental and food quality and furthermore beauty itself as a nutritional element. All in the greatest respect possible for biodiversity and all the creatures and things with which we share a common destiny.



## Introduction

The concept of the territorial entity Organic District (OD) already appears in its substantial definition in the decree law “Organic Agriculture” of 29/11/2007, art.7, in the chapter of the same name, identifying ‘local production systems...with a marked agricultural vocation according to art. 13 of D. Lgs 18.05.01 n. 228, and in which are absolutely preponderant: (A) the cultivation, breeding, processing and alimentary and industrial preparation of products with organic methods...; (b) the tutelage of typical local cultivation, breeding, transformation and production methods’ (bill ‘Organic Agriculture’, 2007).

The problems of territorial vocation were delegated to administrators on regional suggestion, with congruity indicators (for example based on the theory of fuzzy sets) to prevent discretion, to the evaluation of human capital based on real generational change and a marked tendency to commercial and technical innovation. The fundamental factor was (and is) the establishment of a quality rural district, persisting yesterday and today the question of whether the quality mantra should be a prerequisite for the OD or its purpose. We take notice from the start of how quality is understood as a possible, but not exclusive, declination of agricultural processes and production, and how in the overall view top-down choices dominate.

With a ten-year jump, Law 205 of 27 December 2017 the Ministry of Agricultural, Food and Forestry Policies (Mipaaf) identifies the Food District as a new strategic container, in territorial proximity, to revitalize the rural districts, including the organic districts, with the establishment of a National Register of the Food Districts indicated by the Regions and respective autonomous Provinces. The proposition is the relaunch of supply chains, the territorial safeguarding and development, food security, the reduction of food waste, the reduction of environmental and landscape impact, through quality agricultural and agri-food activities, but also socio-environmental urban-peri urban requalification, and intersections with proximity activities. The national and community defining aspects absolve the necessity to identify those who are likely to benefit economically, especially from the Community, with capital contributions, assuming a certain set of beneficiaries. To give an example in Prot. NO. 10898 of 17.02.2020, ‘Notice bearing the characteristics, modalities and forms for the submission of applications to access food districts as well as granting arrangements of the facilities referred to in DM.7775 of 22.07.2019’, article 4.1 regarding the eligibility conditions states that ‘the district contract aims to promote territorial development, social cohesion and inclusion, to encourage integration of activities characterized by territorial proximity, to guarantee food security, to reduce the environmental impact of production, to reduce food waste and to safeguard the territory and rural landscape through agricultural and agri-food activities. The district contract

must therefore also favor reorganization processes of the relations between different subjects of the supply chains operating in the territory of the food district, in order to promote collaboration and integration between the subjects of the supply chains operating in the territory of the food district, to stimulate the creation of better market relations and to guarantee, as a priority, positive effects on agricultural production'. Article 5.5, and not only, considers as a necessary precondition for the project that 'investments must comply with the environmental requirements laid down in the RDPs of the regions in which they are made'. In particular, 'the measures must comply with national and EU environmental protection legislation and good agricultural and environmental conditions (GAEC) as provided by Article 93 of Regulation (EU) No. 1306/2013'. In the same enforced notice, I draw attention to the ethical aspect for beneficiaries with the possibility of proceedings for mendacity and/or fraud, bribery, and environmental crimes.

The objective of this report is to demonstrate that the national and Community framework is affected by incorrect reference frames in terms of inspirational value hierarchies, anachronisms, and distortions due to scientific-intellectual deficiencies in the evaluation of accumulated diachronic implementations from data-science, and for some reason still ignored. I specifically refer to the necessity that before every productive-commercial process we place the concept of environmental, social and individual health, of knowledge of the contextual aspects forming and informing our existence, of safeguarding decent life prospects for future generations, of the perception-knowledge of what ecosystems are in reality, as well as what is a truly circular economy (waste management-recovery, state-owned properties, cultural and environmental emergencies, alternative sources, regenerative planning, control on industrial and business planning...), in short, the awareness of the precariousness of living in a closed system that presupposes the meticulous knowledge of the connections-interferences and rebound that we must be able to recognize, read and interpret correctly. Knowledge activates consciousness: knowledge which, in order to be such, presupposes interdisciplinarity, foresight, precaution (knowledge is modified and refined) and which justifies in the logic of social protection the possibility of Kuhnian paradigm changes, even if drastic, for the higher purposes of respect and social protection, especially when, as in this case, the theme is our survival. When, for example, we talk about GAEC, how should we judge the current point of arrival that finds us deeply compromised in terms of the environment and individual health? Has the system regulated so far proven successful or unsuccessful? What are the forecasts of continuing a slower but unamended pollution process? Moreover, is the OD an immaculate enclosure, an enclave, in a degraded system or should it not rather be chosen to become the obligatory reference in a process of containment first, cleaning and then

returning to the sustainability of the deteriorated system? What is the concept of quality applied to health processes knowing that over 90% of all our diseases are environmental and/or lifestyle-induced? Is health the primary asset or banal addendum to logics of powerful minority stakeholders in the economic-financial field? Is there still a right to health, to 'bonum et pulchrum' and by whom should it be represented and protected? But, above all, who within the political-economic-health level will pay for the current damage caused by incapacity, blindness, personal interests? Will the huge community of the exposed still have to be sacrificed to the oligarchies animated by social and health contempt? In the case of science and culture, what is dramatically emerging from the above-mentioned excerpts is that agro-industry and agro-ecology are still a double equal mode of good practice; then, who and what is causing the environmental disaster of which we are the sacrificial victims? It is clear that a radical rethinking, a reformulation of sense, priorities and socio-educational aspects are necessary, considering, moreover, that ironically, the last-resort payers are, concretely and medically, precisely us. No longer low level make ups then but in-depth analysis based on 'virtute e canoscenza', exactly in the order proposed by Dante.

## Materials and Methods

The publication 'Distretti Biologici e Sviluppo Locale, Linee guida per la programmazione (Organic Districts and Local Development, Guidelines for programming) 2021-2027, ReteRuraleNazionale 20142020', made with the assistance of the European Agricultural Fund for Rural Development (EAFRD), 'within the activities foreseen by the National Rural Network Program 2014-2020', under management Mipaaf, was considered as a reference. The document is in fact 'Project file CREA 5.2, Actions for organic agriculture'. CREA stands for Council for Research in Agriculture and analysis of the Agricultural Economy. A noteworthy mention emerges in the publication, concerning the concept of the empowerment of local communities, thus reiterating the social function of agriculture, the necessity for short supply chains for extensive cooperation, considering the pedo-climatic characteristics, territorial resources, and its socio-economic characteristics, so as to avoid depopulation and to attenuate the environmental emergency. It is explicitly stated that 'the organic district has the task of identifying the priorities of the territory and bringing them to the attention of the administrations...' (p. 7). The primary proposition is group certification for small farmers, facilitating the Community regulation which has been in operation since 1 January 2021, in which ODs, once the individual access requirements are met, may preside over a 'system of internal controls within the group of operators providing a documented set of control activities and procedures under which a person or body may be responsible for verifying compliance with the Regulation'

(Reg. EU No 848/2018, Art. 36, paragraph 1, point g). It is asserted that internal controls will in any case be viewed by competent authorities or by a delegated body (Reg. EU No 848/2018, Art. 38, paragraph 1, point d), and the real possibility arises for ODs, within State/Regions, to assume the role of legal entity, especially if the extension, cooperation, networking, agricultural-cultural innovation become steadily implemented at community level well over the current 5.4% of the national territory (3.5% of the population).

Imagining the OD as a defined and limited territory, the hope is that it functions as a yeast for its rapid and broad expansion, not as 'péras' (border) of a 'èidos' (form), but a dynamic reality of crossing the border itself, of shifting the Latin 'terminus' for explorable semiospheres of high cultural significance, in opposition to the Latin 'limen' nuance of an impassable border.

The report presents an outline of the context-sensitive areas which makes it undelayable to assume agro-ecology as the objective and the necessity of a broad interregnum vision of nature to understand that globalization of knowledge is a priority as it is salvific over commercial and financial ones and, moreover, no longer an optional tool for political decision-makers who want to call themselves such.

In support of this 'ecosophical' vision, neither utopian nor metaphysical, a truly new anthropology, I will briefly address the problem of the environment as containing precious limited resources (currently, we consume one and a half times the available resources) and will try to highlight the importance of noting the complex interconnections in nature and how crucial they are for our own psycho-physical balance. I do not speak therefore of the vast 'cosmotheandric' vision of Panikkar, but of our narrow 'cosmoandric' sphere strictly for what science tells us today.

In order to do so, I'm addressing four topics: 1) the environmental context of reference, 2) the relationships of the plants, model of complexity and vulnerability, 3) microbiota and epigenetics, 4) nutritional quality.

Topics that appoint the OD as the only ecological and respectful alternative to natural cycles.

### *1. The Environmental Context of Reference*

The need to respect the environment could easily be seen, even in man's fiercely defensive anthropocentrism, if the 'featherless biped' of Platonian memory reflected briefly on the fact that only miraculous characteristics (optimal atmospheric conditions, presence of vital matrices, particular angle of the earth's axis, ideal exposure to solar rays activating the vital chlorophyll photosynthesis...) guarantee our late entry to the planet; a planet that has satisfied our needs by adapting itself to our intemperance and dire myopia. Referring to the soil '... the thin layer of weathered

rock, dead plants and animals, fungi and microorganisms blanketing the planet has been and always will be the mother of all terrestrial life – and every nation's most critical resource, one that is either renewable or not, depending on how it is used.'

(1) the correct interaction of species presupposes biodiversity in its declinations of species (alpha diversity), community (beta), regional (gamma), in which the same agricultural use should be subject to self-healing disciplines (2), for example without leaving the soil bare, condition that makes it 10 to 100 times more vulnerable to erosion, systematically exceeding 1 mm per year, resulting in the abandonment of 30% of cultivated areas from 1990 to this day. The soil must also feed itself and requires fuel for microbes, various invertebrates that build the autopoietic network, allowing for greater water permeation and therefore resilience to drought and flooding. Organic cover material and mulching provide more carbon to the soil, thus creating conditions for a balanced biota, containing the role of pathogens in biodiversity and intercropping (3-4). At present, 80% of the 1500 million hectares of agricultural land is in monoculture; 90% of corn and soy produced is not for human use (animal feed, biofuels); on the other hand, 70% of the food we consume comes from farms of small-medium farmers who use only 20% of the soil. The loss of humus, carbon and organic matter has led to the exponential increase in chemical products with sequential groundwater pollution, resulting in 'chemical treadmill' in foodstuffs. The spread of fertilizers alone rose from 14 million tons in 1950 to 180 in 2015 (5). The massive introduction of chemicals began with the need for the disposal of byproducts from the industry and the Haber-Bosch process which allowed the use of synthetic nitrogen by making apparently obsolete crop rotations and the use of animals, now releasable from the expensive mechanism of their nutrition (6), yet at the same time, triggering the lucrative and devastating market for intensive farming. The obsessive replication of monoculture sustained by chemistry has deconstructed the delicate characteristics of the soil, distorted the microbiome and almost abolished biodiversity (7) with increasing phenomena of parasitic resistance and the need for growing increments in phytopharmaceuticals with relative further toxicity. The discovery of agricultural biodiversity as a resilience factor is, astonishingly, only making its way now. If we look at drought damage, it affects already fragile monocultures in a differentiated ways; corn and soy production has decreased by 30%, making it wiser to introduce sorghum and millet into perspective. (8). Contrary to what we have been led to think, it has long been known that to feed 9 billion people in 2050, agro-ecology will be required (9, 10). The need to combine the agricultural and forestry sectors stems from the evident need to mitigate the negative role of the food sector in terms of greenhouse gas emissions, amounting to 30% overall (release of CO<sub>2</sub> and nitrous oxide from fertilizers into the atmosphere is 300 times more harmful than CO<sub>2</sub> (11),

and 30% of the world's final energy consumption with 2/3 of this energy used for food processing, transport and preparation of food with a strong contribution to the dead areas of the world due to excess phosphates and nitrates (12-13). It is important to note the harmfulness of pesticides, herbicides, insecticides directly responsible for cognitive dysfunctions, dysendocrinopathies, behavioral alterations, lymphomas, childhood leukemias, loss of IQ in children (14-15). It is worth highlighting the dramatic health costs of the use of pesticides, as shown by the largest three-year study ever conducted by the New York University Medical Center (16), data provided by the National Health and Nutrition examination Survey (NHANES) which attributes to them 2/3 of the costs deriving from the development of systemic, endocrine, and neurological diseases with intellectual disability in 43.000 children and a cost of \$266 billion. We can also prefigure the conjunction of the rate of variation of the average temperature from 1981 to 2019 in constant growth and extreme temperature indices that sees 2019 as the 24th consecutive year with WSDI (Warm Spell Duration Index) indices higher than the climatological average (ISPRA, State of the Environment 94/2020, Year XV, SCIA referred to 2019), with the erosion of the soil mentioned above and the summation effect of an accumulation toxicology. ISPRA also stated in its national report 2018 'pesticides in water' (referred to the two-year period 2015-6) that 67% of surface monitored waters and 33.5% of subterranean waters contain pesticides, with an average cocktail of 5-55 substances with prevailing herbicides (52.5% for surface waters, 43.4% for subterranean ones), atrazine, metolachlor, glyphosate and its metabolite AMPA, alpha-amino-(3-hydroxy-5-methyl-4-isoxazol) propionate acid. Second place in surface waters is insecticides, 25.3%, with the neonicotinoid imidacloprid currently banned, among the most present and fungicides in subterranean water 32% (17). The origin of many pathologies due to exposure to pollutants is certain, such as the biomagnified transgenerational effect to DDT (DichloroDiphenylTrichloroethane) in the case of autism, through the recent plasma detection of the by-product-biomarker DDE (p, p'- DichloroDiphenyldichloroEthylene) (18). But exposure to these pollutants also concerns the etiology of multiple sclerosis (MS), of most neurodegenerative and autoimmune diseases (19), obviously linked, as we will see below, to the drive of facilitating pleomorphic genetics (in the specific case MS the HLA-DRB1\*15 allele is a negative factor, the HLA-A\*02 a protective one). The breaking of balances in the soil and in the atmosphere through the introduction of nanoparticles, also from agricultural activities skipping the blood-brain barrier and constituting, at the cerebral level, non-chelatable diachronic inflammaging processes, causes vascular and cardio-cerebral de-structuring (20). Moreover, the carbonaceous particulate matter from biofuels, biomasses, DEPs (Diesel Exhaust Particles), has characteristics of genotoxicity, neurodegeneration and carcinogenicity, causes additive

effects with respiratory and allergic problems (allergenic aerosols) with additional dysregulation of the pollen circulation, by the mechanism of the hitch-hiking which also concerns viruses and bacteria. 'Global warming affects the intensity, derivation and onset of the pollen-spores season as well as the allergenicity of the pollen with enhanced photosynthesis and reproductive effects and pollen-production' (21). The Lancet Planetary Health has clearly shown the connection between particulate pollutants and cardiovascular diseases due to climate change, however, it has not been possible to establish a threshold for nitrogen monoxide below which there was safety in terms of mortality (22). In the interaction between climate change, VOCs (Volatile Organic Compounds), agro-industry and matrix pollution, modifications in the colonization of the respiratory tree and antibiotic resistance take place (23), as well as changes in the psychopathological sense (24).

There is no doubt about the relation between global warming, neurotoxicity, and the increase in fine particulates, also in combination with lipopolysaccharides. The transit to the cerebral level is carried out by the nasal way through the olfactory bulb, by the respiratory way and by ingestion: by the hemolymphatic way, overcoming and altering the permeability of the blood-brain barrier with proinflammatory deposit of amyloid and tau filaments, direct damage by neurotoxic substances (e.g. manganese, aluminum, etc.) with alterations of memory engrams, especially episodic memory, by 'endocrine disruption compounds' with the abolition of protective factors of gender, formation of proinflammatory cytokines, development of full-blown and Alzheimer dementia frameworks. (25- 29, 30 - 32).

The theoretical prerequisite for 'development' and the 'green revolution' was the inexhaustible availability of water and fossil fuels in climate stability. None of these requirements survived but the behavioral paradigm had no deflections with the obvious consequences of extreme and increasing environmental degradation (9, 10, 33). We are painfully learning the problems of interconnections and interdependencies whose value of positive synergy is strictly linked to the maintenance of harmony (armòzein = linking) according to the rules of *natura naturans*, and not ours.

In order to better understand the logic of the hyper complexity in which we are immersed, I will mention some relational mechanisms of plants, in other words the interconnections which they, like us and all creatures, establish, modify and undergo. These are not abstract epistemological implications, but the understanding that processes are rarely linear, the variables largely unknown, with limited constants that preside A/R (action/reaction) and the principle of causality, where, even if we can talk of some predictability starting from deterministic chaos, unpredictability and non-linearity remain prevalent. We can only talk about the horizon of predictability, focusing on complex adaptive systems that justify predictability criteria.



For this reason, I speak of multi-transdisciplinarity in a plurisystemic vision which cannot be an interpretation, but a transcription of the data-reality that comes to us from present knowledge. As an informative route, I will touch on some considerations concerning new explorations in the communication-behavior of plants, and on the revolutionary entry in hermeneutical and epistemological terms of microbiomics and epigenetics, which affect all living organisms starting from plants, that represent 98% of all biomass and are vital for the planet. Such an extraordinary extension is not only evidence of a successful model of inhabiting and colonization, but of careful protection of the soil, where even the most feared weeds play a decisive role in the protection and maintenance of the humus and the microbiomics-mycorrhizal network.

## *2. Plant Relations - A Model of Complexity and Viability*

We can apply to plants, as for the animal world, the concept of genomic-epigenetic network: they also have interactions for complementarity/compatibility/insight (niche effect); share via models of success and trans-order and trans-species gene transposition; homologies-analogies via the sharing of the genetic homeobox (as, for instance, the ancestral cryptochrome which frays in differentiated photoreceptors in plants and in man); sense-perceptive mediation translated by A/R or by the interposition of mediators. To give an example, the glutamate receptors that in humans manage memory, learning and interpersonal communication, in plants are cell signaling devices (34 - 41). The exogenously induced experiential-epigenetic data, as for us, and the endogenous listening data are mediated by individual and collective memories. In plants there is a diachronic spatial memory, and the possibility of communication mechanisms, even volatile, that exceed the limit of autotrophism for wider information. Among the memories there are qualitative-quantitative ones of exposure to light via photo-electro-physiological signals with excessive photosynthetic load that inform the young leaves through old ones. Short-term memory has been demonstrated in carnivorous plants (*Dionaea muscipula*, *Drosera capensis*) in relation to the presence of protein contact and to a limiting and sufficient number of evoked action potentials, just as epigenetic memory, as in the case of the FLC (flowering locus C gene) from vernalization (*Arabidopsis thaliana* L., ATL), or the water or salinity stress on *Zea mays* L. With LTM, long-term memory, and STM, short-term memory, learning and decision-making are activated. Plants 'are able to encode spatial and temporal information, and to modify their behavior on the basis of the information present in the environment' (54), developing responsive behaviors to classical and operating conditioning as well, but in harmony with the inside/outside of the plant by means of repressor and promoter genes in a multifactorial logic that manages flowering, sprouting, or decrees project abortion, perhaps for unfavorable biotic/abiotic condi-



tions, in an ultra-individual logic of species survival (42- 56).

Life is therefore organized through learning, which in turn is organized by memory via competitive and collaborative aspects. Through the phloemic vessels for lymph and the chlorophyll photosynthesis the miracle of CO<sub>2</sub> intake is achieved, which, combined with soil H<sub>2</sub>O, causes the formation of sugars and oxygen then released into the atmosphere. The absorption of soil nutrients takes place thanks to the radical hairs of the rootlets which have a protective cap of the meristem (embryonic tissue present in roots and sprouts). Plants have senses and therefore morpho function logic for refined sense-perceptions. A small plant such as ATL has at least 11 photoreceptors (we have 4); the possibility for the plant of a distinction between real water (radical increase) and the recording of its flow with the capacity for vibrational discrimination is known. A preference for the development of buds, flowering and length of branches, for natural sounds of birds or Indian or Western sacred music (sacra) has been measured; a differentiation capacity between the noise of the wind and that of the mastication of the caterpillars. The roots of the plants, through the interaction of gravity-touch circumnutate, causing oscillations and deviations in search of nutrients, oxygen, and water (hydrotropism). Light uptake from roots through the HY5 protein that develops healthy roots has been demonstrated. The plant management capacity emerges in the recognition of self - no self that prevents self-fertilization processes for the same individual or for genetically related individuals, through radical recognition and not only (chemical exudates, surface enzymes, individual microbiome, COVs, electrochemical signals) that change social behavior. At root level, colonization for access to and management of mineral-water resources can be increased, with morpho-functional adjustments in the event of, for instance, drought. We can therefore speak of the decision-making capacity of a plant (57-58) and of optimal development in harmony.

We can firmly say that we are confronting a widespread Wood-Wide-Web of extreme complexity where synchrony and diachrony are mixed in a unified field of difficult reading. Climatic changes can render philo-ontogenetic adjustments and selections unfavourable to our existence. Nitrogen-fixator bacteria (nitrogen, 80% of the air we breathe, not useful except for the action of nitrogen-fixators that transform it into ammonium nitrogen, thus making it assimilable by plants which release proteins and sugars) and mycorrhizae (exchange between soil fungi and roots, in other words phosphorus in exchange for sugars from photosynthesis) allow for vegetal development in the logic of cooperation. Bacteria dialog with roots in genetic-epigenetic exchanges (NOD genes) for the activation of synergies. At the same time, epigeic endophytes (fungi and bacteria) defend the plant by making it toxic to aerial attackers, and the CMN (Common Mycorrhizal Network) allows informational and nutritional ex-

changes between roots and the fungal network. The radical detections allow stomatal modulation, inducing their closure to reduce the water dispersion in case of drought. The plant bacteria ratio is widespread and goes far beyond the classic bacteria-leguminous binomial. This is documented in the case of rice. In this sense biomass sums microbiome, microalgae, nematodes, fungal hyphae, protozoa. The microbiota, understood as a bacterial community beyond the previously mentioned properties, allows the solubilization of phosphorus, the defense of the plant, the production of plant hormones, the harmonious growth of the plant (59- 67). With CMN, an informative-nutritional exchange and immunological priming is activated for the mutualistic-symbiotic action of the hyphae. Carbon, nitrogen, phosphorus, and mineral salts may be exchanged and transferred, for example, to young neighboring plants in difficulty, in exchange for photosynthesis sugars, essential for fungi. Mycelia can produce warning chemicals for neighboring plants. Plants deprived of mycelium are immunologically depressed, but in case of the use of herbicides, or also naturally as for the walnut juglone (*Juglans regia* L.), the toxic mycelial conduction can result fatal to the plant (allelopathy). The communication between plants includes the emission of VOCs, molecules containing carbon (over 30.000) and uses volatile forms of jasmonic acid (e.g. MeJA, methyl jasmonate, stress phytohormone), or exenol, in case for example of aggressions or damage, as well as ethylene, salicylic acid, which allows alertness in genetically and non-related plants. Some allelochemicals, such as synhormones, may attract parasitoids/predators that come to the aid of the plant emitting them. The development and metabolic aspects, at the end of reproduction, are carried out by the phytohormones, in particular, by ethylene produced by methionine for maturation and stress, abscisic acid (ABA) for stress (dormancy of seeds, and buds, radical formation when needed, stomatal closure) highly hydro-conditioned, auxin produced in the meristem, in fruits and seeds in development, in leaves, with the action of promotion of cell division, cytokines with synthesis, mostly radical and via xylemic transport, involved in the cellular differentiation-proliferation and leaf senescence, gibberellins linked to transient phases of elongation-growth of the plant. (68 - 77). From this brief analysis similarities emerge between plants, animals, and insects characterized by similar sequences in all clades, with human sharing in genomic terms (3000 genes for plants, 5000 for insects) in the long process of convergent and divergent evolution. Possibly, ubiquitous ATP (adenosine triphosphate) was already synthesized in a prebiotic context and has worked as a development promoter by directing the development of primary metabolism (modification and synthesis of proteins, lipids, sugars, and nucleic acids) towards morpho-functional and energy determination (for instance, the Krebs cycle performed in the mitochondria of eukaryotic cells is common to all living cells) (78).

Interregnum balances are therefore dependent on complex and fragile interconnections: addressing Brucker's studies, we identify the hologenome (the capacious hologenome) (79) as the sharing of a common ancestor, and a common destiny. The 'single-celled common ancestor', with plant-animal support features, seems to have appeared approximately 1 billion years ago. In the widely accepted endosymbiotic theory of Margulis (80), mitochondria and chloroplasts would derive from prokaryotes introduced into major cells with the formation of eukaryotes, in the context, naturally, of multiplicative genetic events that left the ancestral organism with abundant 'spare genes'. The nervous system in animals and chronoflagellates (the same calcium and sodium channels for neuronal electrical activity and proteins releasing neurotransmitters in animals), due of course to the long process of evolution, dates back to about 600 million years ago. The construction of interdependence and interconnection is a natural, subtle, hypercomplex process hence the discovery that our intestine (in fact, every district within our body) possesses 100 trillion microorganisms that until yesterday were only supposed to crowd the soil (up to 1 billion per gram of dirt) should not have surprised us.

### *3. Microbiota and Epigenetics*

Microbiota has been permeating our plant-animal co-evolution for at least 400.000 years, representing in our own genomic terms more than 140 times our celebrated classical genomic kit. In other words, the microbial collective unconscious inhabits the human body, even determining its morpho-functional and neurotransmitter aspects, which are pompously claimed as distinctive of humans and decisive in the cognitive nature of motivation, in higher nervous activity. For instance, a small wheat plant is characterized by 25.000 genes and 16 billion nucleotides; in this sense, we prove to be less endowed than an onion, a discovery which has prompted disturbing inquiries following the end of DNA sequencing (2006), forcing us to profoundly revision the concept of ecosystem and introducing, after microbiomics, epigenetics as an adaptive mediator of our outside-inside. We define the microbiome as the genomic aspect of the microbiota, referring not only to the bacteria complex inhabiting us, but also to the viral one (virobiome), the fungi (mycobiome), the bacteriophageoma, parasites and others, precious symbionts and commensals only if in harmony with our body-vehicle. The microbiota situated next to a shared phylogenetic nucleus is individualized (1000 phylotypes), linked to the environment, lifestyle, ethnicity, and nutrition. 80% of bacteria are linked to fermentation (*Bifidobacteria* and *Lactobacillus*), 20% to putrefaction (*Bacteroides*, *Clostridium*, *Escherichia*, *Eubacteria*) (81- 88). By 'epigenetics', we identify the infinite genetic expressions that take place without genetic structural modification, yet altering and adapting our

existences to the environment. (89 - 92). An exemplification could be the previously mentioned 'FLC gene', which turns off 'a frigore' by chromatographic packing by histone methylation; subsequently, the histone code is re-programmed, in this case in transgenerational logics, a sort of jumble of procedural memory but also semantic and autobiographical-episodic vegetal memory. The epigenetic processes of vernalization via morpho-functional imprint concern the entire biological world and take place through histone acetylation-methylation, DNA methylation, microRNA formation, prion appositions, histone ubiquitination, etc... Increasingly acknowledged has become the role of miRNA, 20-22nucleotides, of endogenous origin and encoded by a thousand genes conserved through evolution, not with protein synthetic function, but rather intended for the stability-translation of hundreds of genes' mRNA, aimed at cell control-development-apoptosis, in addition to the management of stress in terms of immuno-modulation and response to inflammation; in other words, to correct allostasis synergistically with basal metabolism. We have to imagine that although epigenetics is indeed adaptation to the environment, there is a vital limit to the effort of incorporation, which cannot be activated, for example, for massive or transgenerationally unrepairable damage. The destabilizing event, simply put, must be small and not prolonged over time. To further stress this concept, we should remember that normally up to 500000 molecular lesions per cell are inflicted to our DNA daily, through hydrolysis or mismatch of bases, or their alkylation and oxidation. If the offensive load is too great or repeated, the reparative mechanisms (MGMT, MethylGuanineMethylTransferase), apoptosis, base excision repair (BER) by activation of a DNA-glycosylase and subsequent DNA-ligase, repair by excision of nucleotides (NER) by endonucleases and then DNA-ligase replacements, and mismatch repair (MMR). RNA polymerases must be able to promptly and primarily focus on the most vital areas, in order to facilitate efficient recleaning. In other words, the load must not be excessive nor chronic in order not to create destructive DNA adducts, even at mitochondrial DNA level. Therefore, we can say that the genetic and genetic-polymorphic structure functions as a fluid genome in the interaction with the outside-of-us, in which ontogenesis is recapitulation, as well as a new reading of phylogenesis. For this reason, I have spoken elsewhere of systemic filo-onto-epigenetics (SFOE), now an indispensable reference for socio-health-environmental assessments, but also evidently political-economic, and of course individual, evaluations. 'Epigenetics is about how the genes we inherit from our parents are controlled, and how they interact with our environment, how our genes make us, well, us' (93). We are perpetually provisional, liquid assemblies: metagenomics conveys a continuous becoming in perennial dynamism. This results in contacts proving crucial in their outcomes; and although there is no linearity and predictability by definition, the

quality of the contacts can be salvific or fatal in relation to our ability to read and respond. Even the inert particulate defines variations on the germ and somatic line (94-95).

The preceding considerations justify the necessity of an immediate adoption of the logics of hyper complexity, interdisciplinarity, and the precautionary principle, in order to take the time to carefully analyze, in existential terms, the purposes of acts; to avoid being dazzled by the tools or misplacing them, due to their undoubted fascination, as objectives, as already happens in selective adolescent mutism and hikikomori, dramatic examples of distorted and pathogenic identification-dependence of life with *téchné*, and of the latter with science.

Let us remind ourselves, once again, what our microbiota is, in order to protect it, keep it in a position of symbiote commensal, and prevent it from becoming a pathobiont. Its function is not limited to the correct functioning of the digestive system, but extends to the prevention of asthma, hypertension, obesity, diabetes, dysphoric syndromes, and the entire complex of chronic and neurodegenerative diseases. The central nervous system, autonomic nervous system, and enteric nervous system (ENS) are connected through the informational function: inflammatory processes alter microbiome responses (96), among these inflammatory factors are environmental pollutants, including plastics, microplastics, radionuclides, nutritional aspects (nutrigenomics) and climate changes.

The gut-brain axis is directly linked to environmental contaminants, toxic substances, and nutritional and behavioral choices (such as nutrition and drug abuse, especially antibiotics). 'The main message is the gut microbiome is a key player in the spread of antibiotic resistance, and that medications other than antibiotics can change the structure of the gut microbiome and influence health in ways we weren't aware of before the current explosion in microbiome science' (97).

For example, a predominance of *Faecalibacterium* and *Coprococcus* is an indicator of eustress and quality of life, of lack of depression. If *Prevotella* is deficient at 12 months, perhaps due to an antibiotic treatment, it can elicit disturbances at 2 years of age; this future damage could be corrected if acted upon within one year. 'The mechanisms may include stimulation of the vagus nerve, release of cytokines or enzymes, tryptophan metabolism, interaction with the peripheral immune system' (98), and production of SCFAs (short-chain fatty acids). Disorders can presently be monitored via '16SrRNA gene sequencing', considering that genetic patterns are reset at each generation and differ from the mother cell. The benefits of the microbiome are granted by the inhibition of pathogen adhesion, their competitive exclusion, production of antimicrobial substances, and immunological modulation, which together determine organ protection. 'Organs with high tumour incidence in inflammatory settings are

often those that interact closely with microbial products or directly with microbiota, such as the intestine or lung' (98). The result is activation of the inflammasome, i.e., a low-grade inflammation with increased hsCRP (high-sensitivity protein C) and cytokines, *primum movens* for the development of cardiovascular disease, vascular disease (CAD Coronary Artery disease, CVD Cerebrovascular Disease, PAD Peripheral Artery Disease), cancer, heart failure, and atrial fibrillation on the drive of dyslipidemias and unhealthy diets. The intestinal microbiota produces specific metabolites affecting cardiovascular risk, such as serum levels of phenylacetylglutamine, trimethylamine oxide (TMAO), indole propionate (IPA). Incidentally, high levels of TMAO are related to meat diets, another reason to drastically reduce meat. A balanced microbiota has a decisive anti-inflammatory role tasked with preserving the microvascular endothelial function, as seen from RH-PAT (Reactive Hyperemia-Peripheral Arterial Tonometry); its dysfunction results in atherogenesis and the increase of solid tumors by production of ROS at endothelial level. Stress results in apoptosis and genotoxicity with DNA damage. The microvascular alteration undermines the removal of toxins and waste products, determining, specifically at the temporal lobes level and due to a particular vulnerability, suffering and oxygen reduction, possibly in association with an increased sympathetic stimulation with cognitive and memory processing enfeeblement. Hypoxia may stimulate angiogenesis, common cause of athero-carcinogenesis and phlogosis (IL1b, IL InterLeuchina). Lung dysbiosis may cause cancer (activation of the 'lung resident gammadelta cells' oncogene). Eubiosis can also attack the quota of infectious cancers (13%) (99 - 111). Eubiosis refers to a vast repertoire of mi

crobiota including the skin, primary protection and access filter, and the oral cavity. It is impressive that 100% of AD patients have *Porphyromonas gingivalis* (but also *Fusobacterium nucleatum*), periodontitis bacteria, which cause 'downstream inflammation' with tau tangles and amyloid-beta (gingipain hypothesis). Such infection can overcome the microglia barrier. Oral dysbiotic microbiomes underlie periodontal diseases and cavities; moreover, 'oral disease contributes to the severity and progression of several systemic diseases, like rheumatoid arthritis, diabetes, cardiovascular disease, and Alzheimer's' (112). It is therefore necessary and feasible to contain infections by reducing proinflammatory cytokines, IL-beta, TNF-alpha (Tumor Necrosis Factor), IFN-gamma (Interferon), IL-6 and IL-8. Eubiosis is also an underestimated social-health problem: in hospital infections, the patient's microbiome functions as a vessel for BSIs (bloodstream infections), as observable from the tracking of SNVs (Single Nucleotide Variants), which distinguishes bacterial species (StrainSifter) (113 - 116), thus posing the problem of pre-hospitalization triage. A high content of soluble and insoluble fibers allows a positive response to immunotherapy multiplied by

a factor of 5, as seen by ‘whole metagenomic shotgun sequence data’. In conclusion, our balance is entrusted to the infinitesimally small that comes to us mostly externally; the microbiome is an extraordinary modulator of the gene expression of intestinal epithelial cells with effects on the host receptor availability, the metabolism of lithocholic and deoxycholic acid, and the glycosylation reactions; moreover, it produces antibiotics and bactericidins, as well as short chain fatty acids, SCFA (acetate, butyrate, propionate), presiding over the synthesis of vitamin K, B12, niacin, thiamine, riboflavin; it favors the action of alveolar macrophages. Thus, it becomes essential to protect ENS for neuroimmunoendocrine homeostasis: pollutants, both nutritional and non, alter the second measure firewall, the liver which protects, through MAIT (Mucosal-Associated Invariant T), and antigenic sensitive T cells in the case of inflammatory cytokines (IL-17 for example) and various antigens, via synthesis from microbial riboflavin. We can imagine GALT (Gut Associated Lymph Tissue), MALT (Mucosal Associated Lymph Tissue), IgA, the mucosal barrier, and the microbiota as components of the true immunological network (117-120). It is most useful to recall the multiple activation modalities of the brain-gut axis via biunivocal nerve, vasculature-lymphatic, humoral, and neurotransmission routes (GABA, 5HT, SCFA, n. X, proinflammatory cytokines...). A reminder that SCFAs are an energy source, essential in the morphology of the nervous system, inflammatory reduction, and the improvement of insulin sensitivity. This level of complexity ties our existence to life outside us: aerobic bacteria (e.g. yeasts) provide an oxygen-poor environment for photosynthetic ones, thus triggering the optimal function of the latter. For instance, the genus *Rhodospseudomonas*, also digester of aromatic bonds, is able, via nitrogenase, to transform nitrogen gas into ammonium. Yeasts themselves (e.g. *saccharomyces cerevisiae*) produce CO<sub>2</sub> in an oxygen environment, while contributing to the transformation of sugars into alcohol in an anaerobic environment. As Lukens suggests, the microbiome in its mother-child relationship is strongly influenced by stress and diet; in addition, the metabolites produced can cause neurodevelopmental alteration (121).

#### *4. Nutritional Quality*

The genetic/polymorphic-epigenetic-microbiome network, therefore, represents the philo-ontogenetic substrate that characterizes nature and us; what has been given to us and what we contact and personally add to our experience through more or less conscious acts, which may facilitate or undermine our body-mind. Once again, context plays a decisive role: L. Feuerbach’s statement ‘We are what we eat’, although in the perspective of a violently anti-idealistic materialism, photographs an incontrovertible reality; as explained by the philosopher, food represents the foundation of the cultural and sentimental process (122). A body which, in order to optimally func-



tion, must be supplied with macro-micronutrients of adequate quality and quantity: every function, every metabolic and reductive oxide mechanism, the characteristics of psycho-neuro-endocrine-immunological aspects (PNEI) depend for their optimal functioning on nutritional quality (123-124). This inevitably derives from the matrix one first, and from the productive-transformative one (think of ultra-processed foods making up 40% of consumed foods) secondly. Nature presents delicate self-regulating and autopoietic mechanisms (125 -126), managed, at the micro level, by non-mechanistic paradigms based on energy potentials, not representable by state variability; this structure illustrates a world in feverish becoming, not reducible to something linear nor mechanistic, for the variables are largely indeterminate within unmanageable fields of force, changing by systemic, rather than mechanical-linear, causality. It is the context, the combination of parts, that activates trends and potentialities, and the quality of the context that ensures integrity and the maintenance of good structural features, such as proteic ones, by avoiding prionizations and the presence of non-sense mutations at molecular level. Industrial agriculture, built on monoculture and mechanization, is based on yield per hectare; on the other hand, biological-biodynamic agriculture sums different crops whose overall value, always per hectare, even in quantitative terms, is decidedly higher. Overall, 'industrial agriculture accounts for 75% of the ecological destruction of biodiversity, land and water, and contributes to 50% of greenhouse-gas emissions, causing air pollution and climate chaos. Nearly 75% of chronic non-communicable diseases are food-related.' (127). It is thus unsurprising that the direct oncological incidence from nutrition amounts to 32%, perhaps due to the desertification induced on our microbiome, mycobiome, bacteriophage by the existence, at this level, of the shikimate pathway, which produces tryptophan, phenylalanine, and tyrosine in bacteria. Since the human body does not possess this route, it is vulnerable to pathologies, for our bacteria is directly affected by the damage caused by pesticides, herbicides, and fertilizers. One must remember that these amino acids are essential to produce dopamine, serotonin, adrenaline, melatonin, folates, vitamin E, and thyroid hormones. The dramatic increase in pathologies within the autistic spectrum and neurodegenerative phenomena is an eloquent indicator (128). Crucial is the necessity of the free association of nature in nature, to verify compatibilities, the only way to true food quality. Such is the case of the 'salvestrols' (129) which, in association with *cyp1b1*, build powerful anti-cancer apoptotic molecules; another instance is that of the distortive saga of GMOs, whose resounding failure is masked by disturbing interests proposing an opposite, delusional narrative of reality. Note that GMOs, without lingering into an ideological polemic, possess constructs (transfer units) characterized by extremely fragile bonds. Often, these constructs are viral with genes consisting of heterogeneous DNA in the construction of 'cassette', including



genes responsible for antibiotic resistance that inhabit the transgenic organism. Such instability causes the increase of horizontal transfer and recombination of DNA from plasmids, transposons, viruses, and bacteria. There is a paroxysmal amplification of the process of creating new bacteria and viruses, but also of the spread of antibiotic resistance via strengthened pathogens, resistance to phytopharmaceuticals, and matrix spread of transgenic DNA. Moreover, the manifest GMO hypofertility forces annual repurchasing of the same seeds, destined to monoculture-directed production, disregarding biodiversity; a situation heavily favoring seed companies. Relying on natural cycles that combine different levels of complexity to generate new compatible and stable evolutions is therefore wise, salvific, and above all healthy; especially once recognized natural cycles as infinitely more sophisticated and congruous than human intervention. This likely means focusing on food biodiversity, autochthonous clones or naturally hybridized ones for better adaptation, on the abundant introduction of soluble and insoluble fibers, and on heritage fruits, cereals and legumes, since bio-engineering hybridization already involves a remarkable nutritional loss; this would allow returning to valorizing wild plants, extraordinarily rich in salvestrols (130), thus approaching the logic of controlling the seeds biopiracy, and allowing instead exchange and diffusion for the maximum variety throughout different agronomic areas, in order to facilitate their establishment and replication. Stressing the logic of mixed variety seeds for different areas to recover genetic strength and emphasize the replicative possibilities (131 - 134). All this in the containment-abolition of monoculture, intensive farming, and use of fossil fuel agricultural machinery now that switching to vehicles powered by renewable energy is, in fact, possible and convenient. In conclusion, eating better and less, especially when considering that the caloric restriction, activated via the SIR-1, AGE-1, and DAF-2 genes, increases the repairing capacities of the DNA (135) while respecting the environment and its ecosystems.

## Discussion

To summarize, we should proceed cautiously, aiming at multi-interdisciplinarity, the recovery of the sense of community, and the drafting of medium-to-long-term predictive strategies based on present knowledge, which, although in process, already presents indisputable evidence. Among these, 1) the widespread environmental degradation, 2) increasing pollution of matrices and the absolute lack of a regenerative policy concerning them, 3) the impoverishment of a soil increasingly exposed to climate change and incompatible agro-industrial practices, which are worsening the abandonment of the fields and sanctioning the severe loss of income for monoculture practices, 4) the negative social-health consequences, 5) the loss of the good and the beautiful - not by chance etymologically connected.

The missing link in the explanatory logics of interconnection is provided by the combined disposition of genetics-polymorphisms, robustness-hardiness (136), and epigenetic-microbiota, the fluid-software genome. All framed in the logic of a systemic-contextual randomness, in which even the celebrated DNA, as Lewontin says, would only be a dead molecule without the protein-enzymatic action; as if to say that the self-replicating characteristic is attributed to the inducing complexity, including all the implications that follow (137).

In reality, the genome is unique for its ancestral adaptation properties and polyglot language; however, precisely because of its constantly evocable expressive-functional modification, it presupposes an environment modified according to rhythms of sufficiently natural interaction. More specifically, following the secure timing of natural complexity in order to avoid dramatic incompatibilities that would see our biological life, rather than nature, in danger. The accumulated epigenetic transgenerational appositions are an unequivocal sign of the interconnection within environmental space-time. However, this could place us, and not in an epistemological sense, in a particular nuance of the 'spandrel paper' of the Gouldian vision of forced entrainment of cumulative dysfunctions: the paradox suggests that a poor management of us-outside of us could make us less reactive and adaptable compared to previous generations, thus invalidating the adaptive, rather than evolutionary, concept (138). Evolution is not synonymous of a possible improved world, but rather indicating superimposed-modifying stages that are not necessarily functionally augmentative, with trends that can aggravate biological vitality, up to its complete negation.

The Anthropocene illustrates an egotic and decontextualized man, characterized by unprecedented epistemic violence. Its infinite potential is darkened by a principle of fallacious and unscientific individuation, since the discovery of the microbiome proves our individual consciousness as supra-individual, hetero-induced and also dependent on natural-cultural context. A paradigm shift that redraws our boundaries, which, after the symbiosis of the maternal amniotic shell, should return us as members of the world in adulthood. Cast into the world no doubt but to rediscover our origin and responsibilities within the interconnection of a vital system, even if biologically closed. We require a great amount of knowledge to tackle hyper complexity, to recognize the nature-man interconnection, to marginalize the mechanistic culture of linear causality, to adhere to the capacity for doubt and for the abstract Heisenberg and Gödel have instilled, to understand the unthinkable beyond the sense-perceptive appearance. As exemplifications, we find synchronous and equipotential wave-particle coexistence in quantum physics, and microbiome and epigenetics in biology. 'The mechanical mind is a representative of capitalist patriarchy and an instrument of the colonizing empire. It is an efficient tool for exploitation and extraction, manipulation,

and control. On the other hand, it proves unsuitable for the maintenance, reinvigoration, nourishment and growth of life'... 'Knowledge has a shared origin, then it is privatized, armed, made into information, reduced to data, reconsidered, and resold as intelligence. This tangible decay of knowledge in bytes of sellable disposable data (of which we are the source) has been propagated as innovation. The creation of the mechanical mind is based on constructing multiple separations out of unity. (127). If the usable space is limited and based on interdependence, then our choices must be based on 'virtute e canoscenza', that is, on ethics and knowledge. The first 3 mentioned points of evidence require transnational urgent measures and the rapid acknowledgment of the available data by policy makers, with immediate decision-making, to a) convert into agro-ecology an agroindustry which has, so far, proved prevailing, energy-consuming, and responsible for the current dismantling of the matrix, especially referring to accelerated regenerations via 'effective micro-organisms' (EMs), b) introduce circular and virtuous economies, thus eliminating detrimental industrial and social policies based on predatory logics and the induction of aimless consumption, completely disregarding intelligence, human dignity, and the creatures we share a common destiny with, c) activate a vigorous plan of forestation, inclusive of the urban sector, d) better distribute global wealth presently concentrated at the top of the distribution pyramid (Davos 2020: The land of inequality). Industrialization and globalization of food systems, in addition to the advance of fast/junk food, are fueled by industrial food and chemical multinationals; the triggered process is leading to an epochal agricultural crisis, the erosion of biodiversity in agriculture, the increase in toxic substances in food, and the spread of diseases. The agrochemical industry and agribusiness, the junk food industry and the pharmaceutical industry are making great profits; in the meantime, nature, nations and populations are becoming increasingly weak and sick' (127). In this sense, the OD attempts to recreate the optimal conditions so that the process of natural inter-being of extraordinary complexity, also due to its incalculable actors, can deploy correctly according to the rules. Such sophisticated rules of nature, a Spinozian *natura naturans* to be rediscovered.

This means restoring territorial quality, sense of community synergism, building a sustainable future, correlating the territory to the sharing of total sustainability and matrix regeneration, activating a most encompassing collaboration and knowledge among producers and users, and collectively redesigning the landscape in a shared social process (eco districts), attributing to environmental integrity its undisputed role, currently ignored, of the foundation of fertility, life, and the sole possibility of survival. It is a matter of redesigning the relationships between town and country, territory and forestation, of establishing efficient relations between LAG (Local Action Group), area strategies such as those for Internal Areas, GOI (Operating

Groups for Innovation), the River Contracts..., but also with all the tourist and socio-economic-cultural and association realities that can implement the vision of a harmonious, healthy world built on beauty. The fourth point in the debate concerns the socio-health consequences of an oligarchic, financial-globalized system; aimed at immediate profit, it leaves no hope to future generations, excluding democratic shares and creating voracious profit paradigms. It is the case of post-democracy, defined as a pseudo-democratic presentation driven by the media and lobby. Hence the need to broaden the management of public matters by resorting to direct and participatory democracy, given the corruptive fragility of the representative one. Moreover, the OD must include the 8 salvific Rs opposing the predominant liberal-productivism: relocate, reduce, reuse, recycle, reevaluate, reconceptualize, restructure, redistribute (139 - 140). An afterthought, directed toward re-humanization and renaturalization, rather than adherence to clearly dystopian instances; as we know, the ecosphere is unavailable for dialog, we thus become responsible for understanding and building what Hans Jonas identified as the ethics of the future. The bacterial 'quorum sensing' represents the availability of walls for transmembrane communication receptors of semiochemicals whose correct density is a homeostasis factor with electron and photon exchange, that chromosomes and plasmids, various gene pieces, are in continuous horizontal and interregnum exchange. Forgetting about it, for instance, has launched antibiotic resistance (141-143), the deconstructing of the hypothalamus-pituitary-adrenal axis, and the explosion of chronic-metabolic-degenerative diseases with practically insoluble sociosanitary problems. The appalling inequality of access to care, underlined by social genomics (144), is a sign of the genetic-epigenetic-microbiome triad and of a politically insufficient analysis. Neurodevelopment is officially recognized at risk. Moreover, the spread of neurodegenerative diseases is proved to be affected by environmental and electromagnetic pollution, and the use and intake of pesticides, herbicides, and fertilizers. A threat to our existence via direct aggression through alteration of, for example, the serotonergic pathways and/or direct inflammatory action, as observable from the IL17 analysis.

The OD is necessary to eliminate chemistry, rebalance supply chains, focus on biodiversity, and ban fossil energies and intensive farming (145 - 148).

This constitutes an explicit invitation to change our habits, to direct ourselves toward choices that favor the regeneration of soils, the maintenance of water resources, the reduction of air pollution, the respect of archaic plants, rich in memory and defenses (130), to reduce calories, to reduce the consumption of animal fats and animals themselves. For our health and that of the planet (149-150). These choices become obligatory, for it is impossible to continue to anticipate the overshoot day, without paying a devastating price. Regarding the OD, the Mediterranean diet (MedDiet)

modulates the microbiome response, thus causing the deactivation of the inflammasome. In this sense, our ODs are situated in a privileged position, scientifically taking for granted the MedDiet as the healthiest. The last point concerning the territory is beauty: not only in esthetic terms but also as a developer of 'landscapes' of the soul, of processes of return to inner pacification, to ecstatic commotion; a human-nature relationship that refers to identity and insight instances. The landscape, in its historical, artistic heritage, in addition to the experience of our ancestors, symbolizes heritage, theater, nourishment, sacredness, well-being and induction of responsibility (151- 153).

Focusing on the 2021-2027 PAC speech, published in June 2018 (COM (2018) 392), two out of the nine listed objectives deserve a closer analysis. The first one encourages increased competitiveness, while the second promotes the protection of food health and quality. Food quality is not its quantity. Furthermore, the recurrent concept of 'safety' is not to be accepted if intended as the replicability of the genotype aimed at flattening the patented seed market. Such a term furtherly emphasizes semantic ambiguity and is contradictory if the objective is, as previously stated, biodiversity. Moreover, if referring to good health, as discussed above, the golden standard cannot be agro-industrial and intensive food farming, but only agro-ecological implementation and respect for all existing creatures; without forgetting that insects (154), besides constructing our proto brain (78), are important pollinators.

## Conclusions

In conclusion, the OD proposes itself as in proximity to natural rhythms, promoting ethical practices within regenerative agriculture; moreover, it promotes the logic of maximum biodiversity by totalizing agriculture, forestry and livestock through reforestation and territorial remodeling. Such is the case of the required interventions for areas at hydrogeological risk, and for those polluted by phytopharmaceuticals and nitrates; in addition, there is also the indispensable, so far ignored, need to safeguard the installations for drinking-water use. The organic district should become the promoter and defender of the infinite local identities, in total respect for the environment. This entails taking over the most advanced knowledge of agroecology (no till farming, permaculture, construction of collaboration-interdependencies between producers, exchange of know-how, sharing of resources and biological seeds selected naturally for specific territorial adaptations, accelerated renunciation of fossil derivatives by adhesion to renewable energies), and keeping in contact with innovation networks, thus establishing advanced links of exchange and collaboration via the most progressive socio-cultural realities. It also involves entering the historical-artistic and tourist tissue of the society of belonging by reciprocal implementation, initiating dialogs with universities, public and private bodies, institutions, school canteens, and hospitals and RSA. Naturally, simple

consumers would also partake in this dialog via information-promotion, as the OD is the spearhead of a cultural evolutionary process, rather than a nutritional one. The field of cereals provides examples such as the recovery of ancient grains, as well as the potential of the bakery supply chain in historical-cultural and nutritional terms, reflecting on the historical-cultural-nutritional significance of the crops. International literature attributes to the organic-biodynamic not only the evidence of environmental protection which, as stated above, is unknown to agro-industry, but also clear nutritional superiority and maintenance of a state of health, presently essential for the unsurprising overload of chronic degenerative diseases, particularly costly for already troubled health services. It then becomes a matter of activating a real 'grass-roots revolution' which, according to community indications, encourages self-organization, identification of legal roles of broad representation, especially regarding administrative management to avoid blocking from setting up, and to better combine the OD with PSR in the State/Region and Community logics. The PAC, through EAFRD, has identified in the district the subject triggering a cultural and productive revolution. It is the first time that in top-down logics an explicit desire for environmental recovery starts from nutritional quality. This brings us to short supply chains, local markets (farmers' markets), and activation of transformation systems, in order to minimize intermediaries and build GDO-independent circuits at local, national and transnational levels. These require aggregation, multifunctionality of the farm in an effective and synergic collaboration with local associations and networks (AIAB, ICEA, INNER, DEMETER, City of Bio etc.).

The new PAC sufficiently captures the available scientific knowledge, though it highlights serious cultural gaps in the genetic-epigenetic-microbiome network (e.g. proposing a reduction rather than abolition of antibiotics and pesticides, demonstrating that the interests of multinationals come before the right to health). We must realize that we cannot stand in an ontology of the accidental, nor in our currently unavoidable destiny, for the latter is based on the state of necessity induced by operational inertia. However, when the EU document mentions the need for adaptation to climate change, improvement of soils, air quality, protection of water quality, management of nutrients, and sustainable use of water resources, it functions as a resounding endorsement to the OD's moral and value supremacy, taking a decisive leap forward in comparison, for example, to the 2007 legislation (155).

Hence ethics, knowledge of ecosystems, information, training, unbounded environmental protection, and rediscovery of the genius loci, which moreover builds our identity and determines our state of health, are necessary for a new beginning, closing the current gap through a technopolitical foresight that places in prevention the solution for what someone called the three debts of man: environmental, socio-economic, and cognitive (156).

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## 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

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*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

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 (SEs), 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 SEs, 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 SE, 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.



**Modello Human-Environment System (Scholz, Binder, 2003) integrato**

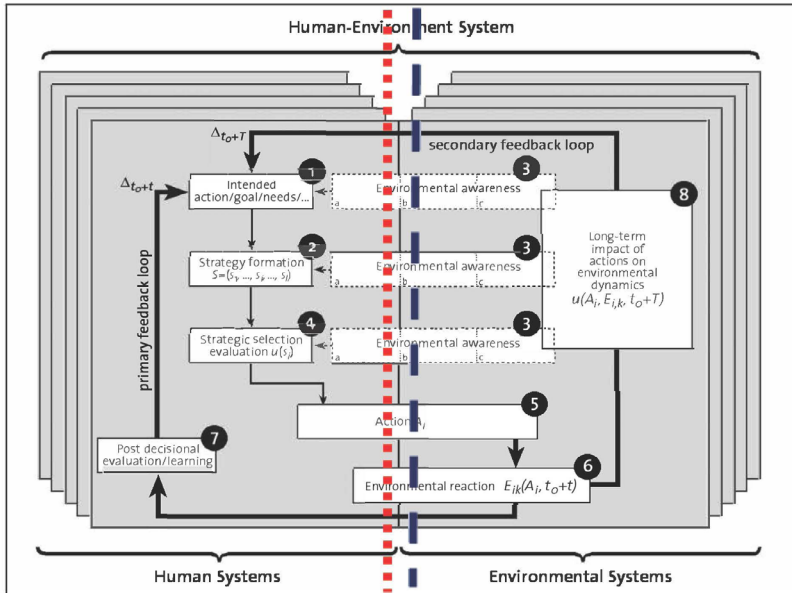


Figure 1: Human-environment system model (Scholz, Binder, 2003) integrated with the plane represented by the TI (long tract line) and with that constituted by the digital environmental system (short tract line).

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).

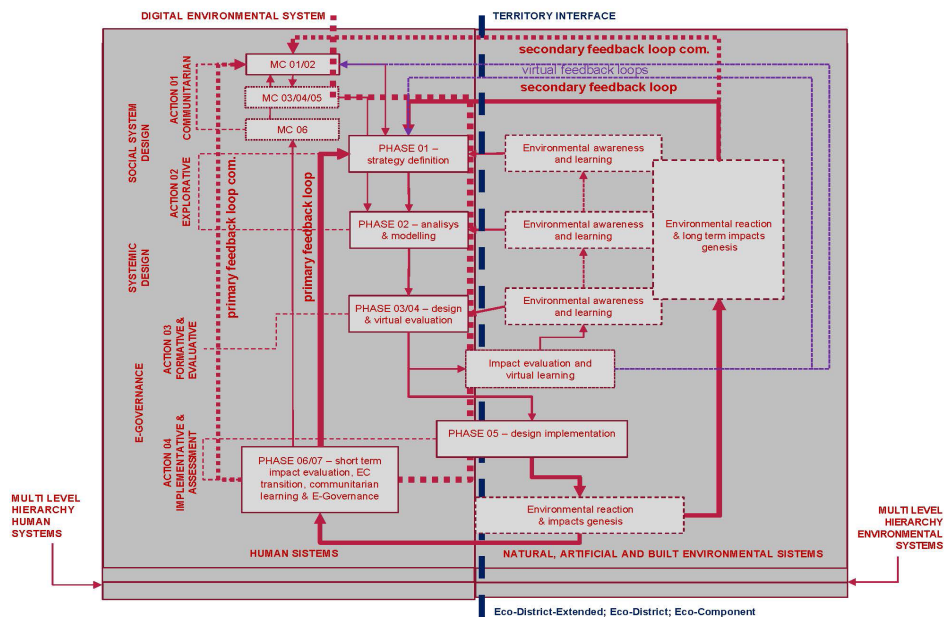


Figure 2: Synthetic graphic representation of the eco-district-systemic-design (EDSD) model; original reworking of Scholz and Binder's HES model by Francesco Masciarelli.

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.

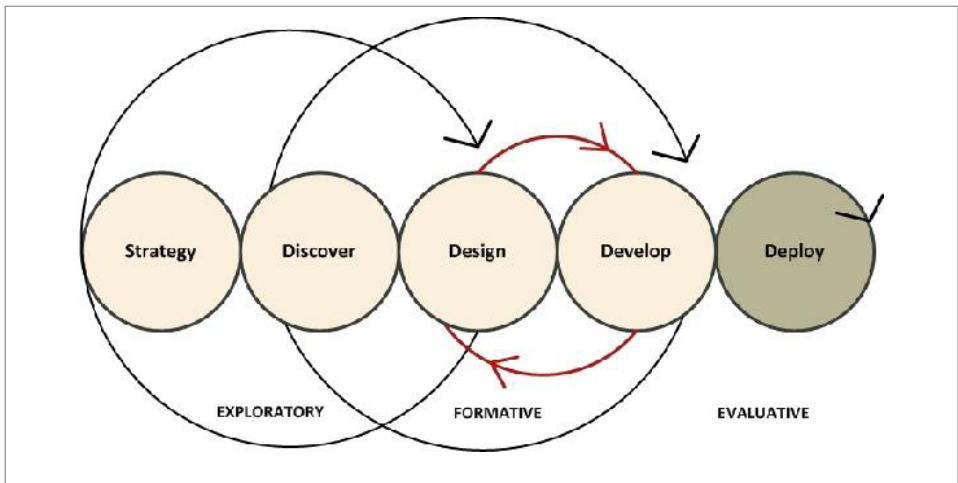


Figure 3: Service system design process model in Jones PH, *Systemic design principles for complex social systems*, 2014.

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-

minated 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).

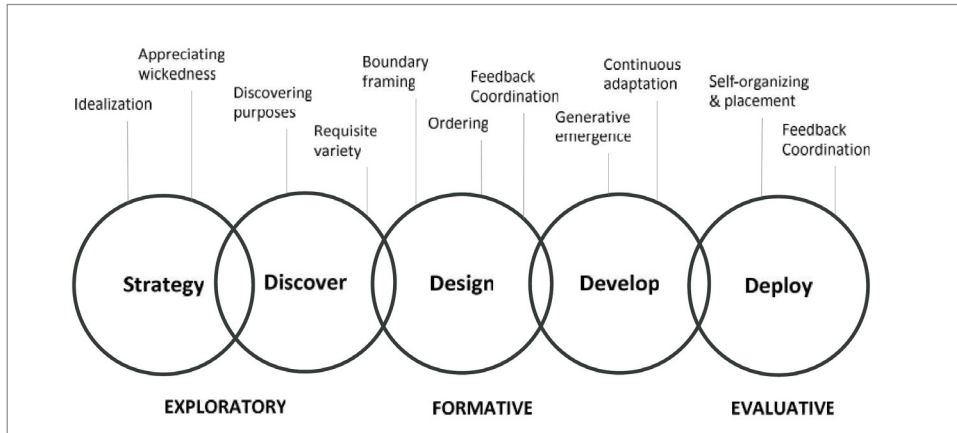


Figure 4: Design principles mapped to the design model in Jones PH, *Systemic design principles for complex social systems*, 2014.

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).

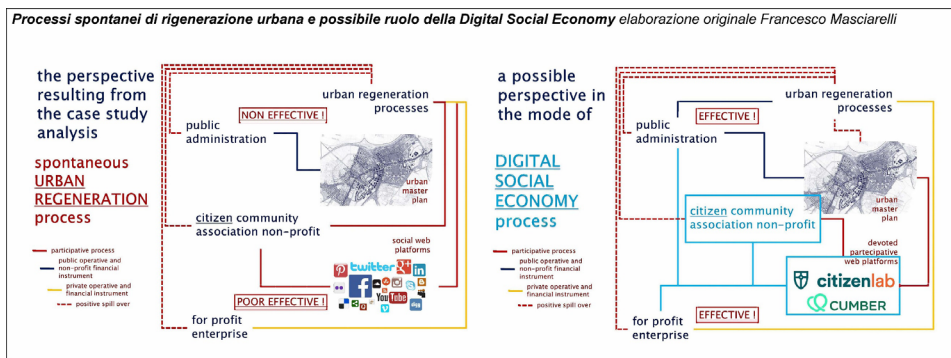


Figure 5: Spontaneous urban regeneration processes and the possible role of Digital Social Economy, original elaboration by Francesco Masciarelli.



The result of this preliminary study on systemic and participatory TI design is the EDS model, shown in Figure 2, which I briefly describe below. For a detailed and complete description of the EDS model, which is beyond the scope of this article, please refer to the full text on the EDS 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:

III: definition of systemic relations on a quantitative basis in relation to the 'de facto' situation.

IIII: definition of systemic relationships on a qualitative basis and modelling, divided into:

IIII-a: variety of the control system;

IIII-b: definition of problem boundaries;

IIII-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-

essed 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.

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## 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

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