Chapter 2
Circular economy in rural areas

by Pier Paolo Peruccio and Maurizio Vrenna

With the advent of globalization and modernity, many rural areas have lost the intrinsic ability to generate their own identity and to impose meaning on their existence. The crisis of rural areas is a complex phenomenon that has roots in the middle of the nineteenth century, with the sprouting of industrialization and the mechanization of agricultural practices. In the ’50s and ’60s, a new wave of demographic and social desertification marked the fate of rural areas forever (Fig. 1). The decision to convert the century-old agricultural polycultures into mechanized and chemically-fertilized monocultures inaugurates a new kind of agriculture that rapidly changed rural landscapes and their equilibrium. In the last two decades of the twentieth century, a decisive disruption took place, and these rural territories became fragile with the loss of their historical economic and social vocations. Deruralization has had a double impact: on the one hand, it has transformed cities by redesigning their urban and functional profiles, increasing their extension, and posed new challenges in the services sector. On the other hand, deruralization has transformed the countryside – shaped by centuries of human presence – because the traditional forms of production faded away.

The current production model blurs the lines between humans and territories while feeding the environmental and value crisis with the delocalization of resources, capital and people. Globalization has allowed companies to move freely: according to well-known sociologist Zygmunt Bauman, those who can leave places are also free from their responsibilities towards those territories and consequences which persist over time. Globalization processes end up unfairly redistributing wealth and poverty, privileges and deprivations of rights, resources and impotence, power and lack of power, as well as freedom and restrictions. Thus, while some citizens become global, others remain imprisoned within their locality. The inhabitants seem desperate, lost, and disoriented because the only locality belonging to them is disappearing from under their feet (Bauman, 1998). In this context, the other face of globalization is growing territorial segregation, combined with social degradation.

Latouche (2006) in ‘Le pari de la décroissance’ warns about the risks of the creation of ‘deserts’. Every year, hydrogeological instabilities, droughts, floods, uncontrolled overbuilding, depopulation, and abandonment – among other factors – contribute to the advancement of new deserts. These factors are leading to the annihilation of entire ecosystems. Over time, the desertification of vulnerable territories has increased the loss of agricultural biodiversity and local wealth. The current economic crisis, which is also environmental and social, requires a radical paradigm shift to recover the relationship between humans and nature. The recent COVID-19 pandemic, for instance, has exposed the fragility and limitations of the production systems and invited us to reflect on our development models. It is necessary to open up to new perspectives, step out of a vicious circle, and respond to the crisis: rethinking an appropriate use of the soil is the logical consequence of an inevitable revolution. Intensive monoculture agriculture will have to change into a systemic local agroecology, with respect for local ecosystems. This shift will contribute – at least partly – to the resolution of today’s problems connected to deruralization, by tackling the exodus and ultimately reversing its trend. A fair and honest relationship between agricultural activities, industries, and communities becomes the fundamental key to this new production model of well-being. Agricultural activities, which have always been the foundation of local economies, need a rethinking not only of processes, but also of social and cultural values.

Already in the second half of the eighteenth century, the doctrine of physiocracy – a term composed by the words ‘phýsis’ (nature) and ‘kràtos’ (power) – recognized the centrality of nature and the role of agriculture as the only source of primary goods, at the basis of all other human activities. The economist François Quesnay, its initiator, argued that agriculture is the basis of all other productive activities and that the weakening of the agricultural sector would lead to an impoverishment of the global population. From the simple defense of the agricultural sector in opposition to mercantilism, physiocracy became a well-rounded social doctrine founded on the concept of a corporate model made up of pre-existing natural orders (Steiner, 2003).

Although similar considerations can be traced back already to the mid-eighteenth century, industrial progress has followed different development paths and moral values, in a way that is independent of its location. Only today, public opinion is starting to realise that environmental problems must be tackled territorially by taking into account the productive and social activities that generate them. People feel the need for belonging to territorial

communities in which human, social, cultural, and productive actions converge. It is necessary to recognize how human development has transformed the agricultural sector, starting from the reflections on the current economic system and the need for systemic strategies. It is common knowledge that present-day agriculture is not only bound to the production of food but has a renewed multifunctional role, providing also advanced services. Modern farms (socially, ethically, and environmentally responsible) are the ones that feed local kitchens, small businesses, food and wine tourism, educational activities, and take care of the territory. This innovative drive may lead to the rediscovery of lost social relationships and long-established agricultural professions. By thinking globally and acting locally, the human damage to nature can be limited, while bonds among people have strengthened through new ways of social and responsible cooperation.

Fig. 1. Giuseppe Spagnuolo, the last resident of the abandoned village Roscigno Vecchia, in southern Italy. Many other villages are facing the same destiny. Reprinted from *National Geographic* website, 2020, retrieved from https://www.nationalgeographic.com/travel/destinations/europe/italy/photos-abandoned-ghost-villages-towns/#/abandoned-italian-villages-02.jpg Copyright 2018 by Bruno Zanzottera.

Therefore, the essential change of perspective and the redefinition of production processes in support of biodiversity permit valorising agroecological experiences and organic agriculture. In this context, a holistic and multidisciplinary vision – that draws inspiration from the cycles of nature – is crucial. In a circular economy perspective, the approach to the production should no longer be linear but turn into a complex network of relationships and closed material loops. These complex systems of activities can create new synergies between local actors and society, promoting a revived cultural identity. In a globalized world, communities are assuming a significant role in the transition toward new alternative models. In this sense, ecological approaches prove to be valid for generating new relations between individuals and the environment. Motivation is the first element to insist on, which is also the perception that a period of serious difficulty could constitute an opportunity for rebirth. Chinese culture does not, by chance, indicate the term crisis with the word 'weiji', which has the dual meaning of 'danger' and 'opportunity'. Taking up the concept of motivation, the development of systemic innovation, and regenerative economies on a local scale must be supported.

Social capital is a tool for aggregation and it is indispensable for triggering virtuous micro-enterprise processes and strengthening connections within the civil society. The definition of social capital by Hanifan (1916) is taken into account in this work. L. Judson Hanifan was an American progressive educator who experimented with teaching activities in rural Virginia schools and noted the weakness of the social fabric of that area. In the micro-relationships among the inhabitants, he identified the engine of a new possible community: he worked, therefore, to reaffirm this sense of identity, and he later introduced the term 'social capital' in an essay, to describe the role of those intangible assets (e.g., solidarity), which have more value than any other in daily life.

The repercussions of an economic model based on social capital would lead to the design of strategies which are strongly linked to the territory and based on local know-how. Adopting a systemic approach means working with a responsible perspective and generating a new type of well-being that embraces established values. An ecological perspective underlies two levels of intervention: on social processes and on systems. Thus, supporting companies in starting new production methods, which move towards bioregional and regenerative economies, is the right approach to improve the connections between producers and consumers, and the relationships among the members of a community.

2.1 The potential of rural areas

Each place is characterised by unique and heterogeneous historical, economic, demographic, and social dynamics. These characteristics derive from the degree of urbanisation which took place over centuries, but mostly from the on-site natural resources. A wise management of natural resources has contributed to long-term development of strong and healthy socio-economic systems. These resources are the environmental and biological forces which can bring value, if adequately transformed. Today, more than 70% of the European population lives in urban agglomerations, mainly in medium-sized cities with populations between 250,000 and 5 million inhabitants (European Union, 2016a). Except some countries, this figure is quite similar to the share reported in the World Urbanization Prospects by the UN Population Division (United Nations, 2018). Cities are the places where our cultures have flourished and thrive; they are centres of innovation, education, and wealth, which attract talents and offer career opportunities and well-being. Economic activities in Europe are mainly concentrated in urban regions, which have generated 53% of all gross domestic product in recent years. (European Union, 2016b).

However, the European territory is incredibly vast and diverse, and not largely urbanised: around 51% of the EU's land area is within rural areas (Eurostat, 2017). Rural areas generally include all the territories that are not located within cities. Typically, rural areas are characterised by small settlements and low population density: for example, agricultural areas, countryside, mountains, lakes, and forests. In this chapter, rural areas are intended as thinly-populated areas outside the main urban centres, according to the degree of urbanisation classified by Dijkstra and Poelman (2014). Rural areas consist of both agricultural fields, but also municipalities with a limited number of inhabitants, small towns, and villages. Over time, the European landscape has changed from being largely rural to being substantially urbanised. Rural areas are vital for the sustenance of cities and urban dwellers. Cities have a great environmental impact (Fig. 2), also called ecological footprint and defined by Rees and Wackernagel (1997, pp. 228–229) as *"the total area of productive land and water required continuously to produce all the resources consumed and to assimilate all the wastes produced, by a defined population, wherever on Earth that land is located. As noted, the ecological footprint is a land-based surrogate measure of the population's demands on natural capital"*. For producing enough food to feed a city, it is necessary to

have large agricultural fields in the surrounding areas or to import products from other areas – sometimes even thousands of kilometres away – and releasing large quantities of carbon dioxide during transportation as a downside. The same goes for other resources, such as water essential to life, but also wood and other building materials. Urban and rural areas are diametrically different but strongly connected. They can no longer be treated as distinct and unrelated spaces, and urban-rural links must be made stronger. Cities have a lot to offer and so does the countryside.

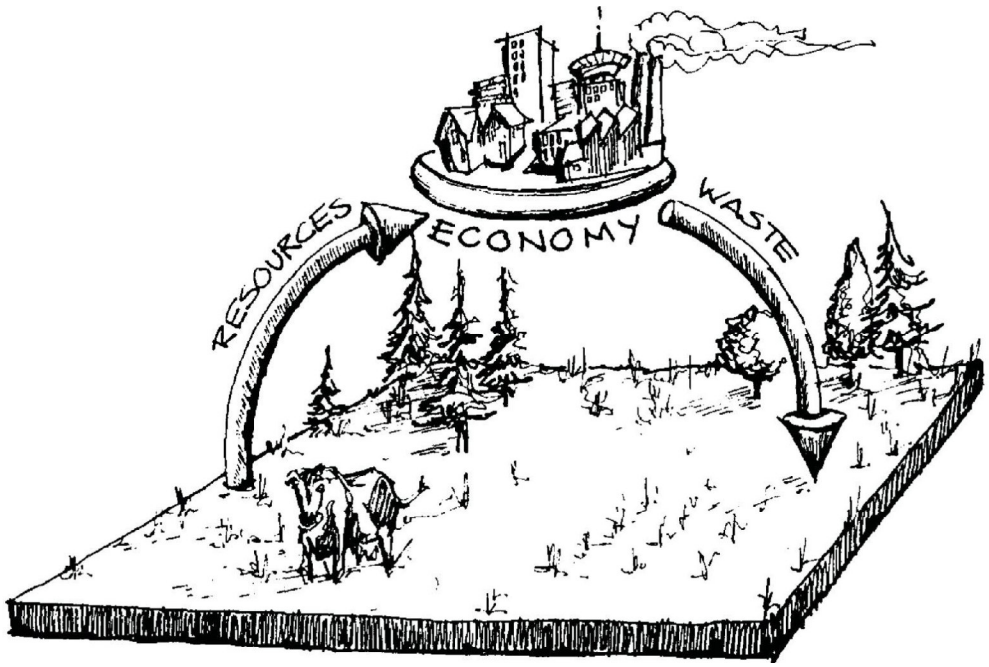

Fig. 2. Industrial metabolism of a city. Reprinted from "Urban ecological footprints: Why cities cannot be sustainable—and why they are a key to sustainability", by Rees, W., & Wackernagel, M., 1996, *Environmental Impact Assessment Review*, *16*, p. 228. Copyright 1995 by William Rees and Mathis Wackernagel.

European rural areas have an invaluable natural, cultural, social, architectural, and productive heritage. Although each territory has peculiar characteristics, which should be carefully considered before implementing circular and sustainable projects, the main commonly found activities in most European rural areas are the agricultural production, cattle breeding, and forestry. There are also other activities such as beekeeping, wine production, and other commercial services such as catering, tourism, and the sale of typical

handicraft products, as in the case of agritourism. Agricultural activities are characterised by numerous companies of various nature. Most of the EU's farms are small, and farming is predominantly a family activity. Nevertheless, the largest 3.3% of the farms (over 100 ha in size) managed more than 50% of all farmland in 2016. These data show that the European agricultural model is moving towards an increased standardisation, both in terms of production and consumption. A large part of the agricultural land is used for monocultures – which allow the production and collection of certain products easily and in large quantities – at the expense of the biodiversity and with evident environmental downsides. It is estimated that around 10 million people are directly employed in rural agricultural activities in Europe. This amount excludes the people engaged in satellite-connected activities. Agriculture remains a male-dominated profession, and an ever-decreasing number of youngsters are attracted to this work, which is very tiring and often poorly paid (European Union, 2018).

In rural areas, there are many productive excellences in the agri-food sector, including also organic products made with sustainable practices. These excellences include the Italian *Mozzarella di bufala campana* (Buffalo mozzarella cheese), the Romanian *Magiun de Topoloveni* (jam made from ripe fruit from various plum varieties), and the Spanish *Jamón serrano* (dry-cured ham), to name but a few. The European Union recognizes and indicates these products through a system of brands for their promotion and protection – protected designation of origin (PDO), protected geographical indication (PGI), and traditional specialities guaranteed (TSG). Local people particularly appreciate these products, which are also commercialised in other member countries or exported outside the European Union. The productive excellence of rural areas is not only linked to the agri-food sector but also to manufacturing. Compared to a few decades ago, the number of European industries has fallen in favour of an economy predominantly based on services, whereas the manufacturing sector is increasingly considered to be a major division, which produces positive cascading effects on the rest of the economy. Some industrial areas have been partially (or totally) incorporated by the urban development of cities in recent years; many industries are instead located in rural or peri-urban areas with reduced population density and connected to centres with higher population through infrastructures, such as highways and railways. The symbiotic relationship between rural and urban areas, therefore, is powerful and perhaps even more evident for these production systems.

Europe is renowned worldwide for the rich and diverse expressions of the immeasurable cultural heritage, which also includes natural sites, in addition to archaeological sites, monuments, architectures, sacred places, works of art, historic cities, and literary works. Rural areas offer fascinating natural landscapes such as parks, forests, mountains, beaches, and hilly areas, many of them being protected. These natural wonders attract visitors from all over the world and create a prosperous economy based on tourism, catering, and leisure activities, as well as on environmental protection. In some areas, small local craft activities are still thriving economically, due to the quality products that are created with centuries-old techniques by master craftsmen (Menzardi, Peruccio, & Vrenna, 2018) (Fig. 3). Nonetheless, this sector is affected by globalisation that has delocalized many production chains, but also by profound changes in the usage and consumption habits of modern societies.

Fig. 3. Scapin, a traditional footwear from Valsesia (northern Italy), made by skilled craftsmen in a special limited edition. Reprinted from "Design strategies for enhancing territorial legacy. The case study of a diffused art exhibition to revitalize specific territories in Piedmont region - Italy", by Menzardi, P., Peruccio, P. P., & Vrenna, M., 2018, *EURAU18 Alicante: Retroactive Research: Congress Proceedings*, p. 450. Copyright 2018 by Moresco Cashmere.

There is no doubt that rural areas play a key role in the development of societies and economies, which can grow thanks to the transformation of natural capital into economic capital. Some of these rural areas are among the most productive and wealthy areas in some countries. In general, however, these ecosystems – and consequently, the indigenous communities – are suffering severe repercussions from an economic system which has weakened them in the long run. Young people have long left the rural areas, attracted by the job opportunities and glamour of the cities, and they have left the elderly behind. The rural exodus has led to an ageing of the population, the abandonment of the land, and a greater level of poverty, accentuating socio-economic disparities with the more urbanised areas. Furthermore, most European rural areas face the challenge of creating high-quality and sustainable jobs.

Concerning the environmental protection, many practices have proven to be unsustainable. In agricultural production, for example, the waste of water is high, as well as the use of chemical pesticides polluting the land and aquifers and accumulating on the fruits and vegetables we eat. Similarly, the extensive use of fertilisers to maximise yields significantly depletes the soil, endangering its fertility over time. In single-sector activities, waste is often not reused nor valorised because it has no market value. The freight transport systems are also inefficient, and most of the packaging is not eco-compatible. Thus, the environmental problems have added up to the socio-economic issues. Unemployment linked to the loss of traditional jobs and local know-how affect the older generations in the first place and impacts on the young people in the most depressed areas. The latter, in the absence of educational qualifications and theoretical knowledge, no longer have the tools to specialise and become professionals in a particular field. This discussion is relevant both for the production of typical foods, as well as for craftsmanship activities.

In a transitional period like the one we are experiencing, the Old Continent must look to the future by learning from its historical roots. The agenda must be extended far beyond the urban growth of smart and modern cities and should include a coordinated development plan for European rural regions as well: this plan should leverage the great potential of the areas and make the most out of them. The potential must be transformed into action, with an overall perspective of environmental, social, and economic sustainability that can bring well-being to communities, regions, and socio-economic systems. The development of new growth models would address weaknesses, bring about

demographic change and transform territorial know-how into strengths. A rediscovery of the local heritage is needed to connect people to their territory and history. Agriculture can also create new job opportunities for meeting supply and demand, especially between rural areas and medium-small cities. A radical change in the regeneration of rural areas could occur through the implementation of circular economy practices. Also, a shift towards more sustainable production, business, and life models should be aligned with the cycles of nature. These measures would reduce rural exodus and guarantee the future of the local agri-food and production sector. Today there are all the elements to start the transition. However, the process is not immediate. Fortunately, in recent years the topic of the circular economy has been trending and has attracted the interest of many professionals from varied disciplinary fields.

2.2 Circular economy and rural development

Rural regions have great potential for growth and development, but also several problems. The challenges that many of these areas are facing – as well as local communities and productive companies – can only be tackled with targeted approaches and radical visions. Current economic and production systems have proven to be inefficient. These models, based on the so-called 'brown economy' and largely dependent on environmentally destructive activities, are now more than ever outdated because they only take economic profits into account. Unfortunately, these models are still widely used. Partly out of awareness and partly necessity, today's generations are, however, observing a gradual transition from linear economies – based on the extraction of raw materials, the production of products, use, and disposal – to long-term sustainable circular models. Circular economic systems are designed to self-regenerate and reuse the flows of matter and energy. These systems consider waste as important resources, to be re-valorised and integrated again in the biosphere. The circular economy is a development paradigm supported by the European Union that reflects the optimist spirit of our times concerning the success in large scale implementations (Bonciu, 2014).

"The holistic approach to the circular economy could prove particularly successful in rural areas because it [...] could aid rural territories in designing sustainable and resilient development strategies" (Salvia, Andreopoulou, & Quaranta, 2018, p. 5). These strategies are aligned with those required to achieve the Sustainable Development Goals (SDGs) by 2030. A coordinated

effort must be made at all levels, involving institutions, cities, municipalities, rural areas, private companies, and citizens (European Union, 2019). The circular approach in rural areas could provide new development opportunities, for instance through the innovative use of biomass. By using agricultural waste, the carbon dioxide emissions generated by the production of mineral fertilisers can be effectively reduced, and fuels can be produced from renewable sources. Also, the quality of wastewater polluted by chemical fertilisers and zootechnical waste from farms can be improved, reducing eutrophication and health risks. Circular systems in rural areas would make it possible to optimise the use of limited natural resources, preserve the environment in its biodiversity, and make it livable even for future generations. Some projects are more suitable for mitigating, others for adapting to the effects of environmental degradation and climate change, which affect farmers and foresters more directly. In contrast with the practices of intensive monocultures and to encourage biodiversity, smaller and diversified agricultural fields can also be imagined in mountain or hilly landscapes which may not seem suitable for agriculture. This method could foster the sale of local and genuine products directly to the consumer, minimising environmental and economic costs related to transporting and eliminating unnecessary packaging. Circular projects would have a great economic and social impact, with evident effects both for individuals and for the whole community. Partly inspired by good practices, new business and consumption models would also permit to rediscover millennial peasant practices that have been lost. The relaunch of these businesses can be a fundamental drive for territorial development.

Circular economy-based projects can operate on multiple levels and multiple scales, coordinating the interests of communities, companies, researchers, academia, policymakers, and all other stakeholders involved. Changes across every field are requested: use of innovative and technological systems, waste processing techniques, design of products, adoption of new business models, implementation of regional policies, as well as a change in consumer behaviours. Starting from a small family-owned business that can radically change its model with small measures, circular economy projects in rural areas can also involve a large number of local stakeholders. The creation of a regional network is critical because it connects anyone interested in developing solutions for rural social, environmental, and economic development. Within the network, material suppliers can be identified more easily, matching supply with demand. A network of this type would allow not only to make economic

improvements but also a positive systemic change for the company, reducing waste by using the outputs of one activity as input for another and creating value-added products.

Europe believes in the circular economy and has adopted an ambitious transition plan for the years to come. Good practices examples are innumerable, and many rural areas where circular economy systems have been implemented have fully revealed their potential. An outstanding example is Kalundborg Symbiosis in the Danish town Kalundborg – the world's first industrial symbiosis system – which since 1972 and well before sustainability became imperative, has adopted a circular approach to the industrial production. Kalundborg was located in a completely rural area, which is still nowadays considered thinly-populated. The development of the town's economy has been remarkable and considered the environmental sustainability. Today the economy of Kalundborg is mainly based on the production activities of a consortium of nine public and private companies, which have a collaborative approach and exchange the necessary materials with each other, bringing well-being to the territory, while reducing the environmental impact and sharing expenses. The symbiosis is also evident to citizens: a system of pipes transports high-temperature steam from a combined heat and power plant to other partners and can be seen running through all the industrial area. If some projects have been implemented on a large scale (e.g., bio-ethanol production), others are still experimental, such as the microalgae production facilities for cosmetic and food use. *"Kalundborg illustrates that there is enormous potential for environmental improvement through industrial symbiosis. Positive applications include increasing energy efficiency through co-generation and by-product re-use, recycling gray (used) water to achieve overall reduction in drawdowns, recovering solvents and re-using many, diverse residue streams that need not be rejected as wastes. Other non-material-based linkages, such as jointly planning transport networks and sharing office, information, or security services, also have potential for environmental improvement"* (Ehrenfeld & Chertow, 2002, p. 345).

Other European countries and rural regions are contributing to the circular transition. Italy in 2019 was the first country in Europe with regards to the overall circularity index, which considers the efficient use of resources, waste management and the level of innovation. Employment levels in the recycling sector were above the European average (Circular Economy Network, 2019). Below are presented just two examples of virtuous companies located in the

rural areas of Piedmont – a region in the north-west of Italy – that have distinguished themselves for their synergic collaborations with other companies and the positive impacts on the territory. The first company is called 'Cascina Pulita' (Clean Farm), the largest Italian company specialising in environmental services for the agricultural sector, with offices in Piedmont and other regions. The company has developed a peculiar system of storage, collection and disposal of waste, in line with the principles of the circular economy. The company promotes sustainable zero-impact initiatives, providing customers with solutions to limit the environmental impact, reduce, recover and reuse waste. Cascina Pulita is also developing an operating manual to be distributed to companies to help them manage waste throughout the entire supply chain and offers them advice on the valorisation of waste to achieve zero impact.[1] Another company that has distinguished itself for its sustainable and circular practices is Baladin brewery in Piozzo, a small village in the province of Cuneo. The brewery was founded in the '90s by the visionary entrepreneur Teo Musso, with the original intent of reviving his small hometown.[2] The company is an *'*agricultural brewery*'* that produces part of the necessary raw material and uses aromatic elements linked to the territory. Today the company distributes quality craft beers all over the world, without losing its identity and the values with which it was born. The brewery embodies many characteristics of the circular economy, including sustainable production process and use of renewable energy. *"Baladin agricultural brewery aims at pursuing a model of 'productive autarchy' in all the steps (except for some spices), in order to reduce the environmental impact. In this context, 'autarky' means taking responsibility for the entire production cycle of the beers [...]. The company is currently carrying out many experimentations to design a 'zero waste' production cycle in which waste becomes a source of energy or a second material for new products"* (Fassio & Tecco, 2018, p. 100). The new Baladin Open Garden brewery, inaugurated in July 2016 and now the company's headquarters, is also a gathering place for the local community and includes common kitchens, a wood oven, a butcher shop, picnic areas, and even a dedicated space at the farmer's market.

[1] More information on Cascina Pulita website: http://www.cascinapulita.it

[2] The fascinating story of how Teo Musso managed to found Baladin and start a new beer culture in Italy is described in the book: Drago, M., & Musso, T. (2013). *Baladin: La birra artigianale è tutta colpa di Teo*. Milan, Italy: Feltrinelli Editore.

There is no right formula, no specific model to apply for successful territorial projects for the circular rural economy as each area, company, and community is unique. In order to revitalise rural areas, circular projects can take inspiration from other cases but must seek the best economic opportunities in socially and environmentally sustainable practices, and vice versa. These solutions must be long-lasting to address current and future problems: European agro-food systems and rural communities should become more resilient in an era of transitions and uncertainties. Compromises should be taken, to guarantee basic human needs, including water, food, health, housing, energy, education, work, gender, and social equity, without overcoming the environmental thresholds (Raworth, 2018).[3] The transition does not happen overnight, but it is gradual and progressive. For transitioning to a complete circular economy in rural areas, technology, market encouragement, and politics will have to change, and skills are needed. However, there is still a strong demand for professionals, managers, and multidisciplinary consultants who can lead project teams. It is necessary to educate young people and the new ruling class (in the fields of economics, politics, science, design, etc.), for circular economy to evolve both theoretically and practically, and to empower them with the tools and mindset for a sustainable and inclusive change.

2.3 The need for specialists

An increasing number of people will be living in cities in the near future. Despite this, rural areas are playing a fundamental role in addressing major global social, economic, and environmental issues. The SDGs include rural development (United Nations, 2015): the 'Zero hunger' objective confirms the importance of increasing investments and international cooperation to end hunger and achieve food security. The SDGs also address the necessity of adopting products and processes capable of developing alternative solutions to the exploitation of non-renewable resources. Thus, a circular economy is a container in which sustainable project proposals should operate.

It is therefore urgent to train professionals – for instance, designers – on how to propose concrete solutions to real-world problems. Tomás Maldonado (1970) has been one of the first to underline this peremptory necessity. He claimed that

[3] It is suggested to read: Raworth, K. (2018). *Doughnut economics: Seven ways to think like a 21st century economist*. White River Junction, VT: Chelsea Green Publishing. Raworth is a British economist who theorized a radical approach to modern economics, that puts purpose at the hearth of every action, rather than mere profit.

the designer's job is that of a technical intellectual, who has an important social role for the entire community. Hence the need for a strong ethical imprint and a solid cultural base. Today, the SDGs are guidelines also for designers in identifying and tackling global problems. The most pressing issue is climate change, as a starting point for dealing with other problems, which can be grouped into three categories: biosphere, society, and economy. *"The focus is shifting from the environment as externality to the biosphere as precondition for social justice, economic development, and sustainability"* (Folke, Biggs, Norström, Reyers, & Rockström, 2016, p. 1) (Fig. 4).

Especially in the last decade, many designers, policymakers, and entrepreneurs have started to face environmental challenges actively, adopting circular economy principles: this is a radical change and is clearly defined by the context to which it is applied. Rural areas are naturally – and historically – prone to these concepts. In this context, it is useful to recall the anthropological theme of 'peasant DIY', a theory developed by Lévi-Strauss (1962). The author underlines the ability of traditional society to operate on material and immaterial knowledge by recombining them creatively. Besides, the predisposition of rural territories to a circular approach is described and compared with the city by Sennett (2009) in his book, 'The craftsman'. He differentiates between the linear time that characterises metropolitan urban landscapes and the circular one which finds its most appropriate habitat in other communities. This brief analysis helps contextualise the area and complexity of these interventions, highlighting the need for contributions from different fields. The development of complex processes and services requires designers with a high level of social commitment and moral responsibility. These people must be able to convey the entire production and consumption ecosystem in the 'shift age', a term indicating a period of change characterised by increased awareness of designers, primarily, and consequently of the wider public (Houle, 2011).

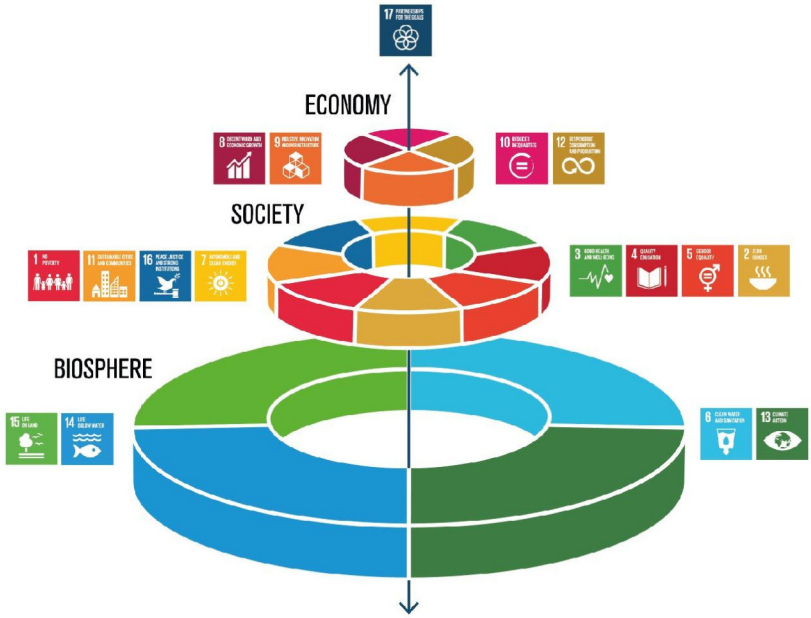

Fig. 4. Highlighting the interconnection between environmental, social and economic problems through SDGs. Adapted from "Social-ecological resilience and biosphere-based sustainability science", by Folke, C., Biggs, R., Norström, A. V., Reyers, B., & Rockström, J., 2016, *Ecology and Society*, *21*(3), p. 6. Copyright 2014 by Johan Rockström and Pavan Sukhdev.

If the famous report to the Club of Rome entitled 'The limits to growth', by Donella Meadows, Dennis Meadows, Jørgen Randers, and William Behrens (1972) has favoured the discussion around environmental and economic issues, similarly the publications of distinguished design theorists such as Maldonado (1970) and Papanek (1973) have fostered an intense debate on the role of designers for the years to come. As illustrated in a recent study by Peruccio, Vrenna, Menzardi, and Savina (2018), an environmental analysis centered on the downstream effects of design – that is about the ruinous consequences of consumption – has to be substituted with a forward-looking critical approach aimed at restating product production, its course, and outcomes. The studies on the complexity and the earliest system theories also entailed a new way to intend and make design. This way would be later defined as 'systemic design' and spread among academic circles worldwide.

Design has taken on a decisive role in the transition toward an ecologically sustainable future. On this basis, systemic design can be considered the outcome of this process. At Politecnico di Torino, Italy, the Master's Degree in

Systemic Design 'Aurelio Peccei' is one of the most innovative training courses at an international level, with close relationships with the Kyoto Club, the Club of Rome, and ZERI/Blue Economy, among other institutions. The Systemic Design course prepares designers to configure and manage wide-ranging design solutions with zero emissions. It promotes a design culture with a different perspective on problems and a multidisciplinary approach to the production systems, but also attentive to the humanistic components.[4] The Master's Degree addresses the environmental issue through the tools of systemic design which lead – based on the reflections initiated in the design field by Alexander (1964), and up to Ciribini (1984) – to the design of open systems in which there is no production waste. It is a design methodology that looks at the entire product-system placed in a specific social, political, economic, and cultural context. It is the strategic design of a scenario capable of going beyond product innovation as an end in itself, by developing wide-ranging themes on which other knowledge must necessarily converge (Peruccio, 2018).

In order to understand the principles governing systemic design – and the mindset of systemic designers, it is appropriate to analyse the etymology of the Greek word 'sinastae'. This term means 'putting things together in a large whole'. In systemic design, this whole is characterised by the context, which is the territory where designers operate. A machine is a system of components, each with its specifics and peculiarities, which work together to guarantee movement. The same applies to a territory. The only difference lies in the fact that designers do not choose the peculiarities based on the functionality they want to obtain but enhance those that are available. A system consists of elements, coherently connected to a purpose, to make something work. A system must include three types of main items: elements, interconnections, and purpose. Contrary to linear thinking, the systemic approach focuses the attention on the local economy. The problem of industrialization is claiming that the same linear and mass-production principles are applicable everywhere, but an approach of this type is beneficial only for large multinational industries (Bistagnino, 2016). The limits of this modus operandi, which has characterized the last century, can also be found in the predictions of Randers (2012) in one of the recent reports to the Club of Rome entitled '2052: A global forecast for the next forty years'. In the essay, he highlights how the next decades will be

[4] More information on the Master's Degree in Systemic Design 'Aurelio Peccei' on Politecnico di Torino website:
https://didattica.polito.it/laurea_magistrale/design_sistemico/en/presentation

influenced by five topics: capitalism, economic growth, democracy, intergenerational equity, and the human impact on the global climate. All these macro problems are, in different ways, connected to local territories. Therefore, acting locally is necessary for projects to be efficient. The concept of efficiency adopted by the systemic methodology consists of redistributing wealth among all subjects belonging to the local system, thus generating wealth within the community. The word 'wealth' does not only refer to the economic profit but extends to environmental and social aspects, thus contributing to the achievement of shared well-being. Rural economies can make the most out of a systemic design approach by making their diversity a resource, as opposed to the industry which considers diversity an obstacle to be overcome through homologation processes that – directly and indirectly – lead to cultural, ecological, and productive impoverishment (Bistagnino, 2011).

Products, relationships, resources, stakeholders, interactions, interdependencies, flows, inputs/outputs, society, environment, local economy, well-being, resilience, and values are the elements that all systemic designers should consider in their projects. This approach permits the re-configuration of a territory's micro and macro dynamics, eventually a rural area, according to its real specificities. The final goal is to maximize every output that is dispersed outside the system so that it can become an input for other new or existing activities within the system. The interventions within the systems do not only look at the waste generated at the end of life by a product or service but at the entire production chain. The focus is on limiting waste at the end of the process, by trying to prevent its generation by connecting the different actors according to the function they play inside the system (Fassio & Tecco, 2019). What has been described so far about the systemic design approach is useful to understand the degree of flexibility of these professionals. They can operate in the field of product design, as well as service design, digital design, and communication, constantly keeping an eye on sustainability and ecological, sociological, and economic aspects. The connections with other disciplinary areas – both humanistic and scientific – are also evident, as well as the different roles compared with traditional designers. As pointed out by Celaschi (2016), designers are now abandoning their previous conventions, becoming mediators of knowledge, looking for collaborations, and interacting with other experts.

To sum up, it is relevant to keep in mind that *"when we talk about productive activities we do not mean only the industrial ones but, on the same level and with equal dignity, also agricultural ones. [...] The harmonious co-*

presence of agriculture, industry and the community with the natural system, within the same territorial context, is the fundamental key of a production model of sustainable development" (Bistagnino 2009, p. 20). Systemic designers have already implemented several circular projects, even in rural areas. These projects have promoted economic diversification, traditional agricultural skills, and new technical/cultural know-how, supporting and developing agro-food systems, thus contributing to sustainable, inclusive, and economic growth in rural regions. It is also worth mentioning the RETRACE project, which is a recent example of coordinated work between universities, local authorities, government offices, associations, and public bodies, to drive sustainable European policies (Barbero & Bicocca, 2017).

Therefore, it is clear that designers are acquiring new circular skills (De los Rios & Charnley, 2017; Sumter, de Koning, Bakker, & Balkenende, 2020) and they are getting more competitive on the job market. However, other subjects also realize that transversal skills are needed to face the new millennium problems. Thanks to these unique multidisciplinary professionals, rural areas – and the world – will hopefully benefit from sustainable and inclusive development.

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Biography

Pier Paolo Peruccio is an Architect and PhD, and also an Associate Professor at the Department of Architecture and Design of Politecnico di Torino (Italy). He is a Board Member of WDO, Vice Head of the Design School, Director of the SYDERE (Systemic Design Research and Education) Center in Lyon (France), and Coordinator of the II Level Specializing Master in Design for Arts. He is currently working on several research projects concerning the history of sustainable design, systems thinking, and innovation in design education. E-mail: pierpaolo.peruccio@polito.it

Maurizio Vrenna holds a PhD in Management, Production, and Design from Politecnico di Torino (Italy). He is currently a Lecturer at Wenzhou-Kean University (China), and during his professional and academic career in Europe and Asia, he has been involved in the development of sustainable products and services. As an independent external expert, he performs advisory services for Climate-KIC, Europe's largest public-private innovation partnership focused on climate change. E-mail: maurizio.vrenna@polito.it