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COMMENT

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In praise of the *persona economica*: listening to plants for a new economic paradigm

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Imagining, first, and then implementing an effective shift toward a new, green, and sustainable economic paradigm that safeguards the commons is required if humanity wants to survive and prosper. This commentary proposes a mission statement for a new transdisciplinary and long-run research endeavor to redefine *homo economicus* by letting him wear a new mask (the Latin meaning of *persona*). It also introduces a provocative definition of "Vegetable Economics," a new economic paradigm that takes inspiration from plants to design economic institutions.

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Introduction

We live in the era of the commons, and we experience the tragedy of their daily overexploitation (Hardin, 1994). This is also true for so-called global commons, such as the oceans, biodiversity, and outer space. The most challenging tragedy we are currently facing is undoubtedly the deterioration of the biosphere (Dasgupta, 2021) due to climate change. Although over six billion "players" take part in the global tragedy of the commons—"a game that we cannot afford to lose" (Pfeiffer and Nowak, 2006. p. 584)—the costs of this tragedy are disproportionately borne by people living in low-income countries (especially in sub-Saharan Africa) and, within those countries, by those living in more deprived households (Hallegatte and Rozenberg, 2017). If insufficiently addressed, climate change, together with other pressing and contemporary issues, including, but not limited to, global public health crises, or the progressive loss of biodiversity of the ecosystems (Dasgupta, 2021), will exacerbate poverty and inequalities within and across countries.

Imagining, first, and then implementing a fundamental, profound, and effective shift toward a new, green, and sustainable economy (Aronoff et al., 2019; Jacobs, 1993) that safeguards the commons is required if humanity wants to survive and prosper. In doing so, we claim that economists should find a new "grand narrative for economic theory," the importance of which has recently been put in the spotlight by Shiller (2017, 2020). This is not a purely rhetorical exercise; sustainability is—in fact—an ethical issue (Zagonari, 2020, 2021). Most existing narratives within economics do not challenge the roots and the basic paradigm of our economic system. A candidate motivation for this impasse is that, when creating economic institutions, economists of the last two centuries chose the *animal paradigm* based on the division and specialization of organs and a hierarchically governed structure.[1] While this choice has produced massive evolutionary success in speed and efficiency, it has promoted a predatory approach to natural resources against the survival of the local and global commons and has not avoided the tragedy of the deterioration of the planet due to climate change (Lawrence and Laybourn-Langton, 2021).

This commentary proposes a mission statement for a new transdisciplinary and long-run research endeavor to redefine *homo economicus* by letting him wear a new mask (the Latin meaning of *persona*) and shifting from the "animal paradigm" to a "vegetal paradigm."

More specifically, this commentary starts with the consideration that economics needs to change its basic paradigm by transitioning from the concept of *homo* to that of *persona* (i.e., by acknowledging that every human being is an individual in a relationship) (Nelson, 2010). This is what we do in Section "Toward the Persona Economica". Once we recognize the need to consider the economic *agent* as a *persona*, we go one step further by saying that this might not be enough unless we also consider the importance of reconceptualizing some economic *institutions*. However, for humans (i.e., those in charge of reconceptualizing and rebuilding economic *institutions*), the transition from in-group to out-group trust and cooperation, from exploitation to mutualism, and from self-interest to collective action is not automatic but requires a conscious deliberation process. Therefore, it requires an example from which to draw inspiration. This is discussed in Section "Toward Vegetal Economics". The inspiration that humans need to build better economic institutions, we claim, can come from plants. This is discussed in Section "Conclusions".

Toward the Persona Economica

When the animal *homo sapiens* had to imagine the *homo economicus*, the enterprises, and the institutions he was operating with, he designed himself (and them) while looking in the mirror with the gaze, knowledge, and skills of that specific historical time and of that particular cultural tradition. Assuming that the purported father of *homo economicus* is J.S. Mill, *homo economicus* then resembles an English white man of the mid-XIX century. Accordingly, economic organizations and institutions resemble how human beings were thought to be functioning at that specific time: self-contained, hierarchically structured, and complex systems with a central brain and specialized organs.

Today, thanks to developments in science and technology, and mainly thanks to advances in behavioral sciences, social sciences, and social neurosciences (see, for instance, Cacioppo and Cacioppo [2020]), we know that *homo economicus*, as theorized by neoclassical economists of the XIX and XX centuries, often does not correspond to how human beings function and behave. Moreover, we know that every human being is neither mythically separative (i.e., autonomous and independent) nor mythically soluble (i.e., entirely subsumed in relationships) but is a *person* (i.e., an individual in a relationship) (Nelson, 2010). This is true from an intuitive, scientific, and evolutionary point of view.

From an intuitive point of view, humans' first experience on earth is that of a relationship; human beings do not appear from the ground separated 'like mushrooms'[2]; we were born, randomly assigned to a group composed of at least the two persons who gave us our genes. We were probably also surrounded by other brothers or sisters. We did not decide the group (i.e., the family to which we were assigned) nor the brothers or sisters with which we had to share our parents and the resources within our families; it happened irrespective of us and without any reference to our preferences or merits. From a scientific point of view, we know that social relationships have short- and long-term effects on several human dimensions, including health (Umberson and Karas Montez, 2010), mortality (Holt-Lunstad et al., 2010), and happiness (Becchetti et al., 2008; Bruni and Stanca, 2008); therefore, they cannot be assumed to be an accident in economic models. Moreover, from a social neuroscience perspective (Declerck and Boone, 2015), we know that the human brain's reward system attaches value to cooperation by receiving inputs from both a cognitive control system (which computes the benefits to the self) and a social cognition system (which analyzes and stores information on the cooperative intentions of others, the so-called "Social Brain"). These two systems are equally important in shaping human cooperation and prosociality (and human competition and egoism). Humans are, therefore, neither cooperative nor selfish by default. Conversely, the human brain has evolved to steer decision-making toward the best outcome given contextual factors and individual preferences and values.[3] From an evolutionary point of view, the human brain principally evolved thanks to the neural mechanisms that enhanced social cohesion and social problem solving (Dunbar, 2003), especially during periods, such as warfare or extensive climate changes, that required a surplus of mutual aid between individuals within communities (Whiten and van Schaik, 2007).

As *homo economicus* has been an icon of the cultural traits of the different societies in which economists live, it has also grown together with the growth of economics as a scientific discipline. Advances in the behavioral sciences, social sciences, and social neurosciences, and in many other scientific fields, have therefore revealed and enriched the old picture of *homo economicus* by shedding light on some important social and ethical aspects that,

today, can no longer be hidden. Confronted with the knowledge coming from different disciplines, the evolution of the paradigm of *homo economicus* needs, therefore, to go a step forward, hence the need for a transition from *homo economicus* to *persona economica*, where the relational dimension is considered in all its nuances.[4]

However, this shift from *homo* to *persona* economica is not enough if it is not radical enough. Developments in several scientific fields have shown that humans have learned to cooperate over the long course of their lives on earth (Nowak, 2013). However, they soon preferred to cooperate with members of their group to minimize the risks and costs associated with betrayal and exploitation (Efferson et al., 2008). While these in-group and out-group categorizations have sometimes produced biases in contemporary societies, including the incapacity to effectively act against climate change deterioration (Johnson and Levin, 2009), they have also been overcome to promote an inclusive social identification with the world community, ultimately transcending human's parochial interests (Buchan et al., 2011). Humankind knows how to become a "we" where there are no "others" (Giddens, 2013) by avoiding parochial motivations and favoring, instead, cosmopolitan ones (Buchan et al., 2009) merely by inhabiting the same planet. The question that remains unanswered is: how to do it?

Rewards (Rand et al., 2009; Yang et al., 2018), and to a lesser extent, punishment, and sanctions (Grimalda et al., 2021) can be the currencies that humans leverage to increase cooperation both within and between groups and generations (Romano et al., 2017). However, these currencies are used ex-post and conceptualize *homo economicus* (and the market in which it acts) as an ex-ante place of non-cooperation. The market, however, can be a place where people are socialized with strangers, and the more people rely on market exchanges, the more *"they will also experience abstract sharing principles concerning behaviors toward strangers"* (Henrich et al., 2001, p. 76), which ultimately improves cooperation (Baldassarri, 2020). This civilizing ability of the market dates back to Mill's (1887) idea of the market as a place for mutual benefit where people come to see one another as cooperative partners, thereby reinforcing their attitudes of social solidarity and goodwill, and has recently been brought to the attention of the general public by economists (e.g., Bruni and Sugden, 2008; Sugden, 2018). However, this is neither an easy nor an automatic process. From a neuroeconomic point of view, for example, the transition from in-group to out-group trust and cooperation, from exploitation to mutualism, and from self-interest to collective action often requires a conscious deliberation process that allows humans to adopt a different perspective to reflect on the global and long-term implications of their decisions and ultimately avoid parochialism (Declerck and Boone, 2015).[5] To conclude, suppose we want to address the urgent issue of planet deterioration due to climate change by creating better economic institutions. In that case, we need to change the economic paradigm, shifting toward a *persona economica* while also finding an example to look at and draw inspiration from in building new economic *institutions*. This example, we suggest, can come from the kingdom of plants, which is, more than others, fighting against climate change.

Toward Vegetal Economics

To understand why plants can be an excellent example from which to draw inspiration in building better economic institutions, we should find some characteristics of plants that have made them so resilient in the fight against climate change. Plants and animals are highly different. The first and most fundamental difference between the two is that animals organized themselves to move on dry land six hundred million years ago. At the same time, plants took roots using the sun as the only energy source. This choice influenced every subsequent transformation of the plant body. First, plants are not characterized by organs entrusted with the main functions. On the contrary, plants distribute the tasks that animals concentrate on specific organs over the whole body (i.e., they are diffuse organisms) (Mancuso, 2017). Plants do not have a brain playing the role of commander-in-chief. Instead, plants are modular, cooperative, and distributed. These structures are sufficiently different from human social hierarchies, which are already less rigid and based more on cooperative agreements than other nonhuman primates (Sherif, 2010). The most relevant portion of the plants is constituted by the root system that guides the plant as a distributed intelligence (Eshel and Beeckman, 2013). Plants exert complex behaviors: they can sense the presence (Vandenbussche et al., 2005) and the identity of neighbors (Chen et al., 2012); they show, during the coordination of individual roots in complex root systems, swarm intelligence (i.e., the ability to acquire information, process it through social interactions, and use it to solve a cognitive problem to achieve mutual advantage) (Baluška et al., 2010; Ciszak et al., 2012). Being rooted, plants cannot escape to avoid dangers, search for food, and solve problems. These and other characteristics make plants particularly oriented toward cooperation and less toward competition.

Like humans, plants also show competitive behaviors (Cahill et al., 2010). However, the key features of plants' behavior (McIntire and Fajardo, 2013) are mutualism (i.e., when partners from different species trade help and benefit from their interaction [Bronstein, 2009; Kiers et al., 2003]), and facilitation (i.e., when partners from different species—but coming from the same trophic level—are in a situation in which at least one partner benefits the other without incurring a cost [Bronstein, 2009]).

Often, even when acting in their best interests, plants help members of other groups. This is the case, for example, for plants that, when damaged by herbivores, release volatile compounds. These compounds attract the predators of those herbivores. These plants "alert" other plants, which, perceiving the danger, increase their defenses (Johnson and Levin, 2009). Often, plants act together to create (and safeguard) a common good. This is the case, for instance, of swamping predators by producing seeds simultaneously (Dudley, 2015). In doing all this, plants never act as individuals but as colonies, as communities. Every plant is a network, while a forest is a network of networks (Mancuso, 2017). This characteristic of plants makes them particularly capable of surviving in situations of particular danger, such as fires. This feature has also allowed plants to solve numerous "tragedies of the commons," such as the need to coordinate in height and not steal sunlight from any forest member.

We do not even remotely want to envision humans becoming plants sooner or later. Accordingly, we do not want to claim that plants are better than animals or that humans should have all the characteristics that plants have, including the inability to choose their role within the ecosystem (which, for plants, has been assigned for evolutionary motivations) or to fight to change their position within a society (which, instead, humans can do). These reductionisms do not belong to science and will not find space in this brief commentary. However, once we have accepted that a change in the economic paradigm is needed and that this change requires a shift from the concept of *homo* (which is now outdated by contemporary scientific discoveries) to that of *persona economica*, we can ask ourselves whether or not it is worth drawing inspiration from plants in creating economic institutions. Although the animal paradigm has generated great success in speed and efficiency (e.g., by creating an improvement, although not equally distributed, in living conditions), it has also developed a predatory approach to natural resources that is no longer

sustainable. Moreover, while at the individual level, we are animals, and, as such, we can run and escape (nobody wants to deny it), at the level of the species, we are very similar to plants: we are sessile. Not having yet another planet to live on, we are forced to remain anchored to this—the only planet we have. We refer to this mental exercise to take inspiration from plants as Vegetal Economics.

Some examples of Vegetable Economics are already present in our societies, while others have yet to be considered. Where can we start? Just as plants react to major crises by resorting to mutualism, humans often respond to epochal emergencies by generating, from below, associative and cooperative realities. Over the long course of economic history, this has been the case, for instance, the *Mons Pietatis* (Mount of Piety), born through Franciscan inspiration. *Mons Pietatis*[6] was, in fact, a public pawnshop where people could pawn their possessions in return for paying a modest and fixed fee, which was intended to act as a payment for the workers of that institution. At the same time, wealthier citizens were encouraged to lend money to the Mons, always in return for a fixed rate (Mews and Abraham, 2006). This new system was a runaway success in Europe. The main difference between an individual money lender gaining personal wealth from borrowing money and Mons Pietatis was that the former provided a loan from the collective capital of the community, thereby helping protect the poorest from exploitative loans and providing important antecedents for subsequent developments of alternative banking, such as the cooperative credit market. The case of *Mons Pietatis* is just one example of many. Plants are, in fact, mainly cooperative beings, and even competition (i.e., for light or roots) can be conceptualized as a sub-game of a greater cooperative game. However, if we wanted to find a starting point toward a new economic paradigm in which the *persona economica* acts within a market that is a place of and for mutual assistance, the world of economic cooperation constitutes an excellent one.

The cooperative movement shared two fundamental concepts with the theories of evolutionary biology of the second half of the twentieth century: cooperation and altruism are not synonymous, and cooperation and competition are not opposites. Conversely, cooperative practices often require altruistic behavior, but the general rule of cooperation is not unilateral sacrifice but mutual benefit, reciprocity, and mutualism. Plants within a forest, for instance, often compete in height, but this competition leads to the mutual advantage of the entire forest. In cooperatives, as in the vegetal realm, functions are distributed throughout the body without (almost) any rigid hierarchical organization. Being anchored to the territories, cooperatives have been, on average, much slower and generally less efficient than capitalist companies. However, they have proved to be much more resilient to environmental and economic crises (Carini and Carpita, 2014).

Conclusions

While even the great protagonists of the new digital economy have borrowed something from Vegetal Economics (e.g., they are increasingly widespread and horizontal networks, akin to cooperatives), they still have not changed property rights, with their profits still concentrated in a few hands. Suppose we seriously want to solve the increasingly urgent issue of climate change deterioration. In that case, two great classics of economic theory (i.e., the issue of property rights and the related one of the distribution of wealth) should come back to the fore. However, they should have to be addressed in a completely new fashion, with categories radically different from those in the twentieth century. Politics and taxes will never be enough. A fundamentally new economic paradigm is required. This new economic paradigm, we claim, should maintain that *homo economicus* is not enough because human beings are, above all, persons; they are in a relationship. This does not mean adopting a holistic paradigm in which the individual disappears, is sacrificed for the sake of the community, or should permanently attach greater importance to global and inter-generational welfare with respect to their own welfare or the welfare of their offspring. In fact, by depicting the *persona economica* as an intrinsically relational subject, we are distancing ourselves at once from *homo economicus* (based on perfect rationality and self-interest), *homo sociologicus* (for whom expectations, norms, and values seldom originate from the society in which he is embedded), and *homo reciprocans* (whose behavior is solely motivated either by positive or negative reciprocity). Instead, we propose an economic approach that considers, at once, the fact that an individual, when making decisions, takes into account their interests, that of the people with whom they are in a relationship, and those of the communities in which they are rooted. The *persona economica* we are advocating for is closer to the description of a human being that is brought about by the most recent advances in the behavioral sciences, social sciences, and social neurosciences.

However, this is still not enough. We know from social sciences and social neurosciences that humans often fail to overcome their particular interests (or at least fail to do so automatically). They need examples and, often, conscious deliberation to do it. This example, we believe, can come from plants. Plants, precisely because they are rooted (as humans are in their communities), needed to develop a sense of cooperation and mutualism that is not required as much in any other animal species. This sense of mutualism has made them so resilient that they are, even today, at the forefront of the fight against climate change. This sense of mutualism is also similar to the description of the market as a place of mutual benefit, for which a certain tradition of economic thought has long advocated. We know that a commentary will never be enough to tackle a complex issue like climate change. With this commentary, we only hope to open a fruitful discussion on these issues that will lead to the creation of a long-term research endeavor. At the same time, we know that changing the economic paradigm is not enough to tackle the issue of climate change. We recognize that the consequences of paradigm-shifting could take years to bear fruit in institutions (both economic institutions, on which we focused here, and other institutions, which are equally important but which were not the object of our discussion) and, therefore, in society. However, we are equally aware that everyone must play a part in this fight against the deterioration of our only planet, starting from their areas of competence. Social sciences cannot hide away and should find alliances with other sciences. In this commentary, we propose one, but there must be others. This is the time, and there will not be another, as there is no Planet B. We can choose whether to stay and watch or finally put ourselves in the fight against climate change deterioration by imitating those fighting this battle for a long time: plants. This is one way to move beyond the Anthropocene while safeguarding humanity and the *persona economica* thereof.

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Notes

1 In economic theory, this translates with the primacy of division of labor (Adam Smith), economies of scale (Alfred Marshall), and the division of knowledge (Von Hayek).

2 "To return once again to the natural state and to look at men as if they had just emerged from the earth like mushrooms and grown up without any obligation toward each other" (Hobbes 2003, p. 102).
3 Notice that there is sharp contrast with Hobbes's politics and Smith's anthropology where interpersonal relationships are always mediated, sociality is anonymous, individuals decide based on their self-interest, and the contract constitutes the main instrument that mediates social interactions (Bruni, 2012).
4 In this commentary, we do not refer to the role relationships could play in socio-economic development. Generally, the social capital theory assumes that relationships can play a positive or negative role depending on the social relations' degree of openness (closure). Generally, bonding social relationships adversely affects socio-economic development, and bridging social relationships has positive effects. As mentioned, this discussion, however attractive it may be, goes beyond the discourse we are carrying on here and, therefore, we limit ourselves to mentioning it here. Still, we will no longer deal with it in the course of the text.
5 Ironically enough, the same neural network of cognitive control, which is usually associated with economically rational decision-making and self-interest, is also the driver of caring for others and is activated to eschew parochialism and short-sighted impulses (McClure et al., 2004).
6 We have cited examples of local institutions. As shown in, among others, Hannam et al. (2017), small-scale cooperation can substantially deepen international cooperation on climate issues. Moreover, as substantiated by Ostrom (2012), particularly for issues like climate change, positive actions are already underway at multiple and smaller scales. Therefore, an interacting ecosystem of agreements across several levels of governance is more needed than a single comprehensive regime with universal participation. This choice does not want to carry, per se, any negative judgment for nonlocal institutions.

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Competing interests

The authors declare no competing interests.

Additional information

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