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The Target Malaria project and the gene drive experiment: for an ontological politics of the neoliberal bioeconomy and its controversies

(doi: 10.1423/115307)

Rassegna Italiana di Sociologia (ISSN 0486-0349)
Fascicolo 4, ottobre-dicembre 2024

Ente di afferenza:
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by Maura Benegiamo

1. *Introduction*

The hybridization between scientific knowledge and its technological application has accelerated since the first decade of the post-war period resulting in the progressive alignment of the scientific practice towards the production of outputs directly exploitable by the market, industry, and societies (Echeverría 2005). This has increased the importance of the economy of science as a driver of the high-tech sector and, more generally, economic development. The term «knowledge economy» (see for example Powell, Snellman 2004) reflects this centrality of techno-science and the prominent role played by innovation processes in the development strategies of global capitalism and national economies.

The enthusiasm for techno-scientific innovation has also been accompanied by growing concerns about both the risks and the social and ecological implications of new technologies and their use. This has fuelled a debate, often linked to specific innovations, that has transcended the scientific and industrial community and has gone beyond the issues of safety and quality of specific products to discussing the ethical implications as well as the aims and needs to which innovation processes respond. In this sense, the nuclear debate and the debate on GMOs have been two major areas of discussion on the role, implications, and purpose of technical and scientific innovation (Von Schomberg 2013). These debates have reinforced the awareness that innovation must be questioned not only for what concerns its products but also in its assumptions, and aims.

This acknowledgement has also entered the more institutional policy frameworks, for instance the European Union has integrat-

ed the *Responsible Research and Innovation* (RRI) approach to science policy processes, acknowledging the need for a paradigm shift in the governance of innovation (Arnaldi, Gorgoni 2016). The RRI approach aims to create more inclusive pathways to enhance the capacity for continuous adaptation in knowledge creation processes and achieving truly sustainable and equitable social and environmental goals. Along the same lines, the idea of citizen science, which has also undergone varying degrees of institutionalisation (Serrano Sanz *et al.* 2014), values the contribution of «non-professional scientists» and the participation of a more extended community of actors in the production of new knowledge for science and society (Vohland *et al.* 2021).

The importance of opening scientific processes and their evaluation to multiple voices and perspectives has gone hand in hand with the recognition of the epistemological nature of science, in addition to its ethical and social aspects (Maasen, Dickel 2019). Consequently, promoting and extending «epistemic inclusion» turns out to be crucial for making processes fairer and more accountable (Zwart, Block 2024). At the same time, however, despite the importance of these advances, the increased focus on ontologies in social and political theory, and especially in anthropology and science and technology studies (Pickering 2017), invites one to question the relevance of framing the process of science participation and citizen empowerment as a solely epistemological question, centred on the nature of knowledge and ways of knowing and learning about social reality. As stated by Ander Burman (2017), epistemological perspectives can indeed be limiting when they are understood as detached (*disembedded*) from the «ontological» contexts in which they emerge, or, in other words, when the nature of knowledge is separated from a discussion over the nature of the reality within which knowledge is given, and how these two dimensions relate.

These issues are particularly relevant in the context of ecological transition and sustainable development, which are witnessing the clash between radically different visions of how to compose the relationship between environment, society and economy and the reality of these relations. In these conflicts, it is not only about discussing the risk of epistemic injustice or violence: «what is missing is the fundamental discussion about what there is and the mechanisms by which a dominant reality imposes itself on other realities» (*ibidem*, p. 925).

This article moves from such considerations and proposes a reflection on the role that ontological dimensions assume in the context of the most recent trajectories of techno-scientific development, driven by the bioeconomy paradigm. It suggests a shift from a conception of the politics *of science* understood as a problem of inclusion of different epistemologies and points of view, to the recognition of a *politics of matter* or ontological politics (Pellizzoni 2023), as a central aspect and conflicting stake in the current development dynamics involving the relations between science, society, and the non-human world. In this sense, the aim of this article is not primarily to provide an analysis of techno-science assessment methods and procedures, but rather to highlight the ontological nature of politics – namely, the conflicting ways in which reality is produced, acted upon, and modified – and of the politics of (techno) science in particular. Recognizing these dynamics, the article argues, can offer broader insights into the relationships between the economy, society, and techno-scientific innovations, leading to a more comprehensive understanding of the dimensions involved in governing innovation processes, particularly in relation to environmental issues. This can also enhance the understanding of the main challenges faced by participatory and responsible science initiatives in effectively countering power asymmetries, overcoming the neoliberal approach to conflict governance (Blok, Lemmens 2015; Arnaldi *et al*. 2016, Arienzo 2017), and promoting alternative valuation practices that challenge the idea of generalized commensurability implicit in the neoclassical economic utilitarianism paradigm (Centemeri 2015).

As said, this article examines this proposal in light of recent technoscientific developments associated with the idea of bioeconomy, which serves as a principal strategy employed by neoliberal development to reform production paradigms and address critical environmental issues in response to the climate crisis (Goven, Pavone 2015). By reflecting on these aspects, the article has then a twofold purpose: first, to relate the main insights of the debate on political ontology and ontological politics to the debate on the governance of science and the need to imagine new paradigms for a «post-normal science»; second, to contextualize this necessity within the current context of economic development driven by the techno-scientific paradigm of the bioeconomy and the specific ontological politics that this brings into play. Furthermore, in order to substantiate an ontological

politics perspective on bioeconomy innovation processes, the article analyses a case study of an opposition movement that arose in Burkina Faso in response to the experiments conducted by the Target Malaria project, which focuses on an emerging genetic technology known as engineered gene drives. This latter utilises the hereditary transmission capabilities of genetic structures to influence the evolutionary mechanisms of animal species, and in particular mosquito populations. The article also addresses other potential applications of this technology, along with the social tensions that arise in this context.

The article is structured as follows: the next section briefly introduces the perspective of ontological politics, situating it in the context of the so-called *ontological turn* in the social sciences, and discusses its relevance for the analysis of the bioeconomy and related technological fields. The third and fourth sections present the *gene drive editing* technique and examine the controversy surrounding the Target Malaria project in Burkina Faso, particularly focusing on the protests from rural and ecological movements advocating for the right to food, agroecology, and food sovereignty. Based on the analysis of these perspectives, the discussion highlights the tensions surrounding the nature of society-environment relations, as well as the transformations that are taking place in the context of the neoliberal bioeconomy. These require adopting of an ontological perspective to understand the social tensions at play in the context of the bioeconomy and the ways in which alternative realities are created – or rendered infeasible – in current technoscientific development processes.

Concerning methodology, the data used on this article have been collected through desk research on mobilisations and reports discussing the Target Malaria project in Burkina Faso, as well as through participation in events, conferences and debates organised by various associations involved in the gene drive diatribe, both in Burkina and globally, involving activists, scientists, and representatives from civil society associations.

2. *From political ontology to ontological politics in neoliberal bioeconomy*

The need to broaden the scientific capacity to involve different perspectives and interests directly in the problem formulation,

decision-making and implementation process is increasingly recognised as an important requirement for research, innovation, and technological application processes. About thirty years ago, the idea of *post-normal science* (Funtowicz, Ravetz 1993) theorised the need for new scientific paradigms to recognise the systemic, normative, and uncertain nature of knowledge processes**.** It also specified that this character emerges more strongly when science deals with complex political issues, such as those related to the challenges of climate change and sustainability. Central to this framework is that scientific practice should not simply be oriented towards the search for a single scientific truth but should also include the exploration and implementation of different ways of solving problems, in order to be able to engage with the wider application of knowledge production and to promote broader and more inclusive decision-making processes.

More recently, the so-called *ontological turn* in social sciences (Pellizzoni 2016) has sparked a broad debate on the role that particular ontologies play in aligning the demands for justice and inclusion put forth by specific actors and social movements (Descola 2013; Escobar 2019). The focus on ontologies has raised critical questions about the need to acknowledge and take seriously the existence of alternative ontologies, as well as the power asymmetries inherent in specific inter-ontological relations (Burman 2017). It has also prompted a re-examination of the epistemic approach to difference and its political implications, particularly concerning the concept of multiculturalism (Blaser 2009; 2013), and called for greater attention to those processes that promote forms of ontological injustice (Wilson 2017) or within which ontological conflicts emerge (Burman 2017).

According to Burman (2017), an ontological conflict may involve either a discussion over the nature of reality, or the existence of a multiplicity of realities, which may come into a clash. Within this framework, the recognition of the existence of alternative «worlds» (as opposed to alternative worldviews), implies confronting differences (be they cultural, religious, and political) that cannot be negotiated on the basis of their reference to a common, objective, and external reality against which they would somehow be commensurable. In particular, the burgeoning interest in ontological issues is evident in the postcolonial debate surrounding the notion of colonialidad (Quijano 2000) and in discussions within political ecology regarding the nature and po-

tential solutions to the ecological crisis (Leff 2012). This interest relates both to the role of the 'other' (human and non-human) and its governance through processes of othering inherent in capitalist development (Armiero 2021), as well as to how reality is brought into existence within the practices and methods of elaborating knowledge of environmental problems. The conflict is about the nature of socio-environmental relations, not about different perspectives or cultural (mis)representations of these relations (Escobar 2007; Burman 20017).

The contribution of the Science and Technology Studies debate has also been crucial in relativising and historicising the specific ontology that underpinned the process of modernity and its self-representation. By questioning the separation between nature and culture as a distinctive feature of modernity, the ontological perspective not only relativises and historicises this separation, but also reveals how it functioned to establish political hierarchies based on a biased distinction between the modern and pre-modern, logical and irrational, scientific and cultura (Latour 2012). At the same time, this debate has highlighted the ontological specificity of knowledge and processes of signification as situated practices of relations, management and intervention in the world (Mol 1999). Within this framework, it is the particular political significance, or ontological politics, of science as a process of bringing versions of the world 'into existence' that is brought to attention (Mol, Law 2006, p. 19).

These considerations suggest the relevance of integrating a focus on political ontology – understood as the «power differences that exist between different worldviews in global politics» (Wilson 2017, p. 1083) – with an analysis of the different forms of reality production at play in scientific and innovation processes. Such questions are particularly relevant in the current context, marked by the historical conjuncture of the experience of the climate and environmental crisis, which mobilizes socio-political processes operating at the very frontiers of the historical relationship between society and «nature». This relationship and its constitution become the subject of an ontological politics with far-reaching implications (Fraser 2014; Pellizzoni 2023).

In this context, the bio-economy paradigm offers a valuable vantage point for exploring these processes. Also referred to as knowledge-based bioeconomy, it represents a field of development of the knowledge-based economy (Ahmed 2018; Birch 2022)

that focuses on the opportunities offered by the application of genetic engineering and bioengineering techniques across various production and research sectors (OECD 2006). Promoted since the early 2000s by the European Union and the United States (European Commission 2012; The White House 2012) to foster a gradual decarbonisation of the industrial and agro-industrial sector (see also Vivien *et al*. 2019 for a discussion on the term), the bioeconomy has, however, in a short period of time, evolved from designating a model of industrial exploitation centred on biomaterials and the use of alternative sources, to prefiguring a development model capable of combining the revival of economic growth and the response to the multiple challenges of our century, from food security to climate change (Goven, Pavone 2015; Cooper 2011; Benegiamo 2021).

Thus, if on the one hand, the bioeconomy represents an evolution of the technoscientific paradigm with the aim of innovation-driven economic development, on the other hand, it reframes the issue of the ecological (environmental and climate) crisis and its overcoming as goals of economic growth, rather than prerequisites. Accordingly, it has been stressed how bioeconomy aligns with the main assumptions of the neoliberal green economy and fits into the ongoing process of the neo-liberalisation of nature, which has seen the gradual incorporation of environmental governance practices into financial and market mechanisms (Castree 2008, Benegiamo 2021). At the same time, it participates in so-called biocapitalism, characterised by the progressive assimilation of the ontology of economic growth with that of the evolution of biological systems, resulting from the strategic interaction between neoliberal theories and the life sciences (Cooper 2011).

3. *Engineering our socio-ecological limits: the gene drive experiment and the Target Malaria project*

Gene drives, their uses, and implications, can be taken as an example of how the intersection between nature, technoscience and societal challenges is articulated today in the context of the neoliberal knowledge economy, particularly in its bioeconomy form. They also allow us to focus on certain aspects of the governance of innovation related to these processes, showing how the issue

of inclusion and responsibility meets the ontological question on a conflictual level.

The expression *engineered gene drive* refers to a technology for editing the inherited transferred genome that has the potential to irreversibly alter the genetic traits of a given species in nature (for a thorough analysis of this technology, see AA.VV. 2019). Modifications based on gene drive are considered particularly innovative from the point of view of biotechnological progress, as they would make it possible to overcome the limits of natural selection, which typically prevent harmful traits – such as sterility – from becoming fixed within a population. It is precisely such variations that are of interest in the production of «modified gene drive organisms» (GDOs) and their potential applications. The latter are foreseen primarily in the field of industrial agriculture and environmental conservation to trigger extinction processes of invasive species or pests that have become increasingly resistant to industrial pesticides (*ibidem*, pp. 72-124).

Unlike earlier forms of Genetically Modified Organisms (GMOs), which retain their modifications and rarely pass them on, GDOs derive their efficacy precisely from their ability to spread through a given ecosystem, contaminating specimens of the same species, and increasing the likelihood that the induced variation will be inherited by the future generations. It also means that, in the planned case of their market use, it will no longer be the seed that will be sold or patented, but the living animal organisms that carry the genetic modification within themselves. This shift in emphasis from the properties of an organism to its role as a vector also shifts the focus to the ecosystem in which the organism lives and moves, as it is within this environment that GDOs bring about the changes for which they are intended. If even GMOs ended up having an effect on the ecosystem in which they were applied, in the case of GDOs this impact is not an indirect consequence; it operates as an intended effect. As Maya Montenegro de Wit (2019) pointed out, the possibility of driving genes through wild populations opens up a specific – and innovative – field of agro-ecosystem engineering. Relatedly, and no less importantly, because organisms bearing gene drive technology are designed to modify other wild organisms in their living context, ecosystem modification itself becomes a field of experimentation: «the laboratory moves into the environment» even more so than with previous technologies (Simon *et al.* 2018).

The idea of using gene drives to suppress or modify entire populations, especially those considered to be pests, through genetic control methods and strategies is not new. However, the development of the CRISPR-Cas9 editing technique in 2012 has led to a significant increase in the number of gene drive experiments and the interest they generate. Additionally, the concept of the knowledge-based economy has become a crucial factor in driving research investments. In this context, the knowledge embedded in a product is regarded as an added value, with its marketability ensured through intellectual property patents and licensing systems (Birch, Tyfield 2013). This environment has fostered a tendency to exaggerate the future expendability and fields of application of the technologies being tested.

The phenomenon of techno-scientific *hype*, for marketing reasons or to secure research funding, is a well-known process (Fisher 2020; Pollock, Williams 2010, van Lente *et al.* 2013) that also plays a role in the context of gene drive technology (AA. VV. 2019, pp. 165-175), where the relationship between efficacy, convenience and risk (in particular for the environment and human health) remains uncertain (AA.VV. 2019; Cisnetto, Barlow 2020). Despite this, and despite the existence of unresolved ethical and moral concerns, gene drive technology has been placed at the forefront of various policy strategies. Consequently, numerous experimental projects have already released, or plan to release, GDOs into the environment, many of them with highly unsuccessful results (AA.VV. 2019, pp. 72-124).

Among the various ongoing experiments, one of the projects attracting most attention is the Target Malaria programme[1] , led by a research consortium operating in four sub-Saharan African countries: Burkina Faso, Mali, Uganda, and Ghana. The project is promoted by a research team from Imperial College London (UK) and has received major funding from the Bill & Melinda Gates Foundation (Grant Number: OPP1141988), the Open Philanthropy Project (a donor-advised investment fund of the Silicon Valley Community Foundation) and the US Department of Defence's research and development agency (US Defence Advanced Research Projects Agency, DARPA) responsible for the development of emerging technologies for military use. The stated aim of the Target Malaria project is to eradicate the spread of

[1] Project website available at https://targetmalaria.org. Last accessed 28 June 2021.

this disease: an infection caused by a bacterium transmitted by a specific group of mosquitoes, the female *Anopheles* mosquito.

The two foundations mentioned are major exponents of contemporary *philanthrocapitalism.* This term, popularised in 2006 by «The Economist» newspaper (2006), refers to a dual process: *i*) the growing role of private sector actors, in particular the new generation of billionaires and their powerful grant-making foundations, in addressing global social and environmental challenges; and *ii*) the push for philanthropy to operate more like for-profit markets, with investors and social returns (Bishop, Green 2015; McGoey 2012). The presence of the US Department of Defence, on the other hand, testifies to the dual-use research approach aimed at developing technologies with civil purposes but potential military applications, which has characterised the evolution of the technoscience sector and its funding since the 1990s (Molas-Gallart, Sinclair 1999), with a focus on specific areas including bioengineering and biosecurity (Cooper 2011).

According to data from the World Health Organisation, the incidence of malaria infection is endemic in many African countries and mortality rates are increasing, especially among children under 5 years of age (WHO 2019). The extensive use of pesticides, particularly since the early 1960s, as a method of controlling infection has resulted in progressive resistance in mosquitoes. As a result, there is increasing emphasis on the development of new tools and approaches to control the infection (Raghavendra *et al.* 2011), including the modification of the vector species at the source of infection through the release of genetically modified mosquitoes to achieve population suppression or replacement.

4. *Peasant movements in gene drive controversy in Burkina Faso and the agroecological critique*

On 1 July 2018, following approval by Burkina Faso's *National Biosafety Agency*, the Target Malaria project started the first release of 6,400 sterile male Anopheles mosquitoes in the village of Bana (Barry *et al.* 2020). The chosen city is in the province of Bobo-Dioulasso, the country's second largest city, where Target Malaria has been collaborating with *the Institut de Recherche en Sciences de la Santé* (IRSS) since 2012. However, a month before the release a protest demonstration organised

by the Collectif Citoyen pour l'Agro-Écologie (CCAE), attended by more than a thousand people including citizens, researchers, farmers, and activists from Burkinabé and neighbouring countries, was held in the capital, Ouagadougou, against this decision (Rfi 2018; see also Douce 2018).

The CCAE is an organisation that brings together farmers' organisations, grassroots unions, associations, and other civil society actors. It was founded in 2015, following protests against genetic experiments on Bt Cotton (*Bacillus thuringiensis*) carried out by the Monsanto group in collaboration with the Burkinabe government. The latter is a genetically modified variety of cotton that contains toxins that repel certain types of pests and was introduced in Burkina Faso in 2008 as a solution to boost the country's agricultural production (Luna, Dowd-Uribe 2020). Burkina was also the first country in West Africa to approve the use of this technology in the field, encouraging its adoption by a large number of smallholder farmers (Dowd-Uribe, Bingen 2011). Eight years later, however, the government itself declared its abandonment: the decline in production, the low quality of the final raw material and other critical issues, not least the ones related to the seed purchase and sale agreements between companies, the government and the farmers (Dowd-Uribe 2014; Luna 2020) have seriously undermined the local economy and created deep cycles of indebtedness among farmers (Luna 2020).

Three years later, many of the participants in that debate found themselves discussing the introduction of another genetic technology, the engineered *gene drives mosquitos.* The joint involvement of activists in both protests is not solely a product of immediate local political dynamics, it also reflects deeper structural dimensions, positioning the global peasant agroecology movement as a key player in critiquing techno-fixes and market-driven solutions imposed on nature but also has more structural dimensions that see the global peasant agroecology movement as a key voice in critiquing techno-fixes and market-driven solutions applied to nature (Altieri *et al*. 2017). This is also evident in the collaboration in the Target Malaria diatribe between local movements and think tanks and international associations that are themselves engaged in the debate on agricultural transformations, the impact of new technologies and agroecological and food sovereignty alternatives, such as the ETC group (ETC 2018).

Within this framework, we can identify three main macro-level critiques of the Target Malaria programme, and more generally of gene drive technologies, by the opposition movement. The first has to do with denouncing the colonial assumptions that underpin scientific research in the racialised contexts of the Global South (see for instance, Demart 2014) and how this impacts the participatory processes, or lack thereof. In particular, despite the recognition that indigenous and local communities are key actors in research, governance and decision-making on synthetic biology and the testing and use of engineered gene drives in their territories (IUCN 2019) their participation remains problematic. Regarding the Target Malaria programme, the protest movement blames the lack of a truly participatory and horizontal process, denouncing opaque communication and non-inclusive and non-exhaustive consultation processes (Douce 2018; see also Moolo 2018; Moolo 2018b). They therefore call for greater recognition of the rights of project participants who are being used as a test for this technology.

Furthermore, again with regard to the involvement of the local population, serious ethical questions have also been raised. The African Centre for Biodiversity (ACB) – a research and advocacy organisation working for food sovereignty and agroecology in Africa – writes that the project in Burkina Faso involves exposing study participants to mosquito bites for financial reward, with the possibility of contracting malaria or another vector-borne disease (mosquito) during data collection (ACB 2018). Such dynamics recall what Melinda Cooper and Chaterine Walby (2014) denounce as a disguised form of bio-labour exploitation not recognised as such. However, they are even more problematic in contexts characterised by extreme poverty and asymmetry of access to information, which structure the participation of much of the local population in the experiment. In this context, the opposition movement highlights how the use of African people as test subjects for a technology intended for universal application is reminiscent of racist and neocolonial practices of the past (ACB 2018; see also Fish *et al.* 2021 for a debate on the persistence of such approaches).

A second type of criticism concerns the potential risks to human health and the potential impacts on ecosystems and food chains from the unintended effects arising from the experiment. In particular, harmful effects may arise from the movement

of genes or the escape of organisms carrying engineered gene drives, with consequences for non-target populations or species; changes in the ecological roles played by target organisms, with spatio-temporal effects that cannot be predicted for the next generation; reduced immune coverage of the human population, with the risk of being exposed to new waves of disease in the future. Concerns that are also echoed in various research papers carried out by the academic community (see e.g. Cisnetto, Barlow 2020; IUCN 2019, National Academies of Sciences Engineering 2016) which has also questioned the effectiveness of experiments conducted to date (Gene Watch UK *et al.* 2019).

To these critical issues are added cultural elements (birds feeding on mosquitoes are a ceremonial food in many local traditions) and ethical-moral elements linked to the irreversibility of the experiment and the manipulation of life. Finally, at the level of political choices, what is contested is the funding of a capital-intensive genetic technology, instead of the promotion of public health policies and the funding of alternative remedies, some of which have already been tried locally (Hilou *et al*. 2006). This, is argued, would create a risk of moral hazard by reducing the urgency to implement other available solutions or to address the structural conditions of the problem, including the defence of human rights, the fight against poverty, and the securing of land rights and access to resources for the local communities.

These observations were also gathered in a request for a moratorium[2] issued in October 2018 and signed by more than 200 farmers' organisations, for food sovereignty and the right to food, active regionally and transnationally, and undersigned by researchers, activists, and influential figures in the global debate on food, agriculture, and nutrition, including former and current UN Special Rapporteurs on the right to food. The following year, on May 24, 2019, some of the representatives of these organisations, and leaders of the movement in Burkina Faso, met

[2] *A Call to Protect Food Systems from Genetic Extinction Technology: The Global Food and Agriculture Movement Says NO to Release of Gene Drives*; Available at https://www.etcgroup.org/sites/www.etcgroup.org/files/files/etc_ftfsignonletter113018engweb_1.pdf, last accessed 28 June 2021. See also the accompanying report: ETC, 2018. This campaign led to the approval of a moratorium regarding the governance of *gene drives* at the Conference of the Parties to the United Nations Convention on Biological Diversity held in Sharm El-Sheikh on 17-29 November 2018 (CBD/COP/DEC/14/1930 November2018, available at https://www.cbd.int/doc/decisions/cop-14/cop-14-dec-19-en.pdf).

in Bern, Switzerland, at an international symposium (the Gene Drive Symposium)[3] that brought together scientists, experts, and various civil society actors to discuss the main scientific, ethical, socio-economic, and regulatory issues related to the use of gene drives in nature.

Against this backdrop, the more specific agro-ecological critique of the project also focuses on the economic interests associated with this technology, particularly in the agri-food sector. It highlights the attempt to experiment with a solution that aims to reinforce the agro-industrial logic, making farmers dependent on uncontrollable technologies that would deprive them of the autonomy to rely on their own inputs and specialised scientific knowledge. Although disguised as sustainable solutions, offering the possibility of replacing the use of highly harmful agrochemicals, it would still be a matter of applying an approach based on domination, standardisation, and abstraction from local agro-ecological specificities and the people who work there:

> Naming wild organisms as «pests» or «weeds» and then modifying them to exterminate them is an approach that fits firmly into the simplistic paradigm of industrial monoculture farming. Instead of defining these elements of the farm landscape as an enemy to be vanquished with chemical or genetic weapons, agroecological practitioners, such as peasant and indigenous communities, instead work with the diversity of plants and insects that occur in a farmer's field to create locally specific management strategies (ETC 2018, p. 29).

In this regard, it is worth quoting a phrase uttered by one of the representatives of the protest in Burkina Faso, whom I have had the opportunity to meet on several occasions. The first time we met was in 2019, in Paris, at a round table organised by the Confédération paysanne, a French agricultural trade union movement close to the values and proposal of la Via Campesina, claiming for the de-commodifying and de-industrialising of food and food systems and promoting agroecological solutions. At a certain point, the discussion turned to a statement made by one of the people in the audience. He suggested that gene drives – and in particular their application in agriculture – would lead to the «sedimentation in nature of the logic of the agro-industrial model», thereby rendering «impossible and meaningless any

[3] Conference website https://genedrives.ch/wp-content/uploads/2019/02/Flyer_en_web.pdf, last accessed 28 June 2021.

alternative proposal based on agro-ecological principles and the preservation of biodiversity».

I met the same person again, later in Bern, at the aforementioned conference. A researcher from the MIT Institute, one of the leading developers of gene drive technology, had been invited on stage to speak. Faced with the objections from the audience, the scientist acknowledged the hype effect inherent in gene drives, and the need for the precautionary principle and the involvement of local communities in ongoing projects[4]. However, he argued that the philanthropic interest (curing malaria) justified the experimental approach. At this point, the leader of the Burkinabé movement took the floor and, addressing him, said, among other things: «even if you are interested in Africa's problems, what worries us is the world you are leaving behind»[5].

This exchange highlighted a debate marked by significant incommunicability, the resolution of which cannot be reduced to recomposing alternative interests and worldviews acting upon the same reality. Rather, it requires acknowledging how different possible realities are envisaged, grounded in forms of engagement with materiality that can lead to distinct physical, social, and ecological outcomes. In the light of all this, the question of irreversibility becomes even more significant, and it is no coincidence that the ETC Group uses the comparison with the nuclear bomb, speaking of a «gene bomb» (ETC 2016). What this image evokes is not so much the catastrophic potential of such instruments, but the fact that they configure new worlds and new ways of being in the world from which there is no turning back.

[4] See also https://wyss.harvard.edu/news/safeguarding-gene-drives/, last accessed 28 June 2021.

[5] He also added that malaria management is not a technical hurdle, but a matter of geopolitical and ecological relationships. Geopolitical because malaria data do not map the incidence of the disease in Africa, but reflect the demand for development aid and would be vitiated by this demand; ecological because malaria can only be cured by restoring the environment in which we live and which has been progressively degraded.

5. *Situating ontology in the gene drive controversy: agroecology, sustainable science and philantrocapitalism*

The issues raised in relation to the Target Malaria project and the associated technology experimentation demonstrate the complexity of the decision-making and evaluation processes at play and the multiplicity of dimensions involved, as illustrated by the idea of *post-normal science*. They also confirm the importance of a systemic and inclusive approach, to evaluate the sustainability of this technoscientific innovation and connected policies. In this sense, a research program explicitly intended to anticipate and address the ethical, legal, and social implications and aspects of emerging sciences is a valuable and important contribution to making the processes underlying innovations involving gene drives more accountable in terms of the actors involved, the impacts and the goals set.

However, the conflict that has arisen over the prospect of releasing genetically modified mosquitoes into the environment also reveals the existence of more radical issues, posed by Burkinabé civil society, and transnational organisations to this technology. These issues have to do with the concrete and material ways in which the reality of malaria but more generally, of society-environment regulation, emerges within specific ways of knowing and practising reality, and with alternative ways of making alternative realities emerge. In order to better understand all this, it is useful to consider the context in which the demands of civil society actors have been articulated, and, in particular, the role of movements and debates revolving around the critique of industrial agriculture and the regimes of power that support it.

In Burkina Faso, as we have seen, it is above all the failed experience of the Monsanto group with the GMO BT cotton experiment that has strengthened an oppositional movement around the question of the use of biotechnology in economic development paths. Beyond the simplification or possible instrumentalisation that the national and international movement may have made of the local problem (Luna 2020), what is important to note in this context is how the reference to the notion of agroecology testifies to the presence of realities that move within a global debate on how to understand and repair the «rift» between society and nature (Holt-Giménez, Altieri 2013; Wezel *et al.* 2009). It is a perspective that has emerged strongly in

the context of rural and agrarian movements that share an idea of the food system in line with the food sovereignty paradigm (Edelman *et al.* 2014).

In this context, agroecology reflects a radically different approach to food production from the idea that market principles can be applied to ecological and environmental management. In contrast to an agriculture that must also and simultaneously strengthen the role of the market and increase profits, agroecology is an approach that thinks about the possibilities of achieving food security in a way that also promotes the values of participation, justice, democracy, ecological sustainability, and public health. In this sense, it is an alternative paradigm not only of agriculture, but also of society, where modes of production and related practices are also productive of completely different social and relational realities.

As Samantha Noll (2020) writes, these movements rely on particular ontologies to support their claims for justice and to align their goals with them. In this context, food and land, for example, are different from an interchangeable commodity whose supply and purchase we need to increase, just as they are different from an economic resource whose exploitation and ownership interest we need to maximise. Food, for example, in its co-participation in issues related to identity, culture, place and political action, refers to an idea of oneself as connected with the local context and territory, which also implies an extension of the politics and responsibility of science to multiple dimensions of justice (redistributive and inclusive, but also environmental, intergenerational, interspecies, reparative, etc.). Land, on the other hand, is constitutive of a holistic notion of health, which hardly responds to abstraction processes such as those conveyed by the idea of market exchange (McMichael 2014, p. 51).

In the light of these considerations, we can better understand the continuity between these mobilisations and the more specific issue of gene drives. It emerges how the framing of the Target Malaria project in the context of ecological, rural and peasant movements is articulated as a struggle over what there is, rather than just what to do with what there is. In this context, the agroecological critique of the agro-industrial (eco)system and the use of gene drive solutions in this sector serve as a proxy to highlight a controversy that revolves around how different realities are created, reproduced, or rendered impracticable by a given

techno-scientific innovation and its application. This perspective aligns with the understanding that agro-industrial systems are a central component of capitalist ecological regimes, which represent the historical process of organising nature through capitalism and capitalism through nature (Moore 2010). Following Marx's analysis of the power of abstract logics of capital valorisation to operate as a concrete force capable of producing reality (Toscano 2008), capitalist agricultural system do not merely act upon the world – it actively constructs it in specific socio-ecological ways. It is therefore no coincidence that ontological questions arise as central concerns in the critical debate on the dominant agricultural system and its alternatives. In the words of McMichael (2014):

> The food-land sovereignty movements represent a Polanyian countermovement with a difference-whereas Polany's double movement problematic concerned protection against the market, the twenty-first century countermovement concerns protection against the reduction of life (habitats, food, natural cycles) to «biovalues» [...]. Whereas the earlier countermovement was oriented towards public regulation of markets, the recent countermovement is oriented towards a civilisational goal of regulation of social life by eco-logical principles. This is the ontological difference. [...] where counter movements were concerned with labour, gender, and civil rights in the modern state. Today's counter movements, drawing on this legacy, refocus on more fundamental historical questions of living sustainably on Earth (p. 50)

As Gianpietro (2023) underlines, these issues are particularly relevant for sustainability science, which, on the one hand, has to manage the coexistence of multiple levels and dimensions of analysis and, on the other hand, is confronted with the persistence of cognitive paradigms in which the choice of ontologies is made at a pre-analytical stage that does not allow them to be questioned. In this context, the illusions of progress and technological mastery (Giampietro 2023), and their dominant role in the ontologies of Western modernity, seem to leave little room for addressing the challenges posed by climate change and the effects of the capitalist model of development «including overconsumption, extractivism, and global socio-ecological inequalities and injustices» (Ramcilovic-Suominen *et al.* 2022, quoted in Giampietro 2023).

These «westeocentric» illusions (Leff 2021; San Román, Molinero-Gerbeau 2023) continue to underpin new techno-scientific trajectories of development based on innovative ways of extracting

value from nature. They also permeate what Luigi Pellizzoni (2016) describes as a new ontological politics conveyed by these processes, which understand life as fully modulable, fundamentally hybrid and totally adaptable to the needs of the market. This approach serves to reinforce a capitalist system attempting to renegotiate its ecological limits by bending nature to its needs, leaving little room for alternative ecologies to emerge. Within this framework, the ongoing engineering of nature reaffirms a dualistic logic of domination over the environment, shaping socio-ecological relations and forms of life in turn. These dynamics are also intuitive in the specific technology in consideration, where the proposed innovation has as its main commercial applications precisely the overcoming of the ecological limits of current production models, from the role of resistance to chemical pesticides in agriculture, to the conservation of species threatened by climate change, to the eradication of species that have become invasive in urban contexts or as a result of altered ecological conditions.

These processes bring to light an ontological dimension of politics that extends beyond the material structures within which social action is configured or reconfigured. They also encompass the ways and forms in which reality and its conditions of possibility are produced on the basis of practices and policies that make other ways of existing and relating to the non-human, but also of «being human», impracticable. As denounced by protest related to the Target Malaria project, the gene drive experiment implies not only a particular attention to socio-environmental risk and its distribution among different segments of the population and the necessity to reinforce local participation and awareness on the experiment. It also demands to be questioned in terms of the different forms of imagining desirable transition scenarios that compete on the terrain of development, and the ways in which these are opposed to specific capitalist and market ontologies. These are in many ways «futures» that are mutually and materially exclusive, and which cannot be separated from an analysis of the political ecology in which the specific ontologies emerge, meet or clash. This analysis encompasses the role of the non-human and touches on broader questions of human ontology – specifically, «who we become when we use and alter animals in certain ways» (de Graeff *et al.* 2019, p. 9).

All of this confirms the importance of reflecting on ontological stances in research practices. It also raises the question of

how these stances contribute to shaping the assumptions for the governance of society and the boundaries between innovation, the environment and, in this case, public policy (on health, but also agriculture and environmental protection). Indeed, in the context of the Target Malaria experiment, the production of new nature, shaped by commercial logics, takes place within a framework that tends to replace public policies with the logic of philanthrocapitalism. The former correspond to a democratic order that acknowledges the existence of a society that ontologically pre-exists individuals, enabling their emergence and linking their well-being to principles of equality, participation, redistribution, and mutual responsibility. In contrast, philantrocapitalism, advocates for the strategic application of market methods and motivations for philanthropic purposes (Haydon *et al*. 2019). This approach is based on the (neo)liberal assumption of the naturality of market logics, positing the idea of a total (ontological) overlap between the pursuit of profit and the general well-being of society (Ramdas 2011).

While these aspects run through the entire critical and civil society debate on the implications of «*phylantrocapitalist* gene drives» in nature, this article argues that their analysis must also encompass the ontological stances that make reality manipulable in one way or another, as well as the ontological transformations that this reality undertakes, or does not undertake in the current context of development. It is in this sense that ontology can become purely *political,* according to Mario Blaser's interpretation (2009; 2013), i.e. it is possible to move from the simple recognition of an *ontological multiplicity* (a more 'sophisticated' version of the multiculturalist epistemological approach) to the analysis of the dynamics through which the different ways of «making the world» (worlding), support, interact or hinder each other.

6. *Conclusions*

Through the lens of ontological politics*,* this article has argued the interest of thinking of the governance of science not or not only as a problem of inclusion between different instances, but as a socio-material process, where the conflict is also located at the level of the modes and forms that this socio-materiality takes and how it is produced and practised, including a reflection that

holds together the historical, political and material dimensions in which current techno-scientific paradigms emerge.

The article moved from the observation that, despite a growing interest and willingness to engage with civil society actors, the debate on techno-science assessment methods and procedures tends to focus mainly on the added value that a plural approach to different perspectives and interests brings to the innovation process and its alignment with established social goals. However, rather than creating space for alternative ontologies, a purely epistemological reading of the conflicts and tensions related to techno-scientific innovations runs the risk of further entrenching the ontological assumptions within which current development paradigms operate.

In this regard, the shift from an epistemological approach to an ontological view of politics, and of the politics of science in particular, is particularly relevant in the field of bio-economics. Here, in fact, the tension between economic growth and the ecological limits of capitalist development, in the current trajectories that interweave technoscience, social challenges and innovation, draws a field of action that directly questions the very materiality of social structures. In this context, the processes of neo liberalisation of nature play a relevant role, competing with alternative reflections on the nature of society and of socio-ecological limits, as the case study examined shows. An ontological politics perspective is thus essential not only for understanding the «alternative realities» that clash in specific innovation contexts but also for comprehending the dominant ontology from which these alternatives are perceived and addressed – or dismissed.

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The Target Malaria project and the gene drive experiment: for an ontological politics of the neoliberal bioeconomy and its controversies

Ontological controversies represent a central issue for assessing the sustainability of technoscientific innovation and the policies that rely on them to address specific socio-ecological criticalities. Moving from this hypothesis, this article

inquiries the relevance of an ontological politics perspective to understand conflicts and controversies in innovation policies that affect the relationship between society and the environment, such as those related to the bioeconomy paradigm. The article analyses a case study of an opposition movement that arose in Burkina Faso in response to the experiments conducted by the Target Malaria project and focused on the use of an emerging genetic technology, namely engineered gene drives. It shows how the social tensions and conflicts generated around this technology can best be understood in terms of divergent positions on the ontological nature of society-environment relations and the ways in which alternative realities are created or rendered impracticable by technoscientific innovation and their application. This includes and broadens the question of the inclusion of different visions, interests and perceptions of risk in the politics of innovation and requires that both the epistemic and ontological character of innovation processes be addressed responsibly. Additionally, the article elucidates how, in the context of neoliberal bioeconomy, «philanthrocapitalist» programmes that assume certain views of reality and of the human welfare are in fact ontological politics with far reaching implications.

Keywords: Sustainable science, Bill & Melinda Gates Foundation, Technoscience, Ecological crisis, Agroecology movement, Philanthrocapitalism.

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This research was conducted with the support of the FMSH-Gerda Henkel Stiftung Research Grant 2018. The publication process is further funded by the University of Pisa under the Research Project «Global Crisis, Democracy, and Socio-Ecological Transition» (PRA – University Research Projects).