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Coop-Science: A Horizontal More Inclusive Approach to Citizen Science for Rural Communities in Kenya

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Abstract

Citizen science aims to engage citizens in research projects to address everyday problems. However, it should not be assumed that citizen science promotes public participation per se. To bridge the gap between citizens and science, deliberate effort needs to be made. For example, finding ways to support citizens who have an interest in public participation but live under social and cultural conditions that constrain their ability to engage in science. We are interested in exploring how to tackle these inequalities in public knowledge co-creation. Thus, we propose an alternative to citizen science, thinking in terms of collectives, in particular cooperatives, instead of individuals/citizens. Engaging cooperatives in science could help expand our understanding of the collective dimension's power in solving real-life problems. We refer to this approach as *coop-science*. It could be argued that when cooperatives are involved in science as a collective process, people see the advantages of working collectively to achieve scientific outcomes whilst caring for the common good. In times of polycrisis, particularly in the Global South where the consequences are devastating, cooperatives have the potential, we argue, to resist and flourish. Thus, we explore how *coop-science* can be articulated and implemented as an alternative to Western, more individualistic approaches to citizen science.

Keywords Cooperative-science · Education · Inequalities · Epistemic contribution · Development

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Introduction

Acknowledging the difficulty of defining citizen science (Haklay et al. 2021: 1) as it resists 'obeying a limited set of definitions and instead it attracts discussions about what type of activities and practices should be included', we argue that one way of thinking about citizen science that might be flexible is as 'a diverse approach to scientific research that comprises a variety of actors and practices … and involves both citizens and professional researchers in numerous possible constellations' (Vohland et al. 2019: 1). Thus, citizen science involves different epistemic practices enabling the generation of scientific knowledge by anyone with an interest in doing so, or at least so we are told. However, as Pelacho et al. (2021: 2) and many others (cf. Hayes et al. 2024) argue, participation alone does not assure knowledge production, and this is a problem, 'an epistemological challenge', not only for citizen science, but also for society and development. This begs more political questions concerning who can produce legitimate knowledge, who decides what legitimate is, how is it valued, and by whom? Moreover, what kind of science and thus knowledge and what kind of society does a particular mode of citizen science produce?

Jandrić et al. (2023) argue that, in many citizen science initiatives, participants are from an advantaged socio-economic background and thus highly educated. Strasser et al. (2018) note the same, adding race and gender to the mix. That is, participants in science projects are predominantly well-educated young white men. This poses a considerable equity and inclusion challenge, as argued also by Pelacho et al. (2021), given that public participation in science needs to address people from all walks of life, if the aim is for more egalitarian epistemic and social practices. In addition, people with little or no previous experience in science must not be excluded from contributing to the production of scientific knowledge. The consequence of the systemic inequality embedded in top-down short-term projects is that they neglect a large section of the interested population, thereby denying them the capability to engage meaningfully in scientific and technological development, a point stressed by Fricker (2015) who argues for epistemic contribution to be considered a central human capability. Capability is understood in Sen's (1999) terms, whereby it is not just about having the desired capacities, for it also pertains to the existence of the social conditions necessary to achieve the valued goal of people, in this particular case, that of engaging in scientific and technological development. Moreover, participating in science is considered a human right as stated in the Article 27 of the Universal Declaration of Human Rights (1948): 'Everyone has the right to participate freely in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits.' An active participation should be prioritised over being passive beneficiaries of advances made by professional scientists (Vayena and Tasioulas 2016).

Herzog and Lepenies (2022) and different contributing authors to Jopling et al.'s (2024) collective piece (cf. Stewart; Orchard; Suoranta) contend that citizen science projects need to move towards a more empowered approach; one

where citizens not only collect data, but also participate more broadly in other stages of the research, e.g. setting the aims and goals and envisioning more meaningful ways to disseminate the implications of the study. But also, we argue, having access to improve different dimensions of their scientific literacy. In this respect, Irwin's work (1995) illustrates this idea by conveying a dual relationship between science and citizens. On the one hand, citizen science is a science that serves (or at least it should) citizens' interests, whilst on the other, it is performed by citizens. In short, 'science for the people and science by the people' (Irwin 1995: 69). Interestingly, and still current, Irwin (1995) argued that what is critical for the second notion—science by the people—is to include local (e.g., indigenous and ancestral knowledge) and contextual knowledge (situated knowledge) produced by lay citizens when reflecting about technological risk and science policy. What tends to happen, particularly in data-intensive systems, is that lay people and marginal communities are not invited to the table where risks and harms are discussed (Eubanks 2018; Benjamin 2019; Constaza-Chock 2020; Buolamwini 2017). Liebenberg et al. (2021) and Stewart and Orchard (in Jopling et al. 2024) highlight that citizen science overlooks indigenous knowledge by ignoring 'who' does the science and 'how' it is done. Thus, they propose the term 'tracking science', instead of 'citizen science', as it would better characterise various knowledge practices. They argue that 'tracking science' captures the local knowledge of communities with land-based expertise not formally recognised in science, such as tracking weather or animal migration patterns. Trying to counter this exclusion, we cite a current and poignant example where a cooperative of Maasai women, who live in hard-to-reach communities and are illiterate (when it comes to reading and writing), put at play their land-based expertise to track different aspects of biodiversity loss in the Olerai Community Wildlife Conservancy in Kenya, reporting back to community leaders who have access to the science related to it (anecdotal example of Warui and Kimani, explained in more detail further in the paper).

Tolbert, another contributor to Jopling et al. (2024), contends that citizen science has fallen short of its democratising and participatory aims. Stewart, in the same piece, suggests that 'the words "citizen" and "science" are associated with histories of exclusion, including the exclusion of Indigenous people and their knowledge'. As a Māori Scholar, Stewart asks 'how Māori/Indigenous knowledge partakes in citizen science in the postdigital era'. She goes even further asking an important question, i.e., '[w]hat if a modifier like "citizen" affects and changes what is understood by "science"?' (we address this question further in the paper in the context of cooperatives). Orchard, who also contributes to the collective paper (Jopling et al. 2024), maintains that 'while citizen science proponents often point to the need for new approaches to address the scale and scope of contemporary challenges, there is equally a need to recognise and appreciate the wisdom of these earlier forms of knowledge' (referring to local knowledges). He argues that the development of traditional knowledge serves as a theoretical lens through which to understand the scope of public participation in the generation of knowledge.

The evidence presented so far led us to ask the question that inspired the next section.

What Do More Inclusive Alternatives Look Like?

Given the landscape described above, what alternatives could embrace a more horizontal distribution of power and an egalitarian and inclusive ethos to knowledge co-production? As Hayes et al. (2024) advocate, there are a myriad of challenges that need addressing through citizen science and citizen humanities, for which intersectional research between sectors and disciplines is essential. Primarily, we argue, the aim should be to include those who are living at the margins and excluded from generative epistemic practices (cf. Kuhn et al. 2023). The humanities play a critical role in bringing a broader understanding of the social, cultural, and ethical dimensions to the fore. For instance, an important contribution of the humanities to scientific research is the inclusion of issues like human rights, privacy, and fair treatment of participants, helping to develop ethical guidelines and frameworks that align with humanistic values (cf. Atenas et al. 2023). More recently, Oduro and Kneese (2024) have argued for the inclusion of sociotechnical analysis in Artificial Intelligence (AI) development. Humanities and social science methods, and know-how they argue, should be included in the development of standards and guidelines for AI assessment, research and development, and policy. Humanities and social science experts should be at the centre of hiring efforts aimed at tackling challenges and potential opportunities of AI systems, as well as ensuring that roles facilitating meaningful public participation are embedded in the overall ethos of these companies.

Aligned with, and contributing to these ideas of inclusivity and social justice, the work of Hsu and Nourbakhsh (2020) is noteworthy. They propose an alternative concept to citizen science, i.e., 'Community Citizen Science'. This approach embraces participatory democracy, community co-design, and power rebalance. The idea with co-designing is to develop systems with communities and/or advocacy groups, who are deeply grounded in local cultures and can bring an array of local expertise to inform the design. This approach also seeks to rebalance power by distributing decision-making amongst research participants, being it a scientist or a lay person. To achieve this, the authors propose a 'bottom-up multiparity structure, where community members are the initiators of grassroots movements providing organisational networking and disseminating critical findings to influence policymaking' (Hsu and Nourbakhsh 2020: 32).

In short, communities are encouraged to be empowered to produce scientific knowledge by addressing their concerns and needs and advocating for meaningful impact, aligning research with local social issues. Other terms or frameworks are also emerging, e.g., 'Citizen Social Science' (CSS), which is more widely applied to social science research drawing on citizen science and using participatory research methods to address social challenges, such as housing and climate action, amongst others (Thomas et al. 2021).

When it comes to the use of technology for different tasks in citizen science projects, the work of Rrey-Mazón et al. (2018) at the Public Laboratory for Open Technology and Science—Public Lab—is poignant and pertinent. The authors propose the use of accessible, community-built technologies for acquiring data,

embedding collaborative open-source values into the tools, social formations, and data-sharing practices that emerge from the science project. In essence, they propose the development of collaborative design processes through material engagement with technology making sure that people participate in the social, political, and technological dimensions of the research process. This focus is particularly relevant considering the increasing centralisation and specialisation of scientific and technological expertise that makes it increasingly difficult for people to acquire/improve their digital capability (Kuhn 2022) and technical expertise.

From the literature reviewed so far, we can infer that there is an added value to science projects when we intersect them with the social sciences and humanities, as this contributes to the understanding of the human dimensions of citizen science and can 'open a broad methodological spectrum for enriching scientific research with new approaches that can boost public participation' (Tauginienė et al. 2020: 1). Social sciences and the humanities are also concerned with understanding better 'the motivation and learning processes of participants … to increase their self-efficiency, and the project outcomes and impacts' (Tauginienė et al. 2020: 9), thereby contributing to the sustainability of science, a problem that society is increasingly facing as noted by Pelacho et al. (2021). Given some of the big challenges we are confronting, e.g., the environmental crisis and biodiversity loss, at a time of exponential advancement of AI, social science, although we would say critical social science as it adds the political dimension to social science and humanities frameworks, can offer insights into the sociotechnical character of these challenges, as also noted by Hayes (in Jopling et al. 2024). By focusing on things like value and governance systems, these frameworks could foreground the human dimension so often overlooked by increasing technocratic and profit-oriented approaches. In short, if we aim to make citizen science more human-centred and sustainable, not only social sciences but critical social sciences and humanities have a role to play.

We want to explore one last approach to citizen science that is concerned with problems regarding the governance of science, particularly its sustainability and accessibility. Pelacho et al. (2021) are concerned with the co-production of knowledge in communities affected by environmental, health, and broader social issues and whose interests are not prioritised by those in power. This interest is aligned with ours. Pelacho et al. (2021) consider examples where certain industries appropriate traditional knowledge of communities so that they are excluded from access to knowledge or the use of knowledge that they generated. A poignant example is that of Monsanto (which has been acquired by Bayer in 2019), one of the four big agrochemical companies that control 60 percent of the global seeds market and 75 percent of the pesticides market, leading to a stranglehold on seed varieties, distribution, and prices (United Nations Human Rights 2022).

How did they get there? Indigenous and local resource-based communities have long used their ancestral and local knowledge (considered as a social common good) to shape ecosystems, provide food, and breed better crops and livestock; seed systems are essential to these practices. That local knowledge has not been recognised as scientific or valuable to the Western scientific community. Thus, it has been freely appropriated by others, like Monsanto at the time, who have the corporate machinery to build on that local and ancestral common knowledge, modify the seeds in the

lab, creating what is popularly called 'Terminator Seeds' (terminator is an eloquent metaphor that gives us some indicators about the kind of technology being implemented), patent them, and sell them to farmers, who then are forced to sign contracts that tie them to the ongoing use of those modified seeds. To tie farmers into this unethical business model, what they have done is through 'terminator technology' shut off the reproductive ability of the seeds, and thus, farmers must buy them every year paying exorbitant prices (United Nations Human Rights 2022). As Fakhri (2022: Para 1) sustains, 'because seeds are so central to people's culture and food systems, to control seeds is to control life'. Poignantly, Price (2022: 115) indicates how this shift 'changed not only the ecological practices of agriculture, but also social and political relations of power in the food system transferred from villages to global agricultural seed companies'. This example clearly illustrates how local seed cultivation practices can become inaccessible and unsustainable for local farmers when transformed by for-profit, unethical technologies, such as 'terminator technology'. These farmers, often unaware of these predatory practices, become victims of these neoliberal business models.

This is not the only problem regarding intellectual property and indigenous community-based knowledge, but it suffices to illustrate the point made by Pelacho et al. (2021). They are concerned on how to improve governance, accessibility, and sustainability of science through citizen science. To overcome the public–private dichotomy, they propose to understand and manage science as a 'commons'. The concept of the 'commons' is complex (cf. Dardot and Laval 2019 for its various meanings and historical evolution), but we limit its use in this section to science and knowledge as a common good. We will explore the commons further when discussing how relational goods emerge from cooperatives. Pelacho et al. (2021: 59) define the commons as a 'form of community management of a shared resource', arising from a collaborative, open, and experimental process that involves a community with a common interest. 'Good governance of the commons implies that the communities who share access and/or use of a resource manage their behaviour through self-established rules.' (Pelacho et al. 2021: 59) When the commons pertain to science, which is the interest of the authors, co-production is important. This principle of co-production ensures that anyone concerned about and with a stake in scientific and technological issues has a voice (Pelacho et al. 2021: 60). The inclusive nature of doing science entails a complex interplay between epistemic issues that concern the validity of knowledge (as we discussed earlier) and socio-political issues that question 'who can be considered legitimate and responsible agents of this production' (Pelacho et al. 2021: 60). This socio-political dimension has been overlooked in the questionable appropriation of indigenous seed system knowledge by big corporations (this is only one of many examples). In stark contrast, rural and indigenous communities view knowledge about seed systems as a commons—a social good that belongs to the community. Therefore, cultivated by the community and made accessible to all. Eloquently, the word commons stems from the Latin word *communis*, where *com* means coming together and *munis* means duty, obligations. Thus, the commons refers not only to the common ownership of the object/thing but also to the moral dimension, namely, the shared duty of people involved in a particular endeavour. For the latter, we argue, cooperatives are well suited.

In an increasingly complex world, where the environment continually threatens many aspects of people's social reality, collaboration in the production and reproduction of knowledge needs to involve a constellation of actors. As Pelacho et al. (2021) argue, including traditional knowledges, often overlooked, can provide innovative lines of inquiry and research. This knowledge can be combined with scientific knowledge to produce relevant contributions to science that are meaningful for both the scientific and local communities. The authors provide examples of good practice, where community-based methodologies contribute with data, local culture, stories, etc., demonstrating a generative combination of academic science with local knowledge. Next, we explore a different constellation of actors, i.e. cooperatives.

Cooperatives as a More Horizontal and Inclusive Constellation of Citizen Science

As Vohland et al. (2019: 1) suggest, citizen science entails a variety of actors and practices that 'involve both citizens and professional researchers in numerous possible constellations'. One such constellation, we argue, is a cooperative science, *coop-science* from now on. We have changed the modifier 'citizen' for 'cooperative'. This begs the question of how, if at all, cooperative modifies the word science. Stewart (in Jopling et al. 2024) has already touched on this noting (as we mentioned earlier in the paper) that '[s]uch two-word terms modify a strong knowledge noun (science is paradigmatic) with a "social" adjectival modifier -in this case, citizen- to create a conundrum, a philosophical puzzle'. But as this is a postdigital view on science, which includes the humanities and (critical) social sciences as suggested by Jandrić et al. (2023), we can shed light on the 'conundrum' that Stewart (in Jopling et al. 2024) poses by transcending the more formal understanding of science.

Let us begin by giving one of many definitions of cooperative. The International Cooperative Alliance (ICA: Para 3)[1] defines cooperative as 'an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly owned and democratically controlled enterprise'. In addition, cooperatives have a vital role to play in the implementation of the 2030 Agenda for Sustainable Development given their values and principles, as suggested by the Committee for the Promotion and Advancement of Cooperatives.[2] Cooperatives, through 'self-help and empowerment, reinvesting in their communities and concern for the well-being of people and the world … nurture a long-term vision for sustainable growth, social development, and environmental responsibility' (ICA: Para. 1).

Given that a conundrum is a question or problem that only has a conjectural answer, we conjecture that the term 'cooperative', based on its definition and associated web of meanings, modifies 'science' to suggest a less neoliberal and thus less competitive, utilitarian, and individualistic approach in favour of a

[1] See https://ica.coop. Accessed 5 March 2025.
[2] See https://www.copac.coop/2025-is-proclaimed-un-international-year-of-cooperatives/. Accessed 5 March 2025.

collective-oriented progress of real-life issues that entails a common-oriented social development. A conjecture is a statement that is believed to be true but not definitively proven; it typically emerges from observed patterns, intuition, and partial evidence, often driving further investigation that can lead to significant discoveries. We argue that our conjecture is valid based on the literature discussed so far and the anecdotal (for now) but powerful nevertheless evidence we will share in the next section, which will serve as primary partial evidence. This conjecture drives our further investigation, including the more conceptual approach explored in this paper.

We argue that in times of rising inequality, gender discrimination, multiple wars, environmental collapse, and food insecurity—all of which are interconnected and create a compounded effect known as a polycrisis (Morin 2024), it is particularly urgent and generative to engage cooperatives in addressing real-life communal problems, especially in the Global South. Thus, we want to explore how *coop-science* can be envisioned and articulated as an alternative constellation to more individualistic and utilitarian approaches to citizen science, and we believe that broadening the scope of the remit of citizen science to a postdigital citizen science, as suggested by Hayes et al.'s (2024) call for papers, is helpful. In addition, we argue that given cooperatives' values of self-help, solidarity, and empowerment, they have the potential to resist and flourish amid the current polycrisis. In a slightly different orientation than that of Stewart (in Jopling et al. 2024), we argue that *coop-science* can address some of the histories of exclusion associated with 'citizen' and 'science', including the marginalisation of indigenous and less scientific literate people. Our interest is in the Global South, particularly in Kenya, where women have a long-lasting tradition of working cooperatively and communally to address, amongst other things, gender injustices and inequalities, which are pressing and real problems for them. In addition, women compose almost half of the agricultural labour force in Sub-Saharan Africa (Adlam 2023).

We acknowledge the multifaceted nature of cooperatives encompassing interpersonal relationships, collective processes, and formal organisational structures. They can be understood more broadly as social relations that are built on trust, reciprocity, and mutual aid (Hruschka and Silk 2017). They can also be seen from a process-oriented perspective whereby they are dynamic systems that evolve over time through collective action. It highlights how cooperation is materialised and sustained through ongoing interaction and shared effort amongst their members (Rakopoulos 2020). Cooperatives can, in addition, be recognised as formal organisations with specific legal and organisational structures. This facet of cooperatives focuses on the formal rules, governance mechanisms, and institutional frameworks that define cooperatives as distinct entities within the broader economy.

One area that has received less attention in the literature of citizen science is the synergy between cooperatives, with all its complexity, and citizen critical social science/humanities. Some initiatives in Western Europe, such as the Data Cooperative and Personal Data (Hafen 2019), serve as an illustrative example. However, this initiative does not include active involvement of the cooperative in the research process. Instead, the cooperative acts as the mediator of people's personal health data. Citizens contribute by sharing their aggregated data with health scientists, but they

are not active participants in the science project as such. Rather, they are donors of data needed by health institutions to advance the agenda of personalised health services.

To understand cooperatives conceptually and explore its nature, we will use a relational lens (Donati and Archer 2015), as we consider them to be a particular form of social relation from which causal powers can emerge. Thus, we argue that cooperatives are a strong candidate to co-produce knowledge/science as a social common good. In so doing, they contribute, amongst other things, to the accessibility and sustainability of science, a problem described in the previous section, particularly in rural communities that live at the margin of educational opportunities. In addition, there is the potential to shift the power to the local community where the cooperative originates, as suggested by Hsu and Neubakhsh (2020). Furthermore, we explore the role that cooperatives can play in the implementation of the 2030 Agenda for Sustainable Development given their values and principles, as highlighted by the International Cooperative Alliance.[3] We uncover the role of cooperatives in zero poverty (SDG1), education (SDG4), gender equality (SDG5), decent work and economic growth (SDG8), and life on land (SDG10), thereby demonstrating the meaningful contribution cooperatives make to their members' livelihoods. Moreover, we argue that through *coop-science*, actors can reclaim their epistemic contribution to the common pool of knowledge, which is considered by Fricker (2015) a central human capability (capability as defined earlier). We explore existing *coop-science* initiatives, looking especially into the Kenyan context, as this is where our project unfolds. We delve into the potential of *coop-science* to contribute to solve problems concerning agriculture and food systems in rural and hard-to-reach communities.

This paper is part of our initial conceptualisation process of the different building blocks of a multi-stage impact project: 'Impact from the Ground'.[4] The project is being developed through purposeful effort to learn with and from the community. The overall project seeks to envision and reimagine the future of the dairy industry and the role of women and youth in that future, with community members of Kinangop and Ol Kalou, two rural communities in Nyandarua County, Kenya. As part of the project, we (two community leaders in Nyandarua—Warui and Kimani—and I) envision that the future will include learning new skills and co-producing new (local and technical) knowledge. This would entail not only bringing forth knowledge about the future, for once this future has been locally re-imagined it needs to be realised, which will require further knowledge co-creation and learning. We have already envisioned and articulated a learning framework—the Kitambaa—(tapestry in Kiswahili) that will guide the learning experiences of the participants (Kuhn et al. 2024). It is in the development of this epistemic practice and its ripple effects that we envision the potential of *coop-science*.

One could ask, why is yet another constellation needed? The answer is twofold, contextual and conceptual. In the context of Kenya, and especially in rural

[3] More information available from https://ica.coop/en/newsroom/news/cooperatives-and-policy-makers-recognise-value-mutual-collaboration-promote. Accessed 5 March 2025.

[4] You can find a description of the project here: https://AFA-K.org. Accessed 5 March 2025.

communities, there is a strong tradition of cooperatives in the subsistence farming sector. Whilst there are written records of cooperatives in Kenya dating from 1908 (Zeleza 1990), it is a fact that these constellations were the main way of social organisation in traditional pre-colonial Africa (Federici 2018, 2004; Adlam 2023). This aligns with the communal ethos and values that guide Africa more broadly (we will explain this further below). In general, co-operative organisation dates from ancient times, being the main configuration of rural communities to work on the land. Cooperation describes the mode of human development in a general historical sense as well as specific forms of togetherness and social interaction (Kropotkin 1987; Sennett 2013; Woodwin 2015). We explore the conceptual dimension in more depth in the next section.

The Relational Nature of Cooperatives and Why It Matters for Coop-Science

Conceptually, cooperatives have been recently examined from a sociological perspective (cf. Byrne 2022), but these examinations, Byrne argues, tend to fall into the ideal types of individualistic or collectivistic modernity (Donati and Archer 2015). In the former, the person is viewed as a bounded entity (Gergen 2011), and in the latter, the individual gets lost in a collective grey mass where their agency is somehow missing. An alternative to these two unhelpful perspectives is one which recognises the individual as a relational subject (Donati and Archer 2015) and where social reality is relational (Donati 2014). This is what Donati (2014) defines as relational sociology. Donati and Archer (2015) argue that, increasingly, people are realising that some goals can only be achieved through new forms of association and new social movements. There are many facets to include when defining cooperatives as we suggested earlier, e.g. as institutions (cf. Vargas-Cetina 2005), as social movement (cf. Maeckelbergh 2012; Rakopoulus 2014), or other social forms. For this paper, we want to begin by defining cooperatives at a more abstract level tackling one of the essential elements of a cooperative, i.e. its relational nature. This we will do through relationality, focusing on social relations between positions (embodied by agents, the farmers in our particular case) and the causal powers that emerge from these relations.

Our aim is not to give a thorough description of all forms of understanding cooperatives, but to argue that combining cooperatives and research, i.e. *coop-science* as an alternative constellation to citizen science, can be a generative alternative that is aligned with the context in which we are working. Returning to Donati and Archer's work (2015: 15), they argue that '[j]ustice and social solidarity require a vision that puts the needs and rights of all members of a community in relation with one another. … The decisions, choices, and actions of each of us are not purely individual acts but are arrived at in relation to and with others.'

Although this might seem a relatively new realisation in the West with some exceptions [e.g., the work of Marcel Mauss (1925/1966) who takes an interest in cooperation for its potential of social emancipation and egalitarianism in the development of co-op in France], it is the underlying ethos that has guided people's life for millennia in many countries in Africa, Kenya, not being the exception. As

Gyekye (2016: 137) asserts, 'the communal or communitarian aspects of African moral and political thought are reflected in the communitarian features of the social structures of African societies'. Relational and communal values guide their lives (e.g., Biko 2004; Mbiti 1970). Concerning the traditional life in Kenya, Jomo Kenyata (1965: 45) observed: 'According to Kikuyu ways of thinking, nobody is an isolated individual. Or rather, his uniqueness is a secondary fact about him; first and foremost, he is several people's relatives and several people's contemporary.' Instead of Descartes' motto, 'I think; therefore, I am', that has shaped Western philosophy including their individualistic life ethos epitomised in neoliberal ideologies, African scholars find in the black tradition of Africana philosophy a different motto, i.e., 'I am because we are, and since we are, therefore, I am' (Mbti 1970: 141). Following Nkondo (2007: 91), the principles that inform and organise life under an Ubuntu[5] (a term that emphasises the importance of community) philosophy are commitment to the good of the community in which their identities were formed and an urge to live their lives as bound up in that of their community. In the African tradition, ethics and moral reflection tend to focus more on collective structures than on individual decision-making. Certain kinds of relationships are to be pursued as an end, not merely as a means. Black thinkers, such as Franz Fanon, Amilcar Cabral, Ken Saro-Wiwa, and Martin Luther King Jr., were guided by universal humanism, whereby 'all human beings are related, beyond ties of kinship and community, by bonds of reciprocity founded on the inherent interweaving and interdependence of the world's population' (Hord and Lee 2016: 16–17). In this context, thinking of cooperatives in relational terms as an alternative and more inclusive constellation, i.e. *coop-science*, is culturally meaningful and can thus aid in resisting bourgeois individualism and epistemic violence (Sousa Santos 2014, 2018).

A relational approach to the member co-operative relationship opens a generative frame for understanding cooperatives that are well aligned with an Afro-communal normative framework (cf. Metz 2024). The concept of relationality is complex, and an in-depth explanation falls out of the scope of this paper, but we refer the interested reader to the works of Donati (2010, 2014), Donati and Archer (2015), and Archer (1995), as good starting points. What is relevant for our work is to grasp the idea that cooperatives are essentially a relational entity, and although this idea seems common sense, cooperative literature has not engaged with contemporary relational literature in great depth (Byrne 2022).

Let us begin with the bigger frame of society. Donati (2014: 149) argues that 'for relational sociology, society does not have relations but *is* relations. … Society is the product of associative and dissociative relations that arise from societal structures and continuously alter them in an ongoing interplay. It is a matter of understanding how the structural dynamic of relations creates a society that is different from others because the generative dynamics of the relations that characterize it are different.' This links, and we argue, complements the question raised in the introduction about what kind of science/knowledge and what kind of society does a particular mode of

[5] Although Ubuntu is a philosophy mainly associated with Zimbabwe and South Africa, the communal ethos that underlies it is practiced in many African countries.

citizen science produce? The particular mode or constellation we are proposing is a *coop-science* as we have explained thus far, and the kind of knowledge produced is a social good (which shares some features with the commons) or, in words of Donati (2014), a relational good (we explain relational good further in the paper). The society that a *coop-science* produces or helps to shape is thus aligned with the values and ethos of cooperatives or, in words of Donati (2015), with the relational goods that emerge from the social relations that constitute the cooperative. This is a society where once instrumental rhetoric of development is resisted, communities have the potential to flourish by honouring their cultural values and fulfilling their needs towards more meaningful ways of being and doings within the dairy industry (in the case of this project), foregrounding what they have reasons to value. Therefore, next, we characterise cooperatives and how they align with a relational approach, from which relational/social goods (in particular, knowledge as a common good) can emerge.

More generally, cooperatives are defined by the International Cooperative Alliance as 'an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly owned and democratically controlled enterprise' (ICA: Para 3).[6] As member-run and member-owned, cooperatives empower their members to materialise collectively their developmental and economic aspirations, whilst strengthening their human and social capital. In doing so, cooperatives contribute to the development of their communities. The values upon which they are based are self-help, self-responsibility, democracy, equality, equity, and solidarity. Values that guide members are honesty, openness, social responsibility, and caring for others (ICA). But how can we define a cooperative in relational terms? Starting with a simple example is helpful; we use that of a couple. A couple, seen through a relational lens, can be understood as an emergent relational structure with its own properties and powers. That is, two people come together in a particular way, with particular rules engaging in a social relation, i.e. a couple. The couple, which is the relational structure that emerges from the engagement of two people, has properties that neither of their constitutive parts have. The couple and its new emergent properties cannot be reduced to their individual members. Together, and through their purposeful interactions, they produce different effects than what their members would produce outside if they were not in the couple relationship.

Something similar happens with cooperatives, though it is not entirely equal given the number of the constitutive elements (N), which is bigger and therefore more complex than a couple. However, the essential aspect of a cooperative being an emergent relational structure is the same. A cooperative, which can be seen as a social relational structure, cannot be reduced to its constitutive parts, i.e. the members of the cooperative. The cooperative has properties and causal powers of its own, and therefore, it is 'real' like the couple. That is, the cooperative produces outcomes; it makes things happen in the world. In the case of these voluntary associations, Donati (2015) argues that, for the relational social 'subject' to be established,

[6] Taken from https://ica.coop/en/cooperatives/cooperative-identity. Accessed 5 March 2025.

the N members must have the same *WE* that is emergent from their interactions. The *WE* is constituted by joint action and joint commitment. For joint action, the goal they pursue needs to be perceived as a common task (*com-munis*) that can only be accomplished by their (N) members being in that *We-relation*. That is, carrying out the *munis* (task) together (com), i.e. relationally. This does not mean that the goal must be interpreted identically, but rather, it is perceived as a common task for a common goal. The committed action refers to the acknowledgment that the *WE* must be recognised as a commitment that binds and connects the N members in the association. That is, there is a sense of a shared enterprise.

The cooperative can, thus, be defined as a nexus of social relations, a particular way of arrangement of the parts, i.e. the social relations that generate social relational goods (social relations can also generate evils) (Donati 2015). These are defined as 'shared goods that depend on the relations of subjects towards one another and that can be enjoyed only if they orient themselves accordingly' (Donati and Archer 2015: 206). The relational goods might be intangible; nevertheless, they make things happen in the world; they produce outcomes. Such relational goods are, for example, the emergent values of a cooperative, as defined by ICA: solidarity, care for others, social responsibility, inclusion, equity, and care for the common good. All these relational goods, due to their causal powers, have the quality of making things happen in the world (we are referring here to the world within which the cooperative operates). Hence, cooperatives have a tremendous potential to generate outcomes through the effects of these relational goods (for example, knowledge as a relational social good).

Therefore, cooperatives are natural means of collaborative partnership fostering, through coordinated and reflexive action, prosperity and empowerment, not only for their members, but also for the community in which they operate. Hence, they can be strong contributors to economic, social, and environmental development. The structure of the cooperative, for example, helps organise members into collective action groups (Ferguson and Kepe 2011). Given their values, cooperatives have the potential to safeguarding community relations not only between people, but between humans and non-humans (e.g., animals, rivers, and land), enhance local resources, advocate social responsibility, and adopt sustainable and long-term practices (United Nations, Department of Economic and Social Affairs 2023). No wonder, 2025 has been proclaimed as the International Year of Cooperatives.[7] The aim is, amongst other things, to raise awareness of their contribution to the implementation of the Sustainable Development Goals (SDGs) as we argued earlier. There is robust evidence (cf. Bastida et al. 2020; Adlam 2023) that cooperatives are, ideally, strong contributors to gender equality, sustainable development of the dairy sub-sector (Koyi 2020), and sustainable agriculture (Ferguson and Kepe 2011), amongst others.

Given all the above, we envision the combination of cooperatives and (critical) social science/humanities as a generative means for the co-production of knowledge as *a social-common-relational good*. In the context of our project (rural communities in Nyandarua County, Kenya), this contribution is directed at the sustainability

[7] See the resolution A/RES/78/175 for details https://documents.un.org/doc/undoc/gen/n23/420/80/pdf/n2342080.pdf?token=KS7AZ719wZEJjBfynZ&fe=true. Accessed 5 March 2025.

and affordability of the dairy sector and food systems. We are interested in how cooperatives, through their collaboration with (critical social) sciences and humanities, given all we explained above, can make science more accessible, democratic, sustainable, and collaborative, tackling, at least partially, the equity and inclusion challenge by prioritising the social issues and interests of the cooperative and its context. In so doing, *coop-science* can embrace participatory democracy and community co-design and shift the power (partially) from the 'universally' recognised educational/scientific institutions to the community. We see this shift not as taking over the scientific endeavour, as such, but rather as actively participating in it by sharing the goals and shaping the methodologies that are aligned with the cultural context of the community(ies) involved. In doing so, participants can share their local needs and issues, as well as their local knowledge and expertise to inform the design of the research which, as Pelacho et al. (2021) argued, can provide new and more meaningful lines of inquiry.

Potential Niches Where Coop-Science Has and Can Continue to Be Generative (Women's Empowerment and Agriculture and Food Systems)

Whilst there has been a long history of public engagement in agriculture and food science, the association of citizen science and agriculture and food systems has been less frequent (Ryan et al. 2018), despite the commonalities that these latter two fields share. These authors highlight key opportunities for bridging these gaps by harnessing these commonalities. We share some anecdotal examples (transforming nevertheless) of what we have described as citizen science developed in Kenya in which two of the authors of this paper (Mary Warui and Dominic Kimani) were involved. We build on these examples and rethink them in the light of a different constellation, i.e. *coop-science*, to add new features to an already generative field of research. These examples illustrate what has been done in the Rift Valley, in Kenya (specifically in the Olerai Community Wildlife Conservancy), and allow us to point towards what can be improved in the context of our project—'Impact from the Ground', which involves exploring new niches where *coop-science* can find a generative alliance with (critical) social science and humanities.

One example has to do with scouts that work as wildlife patrollers in Olerai Conservancy:

> We [Warui, Kimani, and Wamiti (the latter from the National Museum of Kenya at the time)] trained a group scouts from the local community in how to patrol around the conservancy and collect data on bird species and other wildlife within/around the Olerai Conservancy, their habitat status, breeding patterns and threats. They do this collectively since they use different tools, e.g. cameras, data templates and GPS for location mapping. The information gathered is useful in ensuring conservation of wildlife and enhancing the coexistence with the landowners. Their knowledge and practice contribute to improving the biodiversity loss so starkly in that area. The scouts have been receiving refresher training from Kenya Wildlife Service rangers enhancing the scouts' field surveillance skills, wildlife management, and reporting efficiency. In

> addition the scouts have been trained in effective data collection using mobile applications. The scouts as a team have contributed to the eradication of logging and wildlife poisoning in the Conservancy.

There are two aspects that align with our ideas exposed so far. First, the Conservancy emerged as a response to the community's need as they saw a problem with the loss of land (the reasons are many; selling pieces of land for income is one of them) and how these small plots that they were left with are not productive for agriculture and livestock rearing. And it also has effects on wildlife and biodiversity loss. In trying to find a solution, the neighbouring landowners united in a cooperative-like manner contributing with their land to form the Olerai Community Wildlife Conservancy. Slowly they were exploring the needs to protect the wildlife, and so the idea of the scouts that received education and training to monitor and protect the Acacia forest from widespread logging and other threats came about. Kipeto, a wind farm in that locality, where the community leaders work (Warui and Kimani), decided to fund the employment of ten full-time scouts and train them with the needed knowledge and skills to protect the conservancy and slowly begin increasing wildlife and biodiversity, which is the current situation as we write. There are common goods—the land, now a conservancy, and its biodiversity, that the collective/cooperative—the scouts—are taking care of as it is in the interest of the community. They have been educated and trained in something that is meaningful to them, and the data they gather and report is not only for the benefit of a scientific project that lives outside of their interest and community. They are not only data providers but a social relational structure, a network of relationships amongst individuals who collaborate to achieve common goals and protect a common good (tangible and intangible). These social relations are built on trust, reciprocity, and mutual aid, fostering a sense of, but also an actual community and shared responsibility. And so we believe that they are a nascent example of *coop-science*.

The other example concerns a small women cooperative/collective learning beekeeping, as Mary Warui describes:

> We have a women's group in Olerai Community Wildlife Conservancy (which is supported by Kipeto energy, where I work). The group was supported to start a beekeeping project as an alternative to sheep and goat trading given the challenges of unpredictable weather patterns. We contacted a bee expert to teach the women all about bees and beekeeping. They had this initial training for a couple of weeks. Then hives were donated and installed in one area, so every member is tasked to monitor the hive, the bees, and their foraging behaviour (all this is part of the training received by the women group) then recording this information. Photos were taken and shared. The information collected by these women has been relevant in the conservation of bee plants and habitat as well as ensuring regeneration of bee foraging in the Masai land, where these women live. The community also gets to know the role of bees in pollination of their crops as they source for nectar and pollen. This makes them understand the harmful effects of using chemicals on their plants. On the other hand, they get to know that different bee flora provides different honey varieties with varying market prices based on their quality (pollen content).

This example also, as the one above, on a small scale, reflects and materialises the principles of *coop-science*. One of the aims of our project is to systematise this initiative so that the women can be a formal cooperative, liaise with an education programme (science) to learn more about the craft but are also then able to commercialise the honey, improving their livelihood and the availability of nutritious food (honey in this case) in their table.

Kovač and dos Santos et al. (in Tolbert et al. 2024) provide similar examples of citizen engagement. Dos Santos and colleagues demonstrate how citizen science can boost community participation, promote environmental justice, and create new knowledge locally. Kovač examines tensions between citizen science and academia, including recognition issues and collaboration challenges. However, these initiatives differ from our *coop-science* constellation, as evidenced by the examples described above.

The anecdotal experiences we have shared suffice to show that there is work being developed in Kenya that involves collectives rather than isolated individuals that have an interest in a common good, and from the social relations, causal powers emerge. What is evident from these examples is that with most of these activities, it is a small group of people (women and scouts) being trained in a particular area of expertise, and they collaborate in addressing local social issues. In doing so, they contribute to the improvement of biodiversity and wildlife in the Conservancy, whilst they learn new knowledge and develop new skills. In addition, they also have access to decent work with economic benefit that improves their livelihoods.

We want to build on the work that Warui and Kimani have been doing and explore how we can harness the history of public engagement in agriculture and food science recognised by Ryan et al. (2018) to make more strategic alliances between, not individuals, but cooperatives, (critical) social sciences, and humanities to engage in projects related to local agriculture and food systems. There are particular social problems that we are willing to address with this constellation of *coop-science*, including gender inequalities and the concomitant issues that most women face when it comes to access to education and economic opportunities along with their exclusion from decent work, decision-making, and excessive unpaid labour. Despite women in Kenya dominating the agricultural and service sector, they are more likely to be in precarious low-waged jobs rather than managerial or organisational ones (Kobia 2017).

Gender equality is seen as a pillar for sustainable economic development and social well-being (McMurtry and McMurtry 2015, UN Women – Headquarters 2024); it is with that in mind that Warui has been working with the beekeepers. Women are being empowered through the acquisition of knowledge, skills, and equipment (bee hives and suits) to proactively engage in activities that have a direct impact on the environment and the land where they live; in so doing, this small cooperative of women shows their concern of their community well-being and the world more generally, nurturing a long-term vision for sustainable and environmental

growth. Although this is an anecdotal experience, we argue that it already shows the value of a *coop-science* constellation.

There is a wealth of literature, and we add to it anecdotally for now, demonstrating how cooperatives can serve as a means to empower women (Ferguson and Kepe 2011; McMurtry and McMurtry 2015), understanding empowerment as a process of transforming the power relationships between individuals and social groups (Batliwala 1993). We are aware that in Kenya, cooperative societies are mainly driven by men, creating class division between male workers and women in the agricultural and service sector (Österberg and Nilsson 2009). This is particularly relevant in the context of our project given that women participate less than men in agricultural research (Cornwall 2008; Phillips et al. 2019), which is, together with food systems, the target area of interest in our project. The lack of participation is sometimes related to targeting mainly literate farmers, who we know are mostly men (McMurty and McMurty 2015), thus perpetuating a vicious cycle of women exclusion. Despite all the barriers women face, we argue that, given the relational nature of cooperatives as explained in this paper, they have a key role to play in supporting issues of gender equality and contributing to achieving some elements of the 2030 Agenda for Sustainable Development. We argue that Warui's and Kimani's work with the women beekeeper and the scouts is a testament of this.

However, it seems to us there is a gap between the ideal case scenario of cooperatives being a means to, amongst other things, women empowerment leading to gender equality, and how this empowerment can be materialised on the ground. We consider that there is a potential to close this gap through *coop-science*, considering that knowledge production can lead to social mobility, economic improvement, and an enhanced capacity for political participation (Frediani et al. 2019). Empowerment, and thus power relationships, can be changed through actions on three different fronts: by interrogating the ideologies that justify inequality, by changing the means of access and control of economic, natural, and intellectual resources, and by changing the structures that reinforce and perpetuate existing power systems (e.g. family, market, education) (Batliwana 1993 in Calvès 2009). We contend that *coop-science* could enable women cooperatives to change the access, first, to intellectual resources through working together with (critical social) science and the humanities. Once that has been conquered, the next step is to change the access to natural resources (land and cows, bees, for example) and as a consequence (not a direct one but as the product of sustain efforts) improve access to economic resources and strengthen women's decision-making in that space (which are next steps we aim to do with the women beefing for example). Warui's and Kimani's work is a starting point that has already transformed communities' life. What we want to do next in our project is upscale this work and transform it into a *coop-science* constellation in a more deliberate and systematic way using the understanding we have consolidated so far.

Concluding Remarks and Next Steps

The next steps in the 'Impact from the Ground' project involve leveraging the *coop-science* constellation to address gender and structural inequities affecting rural communities, particularly women and youth.[8] The project's third stage focused on reimagining the dairy industry's future through Futures Literacy Labs (FLLs).[9] These labs, conducted with Kenyan experts, employ a collective intelligence process to envision different futures for the dairy industry, emphasising the roles of women and youth in that future. The outcome of the FLLs includes participant-generated preferred futures, which include things that people have reason to value, and what they would like to be and do in that future and an actionable story that guides the exploration of necessary socio-political conditions and involved actors. We are currently documenting and preparing to publish this experience, aiming to articulate and realise this envisioned future.

To realise the envisioned future, one of our focusses is education and skill development, for which we have developed a future-oriented convivial learning framework (Kuhn et al. 2024). It is precisely in the generation of this knowledge and new practices that we propose a *coop-science* constellation. This approach builds on the historical role of extensionists in connecting farmers with scientific research. Whilst not strictly citizen science, it creates an opportunity for knowledge co-creation between scientists and farmers. Ryan et al. (2018: 2) argue that 'there [in the partnership] lies an opportunity to leverage the strength of Extension -a height geographical density of professional who take information generated at a central place (e.g. a university) and disseminate it to help local people tailor information for local solution'.

We propose evolving beyond traditional extensionist roles to include cooperatives in knowledge co-production, addressing complex environmental problems within their social context. This approach is critical given that understanding and decision-making in these issues occur in value-laden contexts (Carolan 2008). In the relationship of the extensionist (the science so to say) and the farmers (the cooperative), mixing different kinds of knowledge between specialists (abstract and generalisable knowledge and profit-oriented values) and farmers (practical local knowledge and sustainable-oriented values) is important. One example that illustrates the different values is the push for profit by some scientists versus the focus on strengthening local food systems despite not making as much profit as if they would sell their products to big chain supermarkets. By including (critical) social science and humanities, the different agendas of extensionists and farmers can be negotiated. We align with Freire, who in his work *Education for Critical Consciousness* (1974/2023: 88) criticises the extension/farmer relationship and argues that 'the concept of extension which is characterised by the transference of techniques and knowledge (and we add, their business-oriented approach) is in direct contradiction to a truly humanist

[8] A more detailed account, including a rationale of why imaging the future of the dairy industry is key for rural communities in Kenya, can be read at https://afa-k.org. Accessed 5 March 2025.

[9] More details about what FLL is go to https://unesdoc.unesco.org/ark:/48223/pf0000385485. Accessed 5 March 2025.

outlook'. Thus, we emphasise the need for a more collaborative, context-sensitive, and humanist approach.

Summarising all the above, we can confidently say that *coop-science*, as we have conceptualised and envisioned it in this paper, is a humanist outlook to the co-production of knowledge as a *social-common-relational good* and has the potential to address some of the challenges exposed by different scholars that we have mentioned in this paper. We name some of these challenges as a way of summarising what can be addressed through *coop-science*, but it is by no means an exhaustive list. For example, *coop-science* can support gender equality and women's empowerment (SDG5) including access to decision-making and economic opportunities (SDG8). By integrating the cooperative more actively at different stages of the research process (e.g. when negotiating common values, when setting the aims, deciding upon the methodologies, and selecting the most effective ways of disseminating the findings), science can become sustainable and more accessible (SDG4), a challenge already noted by Pelacho et al. (2021).

When it comes to boosting public participation of women in the agricultural sector through a more empowered approach whereby they can undertake roles that involve decision-making and political participation (SDG5), as suggested by Herzog and Lepenies (2022), we firmly consider that *coop-science* can contribute to address this challenge. Whilst participation in agricultural research does not automatically empower women farmers, there is broad agreement that appropriate participation is necessary if agricultural research is to contribute to empowerment (van de Gevel et al. 2020). We assert that *coop-science*, by fostering a more collective-oriented form of societal cooperation and mutual learning, can lead to social cohesion and sustainability. In so doing, the neo-liberalisation of science trend that is currently driving scientific research, as explained by Vohland et al. (2019), could be countered. By doing so, *coop-science* safeguards a non-economic sphere, i.e. the *WE-context* explained above. Moreover, *coop-science* is also countering the Western more individualistic and utilitarian model of knowledge production, a tendency also noted by Muhtaseb (in Jopling et al. 2024) when he explained the difference between individualism and collectivism. Instead, and as a consequence of understanding cooperatives as a social relational structure, what is likely to emerge from the constellation—*coop-science*—is a *social-common-relational good*, i.e. the co-production of knowledges (plural) as a common good put at the service of the development and betterment of communities and their livelihoods. We argue that cooperatives, as natural vehicles of collaborative partnership and prosperity for all, are very likely to contribute to economic, social, and environmental sustainability across regions and economic sectors. It is inherent amongst them to safeguard community relations, enhance local resources, advocate social responsibility, care for the common good, and adopt sustainable and long-term business practices.

We are convinced that *coop-science*, when the adequate and conducive social, cultural, economic, and political conditions are in place, can give the power back to women and youth to resist technocratic agendas to (mal)development. This can be achieved by fostering more responsive and participatory initiatives centred on what people want and need, but moreover, have reasons to value. In doing so, people can enhance different capabilities, for example, participating in epistemic contribution, a

central capability proposed by Fricker (2015). By exercising their voice and agency, we affirm that rural communities with their farmers including women and underemployed youth will be more likely to resist by actively participating in political and social change, and thus, to flourish amidst the polycrisis that Morin (2024) has so poignantly described.

We still have work to do!

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