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Sustainability and Resilience in the Collaborative Economy: An Introduction to the Cloughjordan Ecovillage

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Abstract: The background of this work reflects the global emergence of an economic anti-paradigm on the model of the Collaborative Commons, alarmed by climate change and the gaping economic inequalities. The Commons intend to address the devastating consequences of a predatory capitalism for nature and society by introducing new and radical forms of ownership, governance, entrepreneurship, and financialisation on a mission to promote sustainability, decentralisation, democratic self-governance and equitable distribution of value. In this framework, this paper aims to offer an introduction to the Cloughjordan ecovillage, which represents a notable case of the collaborative economy in Ireland. Its objective is to examine the Cloughjordan ecovillage through the prism of sustainability and resilience. To this end, I conducted a three-month fieldwork on a mission to explore the normative and empirical aspects of the Cloughjordan ecovillage, focusing on sustainability and resilience issues. The results of this research show that, despite the financial and operational difficulties the ecovillage has faced due to the economic downturn of the last decade, it has proved resilient enough to sustain a community living in terms of a collaborative economy.

Keywords: Cloughjordan Ecovillage, Collaborative Economy, Sustainability and Resilience, Commons-based Peer Production

1. Introduction

The antinomies of Reason and modern science, famously scrutinized by Immanuel Kant, Kurt Gödel and Bertrand Russell on the epistemological level, find fertile ground today on the post-modern regimes of political and economic power built on the rational mastery of the unlimited expansion of technology and economy on society and nature [1-2]. The notion of the rational mastery originates in Descartes's and Bacon's declaration of the human becoming possessor and master of nature, and evolves into the scientific positivism of modernity, applied to capitalist industrialism. Cornelius Castoriadis introduces the term in contemporary discourse to criticize the unlimited application of Reason in the pursuit of irrational ends such as an infinite growth in a finite planet. Mike Hulme translates this term today into the "technical calculus" of science and industry, mastering nature [3].

The unfinished project of the Enlightenment [4] can be erroneously captured today in the blatant denial of the climate change by the current president of US, one of the major pollutant countries of the planet in the last two centuries [5]. The intentional ecological blindness of economic antagonism can be further depicted in dystopian science-fiction scenarios of NASA colonizing other planets due to the never ending threat of a nuclear war between US and a number of candidate countries such as North Korea, Russia and China.

Back to real-time scientific scenarios, research over the last two decades has amply demonstrated a global sustainability crisis [6-9]. The antinomies of economic growth and technological progress crystallize in the salient fact that at the same time that infant mortality is falling, human life expectancy is increasing and global literacy is improving, ecosystems are degrading, global warming is increasing, oil deposits are diminishing, inequalities are increasing and food remains insecure [6, 10]. The situation becomes more worrisome, considering the projection that the world population might surpass 9 billion by 2050, thus doubling or tripling the demand for raw materials [6].

A milestone in drawing the attention of global public policy on the sustainability crisis has been the Brundtland report, which defined sustainability as: "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs." [11]. Since then, research has attributed to the concept of sustainability three dimensions: a social, an economic and an environmental. The different interpretations of these dimensions have resulted in different approaches to sustainability, ranging from weak sustainability to different forms of strong sustainability, according to varying degrees of the substitutability of natural resources with technological capital [6, 12-13].

The weak sustainability approach is premised on the neoclassical economics assumption that technological progress is considered to increase the productivity of the natural stock faster than that it is being depleted, thus yielding substitutable utility and welfare for all [6, 14]. Economic growth can be decoupled from material throughput by technical innovation, which, combined with changes in consumer patterns, can be compatible with environmental protection [15]. Leading mainstream environmental economists such as Solow and Dasrupta and Heal have claimed that scarcity is only relative as there is always the opportunity of substitution [16-17].

Counter to this approach, the strong sustainability approach holds that not all natural resources are replaceable by technological fixes. There are critical levels beyond which substitutability is no longer possible or desirable [18]. Deep ecologists and degrowth movements juxtapose capitalist production with an alternative economic, political, social and cultural production marked by the values of social justice, democratic self-management and the ethics of collaboration. They call for contraction and equitable downscaling in the economy through reductions in aggregate consumption and decreases in growth rates [19-22]. This discourse has been the catalyst for the creation of Transition Towns, resilient communities and ecovillages, which practice sustainability and resilience by means of local governance, autonomous renewable energy production, green building, permaculture, organic farming and biodiversity.

Elinor Ostrom was awarded the Nobel Prize in economics in 2009 for having analyzed numerous successful cases of self-managed common pool resources (ie. forests, pastures, fisheries, irrigation fields). Common property regimes have been successfully operating for centuries across the globe from USA and Switzerland to Spain, Nepal and Indonesia [23]. Later on, Ostrom and her colleagues extended her research, *inter alia*, on information and knowledge Commons [24]. Yochai Benkler coined the term "Commons-based peer production" to describe a novel paradigm of information, knowledge and cultural production supported by the Internet and free/open source software (FOSS) [25]. David Bollier defines the Commons as shared resources (natural resources, technology, knowledge, capital, culture), self-managed by user communities in accordance with the rules or norms of the community [26]. Bauwens and Kostakis attempt today to bridge Ostrom's local Commons with Benkler's Digital Commons by incorporating the ecological model Design Global-Manufacture Local (DG-ML) into Commons-based peer production [19, 27]. The DG-ML model has been enabled today by the conjunction of the modern information and communication technologies (Internet and open source software/hardware) with desktop manufacturing technologies (such as the three-dimensional printing and the computer numerical machines). In this context, the collaborative economy forms economies of scope that promote sustainability and open techno-social innovation while celebrating new patterns of human collaboration. However, grassroots movements such as the Commons and the DG-ML model are still in their infancy, and there is a substantive lack of adequate research and literature. Therefore, such claims still rest on thin conceptual and empirical foundations.

This paper is an attempt to contribute to the ongoing understanding of relevant organizational models. It examines the Cloughjordan ecovillage as a showcase of the collaborative economy in Ireland. The Cloughjordan ecovillage consists of an intentional community who have come together to create an alternative paradigm of economy premised on the principles of sustainability and resilience[1]. By intentional community I refer here to a group of like-minded people who create a community on the basis of shared values and principles [28]. The members of the Cloughjordan community, along with external partners, have formed an ecosystem of enterprises and organizations that promote renewable energies, consensus-decision making, open source technologies, organic farming, cohousing, biodiversity and ecological design.

The Cloughjordan ecosystem represents a strong sustainability approach of the collaborative economy, which expands in Commons-based peer production on the DG-ML model. The main purpose here is to offer an introduction to the case of the Cloughjordan ecovillage from the viewpoint of sustainability and resilience. Future research is called for expanding on the key features of the ecovillage outlined here.

The structure of the paper is as follows: The first section introduces the theoretical framework and research methodology. The second section outlines the historical genesis of the Cloughjordan Ecovillage. The third section develops the key features of the Cloughjordan ecosystem. The fourth section concludes with the assessment of the Cloughjordan ecovillage following the criteria of sustainability and resilience.

2. Theoretical Framework and Methodology

The neoclassical model currently dominates mainstream environmental economics in terms of the weak sustainability approach. Large parts of the scholars in the discipline of economics believe in a physics-like positivistic epistemology

1 See http://www.thevillage.ie/.

of self-interested market actors – individuals, corporations, institutions – driven by a cost-benefit analysis for the purpose of maximizing utility and freedom of choice [6]. Cost-benefit analysis assumes value commensurability and compensability for different objectives. As such, it seeks the optimal solution to a decision-making problem based on the Kaldor-Hicks variant of the Pareto rule, which terms a solution optimal if the sum of the gains outweighs the sum of the costs [6]. Accordingly, environmental problems are anomalies correctable by taxes, tradable permit markets and price changes that stimulate new technologies and resources, while internalizing externalities. To date, the neoclassical model of economics has formed the backbone of the neoliberal deregulation and pro-market globalisation that prevails in most part of environmental policy.

However, the neoclassical model is challenged today on multiple grounds. It is questioned first and foremost within the discipline of economics by various branches such as institutional economics, post-Keynesian economics, neo/post-Marxian economics, complexity economics and evolutionary economics [29]. The cost-benefit analysis ignores the fact that individuals value differently costs and benefits, unless one presupposes a society of individuals with identical preferences [6, 30]. The model of a rational actor calculating past and present information in maximising future utility is in stark contrast with real-world social dynamics, marked by highly unequal power relations and heterogeneous information sources, motives and capacities [6, 31]. Complexity and uncertainty inherent in the ontological multiplicity of nature and society turns any rational mastery of quantifying unquantifiable variables into a *reductio ad absurdum*, if not a pseudo-science [32, 1]. As regards environmental policy, evidence of decoupling of economic growth from depletion of resources show mixed results at best [6]. Therefore, the weak sustainability approach relies on a blind belief in technological progress, not supported by cogent scientific evidence. In other words, it is a self-fulfilling prophecy established itself as science.

Recent studies calls also into question the standard rationale for policy intervention in the conventional firm-level approach to techno-social innovation, which is based on market failure arguments as developed by [33]. The argument goes that a fully competitive market will provide a sub-optimal level of investment in public goods such as information, knowledge and environmental protection. This under-investment calls for public subsidies for basic knowledge development, patent protection and incentive structures such as the system of intellectual property rights.

Tom Dedeurwaerdere, among plenty others, holds that this approach, while necessary to some degree, falls short of addressing the transformation process needed for a strong sustainability transition [6]. He, therefore, points to a normative reorientation of research and policy on the methodology of a sustainability science predicated on the principles of interdisciplinarity, ethics and transdisciplinarity. Diverse institutional processes are essential to reconciling multiple values and perspectives on problem framing. As he puts it: "A key research question in this context is therefore to examine how socio-technological systems can develop the ability to monitor, to anticipate and to involve actors in open-ended processes of adaptive self-governance" [6].

Ostrom was one of the first scholars to call for an interdisciplinary, ethics-oriented and multistakeholder approach against any falsely presumed panaceas either of the state or market sector [23-24]. Her polycentricity model illustrates the diversity of institutions dealing with environmental conservation across the globe. In contrast to standard property-rights regimes, namely government or private ownership, her research highlights numerous Common-property regimes, self-managed on a bundle of rights (access, withdrawal, exclusion, management, alienation) rather than on a single proprietary model [34].

Yochai Benkler coined the term "Commons-based peer production" to describe a new mode of information, knowledge and cultural production based on diverse motivations, modularity and decentralization, supported by the Internet and free/open source software [25]. He also relies on current research to advocate that strong intellectual property rights leads to commercialization, concentration, and homogenization of information production rights, thereby stifling innovation [35]. In contrast to strong intellectual property rights, he argues for a diversity of property rights, ranging from exclusive ones to the General Public License (GNU) and the Creative Commons.

Kostakis and Bauwens attempt to bridge local and global (digital) Commons by introducing in the literature the DG-ML model [27]. In a nutshell, DG-ML model follows the logic that what is not scarce becomes global (i.e. global commons of knowledge, design, software), and what is scarce (i.e. hardware) is local. Global (digital) Commons can connect to local Commons via Transition Towns, decentralised communities and fablabs/makerspaces based on free/open source software/hardware and renewable energy systems distributed through microgrids on Blockchain and the Internet of Things [36]. Moreover, Blockchain technology has at least theoretically the potential to link with DG-ML model on the basis of open self-governance, decentralization and distribution of value [37]. Thus, the DG-ML model introduces an on-demand distributed mode of production that has significant advantages over capitalist production: (1) it lowers production costs (no patent costs, no transportation and maintenance costs, no planned obsolescence); (2) it democratizes production by unleashing new forms of collaboration and techno-social innovation; (3) it contributes to a sustainable and resilient society and economy [19]. The literature has documented so far a number of case studies in the fields of agriculture, manufacturing and biotechnology such as AbilityMate, Wikihouse, RepRap, Osvehicle, FarmHack, Open Source Ecology, L' Atelier Paysan, Bionics [19, 38-39].

However, these are still limited cases. The DG-ML model, the Internet of Things and Blockchain technologies stand at a preliminary stage, and it is early to estimate if and to what degree they can contribute to a collaborative economy. These

are still hypotheses needing to be tested empirically, before they can crystallize into a sustainable economic model.

This paper attempts to contribute to this discussion with the critical examination of the case study of the Cloughjordan ecovillage. I make the claim that, despite the financial and operational difficulties the ecovillage has faced due to the economic downturn of the last decade, the ecovillage has proved resilient enough to self-organize and provide for their members a sustainable living in terms of a collaborative economy, which expands in Commons-based peer production on the model of Design Global-Manufacture Local. The methodology adopted in this paper is ethnographic study intended to describe and interpret the shared values of the Cloughjordan community by means of qualitative and quantitative research. To this end, I conducted a three-month field work in the Cloughjordan ecovillage (January-April 2018). Through the lens of critical literature review, direct and participant observation, unstructured and semi-structured in-depth interviews with members of the community, I examined the normative and empirical aspects of the Cloughjordan ecovillage, focusing on sustainability and resilience issues. I visited 5 times the ecovillage with the aim to interview members of the community and collect data. During my stay, I had the opportunity to interview 4 members of the community. Interviews lasted between 30 and 50 minutes. They were tape recorded and transcribed verbatim. I also participated in the community living of the ecovillage and gained significant insights on the operational and governance model that supports the primary objectives of sustainability and resilience. I observed day-to-day operations and I was informed in detail about the key features of the ecovillage such as the consensus decision-making mechanism, community supported agriculture, organic farming, green building, the role of digital platforms and the entrepreneurship operating within or at the edges of the ecovillage. I had numerous fruitful conversations with members of the community, and I also participated in the demonstration of a citizen science observatory currently running in the FabLab of the ecovillage under the EU Horizon 2020 GROW project. Additional data sources included several documentation related to the operational and legal structure of the ecovillage (Memorandum of Association, Ecological Charter), newspaper articles, the ecovillage website and internal documentation (brochures and leaflets).

Discourse analysis and grounded theory were also combined, where necessary, to reveal antagonistic and emerging discourses in a socio-ecological system dense with complex institutional structures and diverse political views and narratives [40-41].

3. The Historical Genesis of the Cloughjordan Ecovillage

Cloughjordan Ecovillage is member of the Global Ecovillage Network (GEN) which defines an ecovillage as "an intentional or traditional community using local participatory processes to holistically integrate ecological, economic, social, and cultural dimensions of sustainability in order to regenerate social and natural environments" [55].

The history of the Cloughjordan Ecovillage goes back to 1999, when a group loosely associated with the Dublin Co-Housing project and the Dublin Food Co-op founded a non-profit educational charity called "Sustainable Projects Ireland Limited" (SPIL) with the mission to create Ireland's first ecovillage. A board of directors elected democratically was legally responsible for the project, and a panel of experts (an engineer, an architect, an accountant, a solicitor, etc.) was employed to run it. Soon after SPIL's establishment, the group organized a number of monthly workshops with the aim to attract members. Membership was limited to roughly 40 at that time and required making a €1000 investment in the project.

The purpose of the company, as set out in the memorandum of association, is to create and manage an ecovillage that "…will serve as a model for sustainable living into the 21st century and as an education, enterprise and research resource service for all" [42]. The subsidiary objects of the company were to advance the ecological, social, economic and cultural sustainability of community living in rural Ireland. To choose the appropriate area for building the ecovillage, the Company devised three criteria: (1) it should be close to an existing population centre; (2) the land should combine a mix of housing, amenities and wilderness areas; and (3) it should be served by public transport so as to provide access to low-carbon means of transport [43].

By 2002, the village of the Cloughjordan in the north Tipperary was identified as a possible location, and in May 2003 a series of town hall meetings with the residents began. In 2003, an Ecological Charter of basic principles for the development of the ecovillage was drawn up and agreed by members, and by June 2004 a master plan developed and submitted to North Tipperary County Council for planning permission [42]. By that time, all members (roughly 50) had invested €15.000 in the project as a deposit. Following the granting of full planning permission, a 67 acre-site had been bought by 2007, and infrastructure work began in 2007, financed by contributions from members of SPIL and by loans, both from an ethical fund and a commercial bank (in total around €7 million, including the EU Concerto grant for building the district heating system). In the meantime, the project was severely hit by the housing crisis of 2008. There were people who wanted to live there but could not sell their houses or get mortgages or they were seeing their jobs being in danger. Twenty-five people bought sites but cannot build and 15 more have paid deposits on sites. In spring 2009, the house build phase was launched, and by Christmas 2009 the first residents moved in. Altogether 114 housing units were planned, plus 16 live-work units with spaces in which to run businesses. By 2014, 84 sites have been sold and 55 units built. In mid 2014, SPIL had registered 84 members of whom the majority are living in the ecovillage. The total number of residents is currently around 140 [43].

4. Sustainability and Resilience

In recent decades, sustainability and resilience have become key concepts in understanding and coping with environmental change. Both concepts have been employed within widely differing framings and interpretations according to varying techno-scientific, economic and political considerations [12-14].

This paper adopts the framing of the political economy of the Commons [23, 25, 44], which is a version of strong sustainability that introduces a balanced techno-social innovation and environmental change on the model of "Cosmo-Localization" or DG-ML [27]. Sustainability, broadly defined as "the maintenance of capital" [45], relies heavily on resilience as the ability of complex socio-ecological systems to regenerate, change, adapt and transform in the presence of both internal and external stresses and pressures [19, 38, 46-48]. From the perspective of the DG-ML model, sustainability and resilience are subject to the democratic institutionalization of the socio-ecological systems in question. Democratic institutionalization can include governments, universities, ethical market entities, cooperatives, communities, groups, individuals, and so on.

Sustainability and resilience are key principles penetrating the normative core of the Cloughjordan ecovillage, which constitutes a notable case of the collaborative economy that falls also under the DG-ML model. The Cloughjordan Ecovillage has been identified as a leading European project in the creation of a low-carbon future. Of 1,500 projects initially chosen by the EU-funded Milesecure researchers, Cloughjordan featured in the final 23 [43]. The Ecovillage consists of an alliance of multiple enterprises (i.e. WeCreate, Fablab, Django's, RiotRye) and organisations (i.e. Cultivate, GROW, FEASTA). A plausible way of illustrating an ecosystem this scope and size is to analyse its organizational structure in relation to its key features. In other words, to come to terms with the complexity of the Cloughjordan ecovillage, it is essential to articulate its normative and institutional formation.

To begin with, SPIL is an education charity and national NGO, part of The Irish Environmental Network, which is an umbrella network, working to support environmental NGOs through access to funding and services. It is developing the ecovillage and runs the educational and land stewardship programme, which is centred on sustainability and resilience issues. Within the ecovillage there are a number of enterprises and organizations that operate as separate legal entities and report bimonthly to SPIL. Therefore, SPIL is the institutional axis around which revolve all the enterprises and organisations based on Cloughjordan ecovillage.

Cultivate is a not-for profit cooperative and national NGO based on the WeCreate enterprise center (Figure 1). Cultivate is focused on the education, communication and civic engagement on sustainability and community resilience by delivering training, facilitating groups and leading learning journeys on topics of permaculture, green building and the collaborative economy[2]. Since its inception in 2000, it has organized numerous educational programmes, projects, conferences and events, including the annual national sustainable living festival Convergence hosted at the Cloughjordan ecovillage. Cultivate maintains close links with many NGOs, sustainability organizations and other members of the IEN (Irish Environmental Network). It is also an active member of ECOLISE, which is an educational platform supporting community-based initiatives on climate change and sustainability across Europe.

Figure 1. *WeCreate Enterprise Center.*

Cultivate currently leads a work package on Horizon 2020 European-wide project called GROW Observatory. GROW is developing global environmental observation and information systems based on a sustainable citizen platform and community, dedicated to generating, sharing and utilizing information on land, soil and water resource at a resolution hitherto not previously considered[3]. As such, GROW is a notable case of the DG-ML model, supported by the Internet and digital platforms. One of the founding members of Cultivate and SPIL interviewed mentions: "Cultivate intends to further expand its operations on Commons-based peer production, platform cooperativism, Blockchain and open source technologies". Finally, Cultivate links with the Foundation for the Economics of Sustainability (FEASTA), which is a national NGO located at the ecovillage. FEASTA aims to explore the economic, cultural and environmental characteristics of a truly sustainable society, and to disseminate the results of this exploration to the widest relevant audience[4].

During the years, the Cloughjordan ecovillage has evolved into an institutional ecosystem, promoting sustainability and resilience through consensus-decision making, renewable energy systems, green building, community supported agriculture, biodiversity, organic farming, open source technologies and social entrepreneurship.

4.1. Governance System and Consensus Decision-Making

From the beginning, SPIL adopted a consensus-based approach in decision-making as set out in its constitution [42]. Consensus-decision making is a model of participatory democracy employed by groups, organizations and

2 See http://cultivate.ie/.

3 See https://growobservatory.org/.

4 See http://www.feasta.org/.

communities to reach a decision by means of inclusion and deliberation without relying on majority vote[5]. The literature has documented a diversity of rival discourses during the years within the membership of SPIL with regards to governance, consensus decision-making and communication issues. Connolly notes that there has always been a tension between the need to execute time-effective decisions and the need to seek consensus while doing that [49]. Former members of SPIL criticized the hierarchical company structure (the division between the Board of directors and the members) and the consensus decision process as contradictory and thus conflictual. As the project was progressing over time there was the need for the workload to be broken down and distributed into self-organized groups. Some claim that this led to isolation of groups and inoperative consensus-decision making. Some have argued for an "invisible leadership", centralized decision-making process, "ostracism", secrecy, lack of transparency and accountability. Others hold that there is honesty and integrity in the Board of directors and an awareness of proper governance. As Cunningham puts it:

"If there were those who were overly empowered by their assumed leadership roles, there were others who have been described by former members as 'sheepish followers who were dragged along […] who didn't want to rock the boat'. Some members 'opted out because they felt like they didn't have a voice'. Others felt 'it would be too much hassle to put time in'. Still others were reportedly 'happy to let the active group make decisions (…) The majority of the members seemed inclined to accept the status quo- to let the leadership do what they had to do to develop and complete the project" [50].

Interpersonal conflict, combined with financial strains put upon a number of members due to the housing crisis, resulted in the departure of half of the community membership in 2007. This led the membership to adopt the "Viable System Model" (VSM) introduced by Angelo Espinoza and Jon Walker to cooperatives and communities as an alternative to hierarchies [51]. The VSM works as follows: it identifies the project's primary activities (PA) and splits them into groups (PAGs) such as education, land use and site development, each of them having a number of members tasked for the different targets of the PA. These are the groups forming System 1. System 2 consists of a Process group to oversee and correct System 1. System 3 consists of a Co-ordination team responsible for co-ordinating all of the various groups activities and provide a monthly report to the members and the Board. System 4 consists of a Navigation group who are assigned the task to keep up with the latest developments in the wider society in consonance with the ecovillage's activities. Finally, System 5 consists of an Identity group which deals with issues of membership and purpose, thereby supplementing the Board of directors and members in the oversight and direction of the whole project.

Espinoza and Walker note that this transformation of governance diminished the complexity of the initial structure of 20 working groups, thus allocating scarce resources (people) into the most relevant tasks [51]. A survey conducted amongst the members concluded that the adoption of the VSM created a more realistic representation of the community, thus resulting in more efficient communication and greater transparency and accountability. In short, the VSM helped the ecovillage overcome the initial governance problems and build a more sustainable and resilient governance scheme.

4.2. Renewable Energy

As a partner in the Sustainable Energy for Rural Village Environment project (SERVE), the village received funding from the European Union (EU) CONCERTO Program for the purchase and installation of Ireland's first renewable energy district heating system (Figure 3). This central district heating system supplies heating and hot water for the whole ecovillage, fuelled by local waste wood. The heating plant consists of two 500-kilowatt wood-chip boilers backed up by 500 m2 of solar (thermal) panels. It provides each house with hot water via a well-insulated network of piping, while maintaining a 17,000-litre reserve. The ecovillage connects also to the national grid, which supplies electricity to drive the pumps, but there are plans for on-site wind-power in the future. The hot water flows to each house via a heat meter and exchanger that heats the water in a well-insulated 700-litre storage tank, which provides all the volume necessary for heating and hot water. The plant is estimated to save 113.5 tonnes annually of carbon that would be emitted by conventional heating systems.

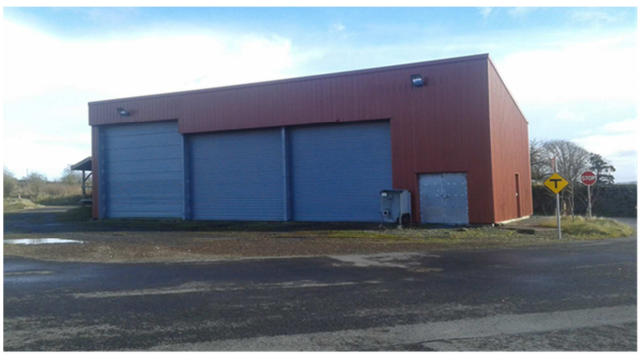

Figure 2. *Central District Heating System.*

The original plan predicted that solar heat would be the main energy source in the summer, and biomass (wood-chip boilers) in the winter. However, the solar panels have not worked so far. Due to the housing crisis, the contractor overseeing the work went bust, and the village is now seeking ways of raising finance to get them operational. Moreover, the unexpected infrastructure costs increased the price of the sites making them difficult to sell. The district heating system, therefore, serves fewer customers (55) than it was designed for (130), thus resulting in higher charges for residents.

Despite the higher costs in the current situation that are expected to drop as more houses are built in the ecovillage,

5 See https://en.wikipedia.org/wiki/Consensus decision-making.

biomass locally produced is generally cheaper, more sustainable and resilient compared to fossil fuels. It has been argued, yet by members that the central heating system might not be resilient in the long term. Therefore, most houses have now a stove in case the centralized system goes down.

Electricity for other purposes comes from the national grid. However, 15 kilowatts of solar energy is generated from photovoltaics on roofs, installed by members through a community scheme. But the photovoltaics do not have batteries, and there is no feed-in tariff. Therefore, spare electricity goes straight into the national grid. There were designs for community energy, but they would have to be planned on a bigger scale. At present, only the WeCreate enterprise center gets its energy through a Community Owned Licensed Supply Company called CRES (Community Renewable Energy Supply).

4.3. Green Building and Co-housing

To build a house in the ecovillage, one has to become a member and buy a site from SPIL. Five years ago the average site price was €80,000; now it is half that. The ecovillage currently counts 84 members registered, 84 sites sold and 55 units built to date. Members build their houses to their own designs but in keeping in line with the specifications preordained by the Ecological Charter, which advises the use of non-toxic materials that are recyclable and sustainable in manufacture, use and decay, regionally sourced and with low-embodied energy wherever possible, thereby reducing the environmental impacts of transport and manufacture [42]. Further instructions refer to insulation levels, cooking and electric appliances, household waste, daylight use, low-energy lighting, air-tightness and ventilation, monitoring and control. However, compromises have been deemed as potentially necessary due to the current underdeveloped state of the eco-construction industry in Ireland [42].

On these terms, different building types and materials have been used to date, including passive timber frame with a variety of insulations and finishes, Durisol blocks (blocks of chipped waste wood bonded with ecocement), sheep's wool, cellulose (shredded newspaper), hemp-lime (lime is a traditional Irish form of finish but the addition of hemp, a fibrous plant material, gives it strength and insulation), cob (clay, sand and straw), a Canadian stick-frame house with double stud walls (with no cold bridging) and kit houses [43].

This blend of designs and constructions account for the creation of one of the most innovative ecovillages globally (Figure 4, 5, 6, 7). As Kirby notes:

The high standard of materials used, however, and the specifications to which houses are built result in the ecovillage having some of the highest standards of building energy ratings (BER) in Ireland. In 2013, the ecovillage constituted 0.015% of all houses rated nationally yet 6.25% of all those given an A rating and 2.5% of all those given a B1 rating nationally [43].

However, a member of the Board of directors mentioned interviewed that a number of residents are facing difficulties in paying their mortgages and meeting their needs. There are, therefore, plans for rental accommodation and for social housing intended for people with low income. The Cloughjordan ecovillage has been working on designing and financing a co-housing project with the intent to foster community resilience by offering the opportunity to people to live together and thus combat the alienation and isolation many experience today. There are future plans to combine green building and co-housing with sustainable and open source technologies, which can lower costs and thus increase community resilience.

The ecovillage, therefore, meets a number of criteria of sustainable housing, such as reduction in long-term energy, maintenance and health care costs; access to public transport; on-site or local employment for the most part; the use of sustainable housing construction designs and materials; on-site recycling of construction materials; on-site renewable energy and waste management; energy-efficient, robust and durable dwellings; access to high quality green space for food, energy, and leisure and access to a wide range of social resources [52].

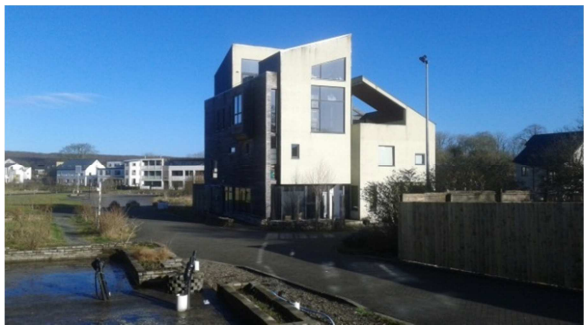

Figure 3. *Green Building.*

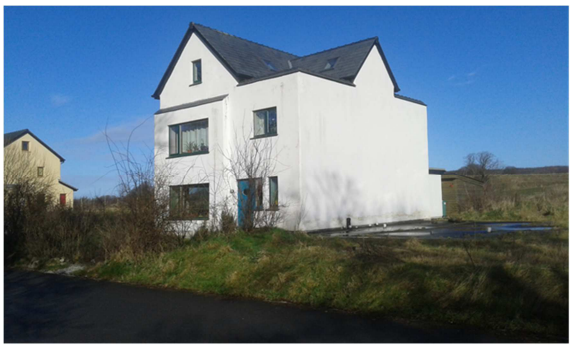

Figure 4. *Green Building.*

Figure 5. *Green Building.*

4.4. Land Management and Community Supported Agriculture

SPIL owns the ecovillage land, which is divided into three main areas: (1) the residential area covers one third of the site; (2) the second third supports services and amenities including the district heating system, the eco-enterprise center, allotments for growing food and a community farm; and (3) the final third is devoted to woodland in which 17.000 trees (mainly native species such as oak, ash, Scots pine, birch, rowan, cherry, hazel and alder) were planted in 2017 [43].

Members have established a Community Supported Agriculture (CSA) scheme with the aim to collectively run a farm on the principles of organic production and permaculture. The farm splits in two holdings—a 12-acre site on the land of the ecovillage and a farm of 26 acres leased nearby. The former grows 4 acres of vegetables, 1 acre of cereals, 1 acre of green manure (humus building) and maintains 6 acres as permanent pasture. The latter is now privately run and the farm buys in milk on a contract basis. Members contribute a monthly fee (around €130) to pay farmers a salary, to purchase seeds and equipment and to lease the land. Members can take what food they want from a central distribution point, supplied three times a week, all year around. Members also have free or low cost access to all of training and educational events.

Overall, the farm contributes to the sustainability and resilience of the ecovillage by reducing reliance on commercial producers, improving the quality of the food produced, and enhancing skills and practices among the members. The sustainability of the farm rests both on being embedded in a wider community and also on the practices of soil regeneration and active seed saving, which are expected to improve significantly through the GROW observatory project currently in progress.

Figure 6. *The Cloughjordan Ecovillage.*

4.5. Digital Platforms and Open Source Technologies

The first community-based Fablab in Ireland is located at the WeCreate workspace at the ecovillage. The FabLab is part of a worldwide network of FabLabs working on additive manufacturing (3D Printing), subtractive manufacturing (CNC routing and milling, laser cutting and engraving) and open source technologies.

One of the founding members of the ecovillage who currently runs the Fablab spoke in detail during an in-depth interview about a project they are currently engaged in. The FabLab collaborates with 18 consortium partners in a working package of a EU Horizon 2020 project running a citizen science observatory (GROW). GROW develops an open sensor project implementing open source DIY solutions for sensing weather data (rainfall, light, temperature, soil moisture) that could help monitor and predict climate change such as upcoming floods, heatwaves or periods of drought. It leverages and combines low cost consumer sensing technology by utilizing open source hardware following the DG-ML model. Information is gathered locally via open source hardware (Arduino) and is made available globally via satellites, using open source software (Drupal, FarmOS) for further local use (Figure 8). The GROW partnership aims thus to connect and scale to globally dispersed communities linked through digital and social platforms, and a wide range of additional citizen associations and NGOs in sustainable agriculture, gardening, food democracy and land management. As such, it sustains an exemplary showcase of the DG-ML model.

The project started out as an idea of manufacturing an open sensor locally at the lowest cost possible, using easily available components through 3D printing, and utilizing open source hardware (Arduino) and software (Drupal, FarmOS). The goal was initially to show that the open sensor could be solar powered and connect to a wireless network. These features did not exist in commercial proprietary products at the time.

Over time, it became obvious that using readings from the sensor could offer a sustainable and resilient method in coping with climate change through the utilization of land use practices that would help retain soil moisture like for instance permaculture design, composting and other regenerative agro-ecology practices. This method is also cost-effective since an open sensor costs around €40 to manufacture, whereas a commercial version of it would cost at around €300-400, considering the relative demand, design, marketing, investment costs, salaries, etc.

From an epistemological point of view, the inter/multidisciplinary dimension of citizen science via the DG-ML model contributes to the verification and dispersion of knowledge inasmuch as there can be millions of citizens taking scientific data locally and scientists translating and validating data globally. The potential, therefore, is here for individuals, communities and new types of organizations to leverage this technology and be more cost-efficient and resilient in relation to more commercial solutions enclosed by intellectual property rights. But this depends eventually on how people value time, money and the relative trade-offs.

It remains then to be seen to what degree the users of these technologies are in control of their use and knowledge; to what degree they are willing to get accustomed to new technological solutions and thus contribute to the sustainability and resilience of their agro-systems.

The member who runs the Fablab elaborated further in the interview on how he envisages the future role of Blockchain in relation to the ecovillage. The interviewee is interested in

particular in the prospect of Blockchain organizations governed by community participation in decision-making. As the member argues: "There is good evidence to show that the normal analogue practices that we take as part of consensus decision-making, whether they are meetings or working groups and forums, have various vulnerabilities to be manipulated by individuals in communities with various agendas…It also takes an enormous amount of time to come to an agreement, which has its advantages, since you do not make rushed decisions…But at the same time I think a lot of decisions could be made more rapidly if a trusted third party was there to validate decision-making process. There are non-Blockchain-based decision making tools like Loomio that are very useful…So a mixture of platforms like that, maybe something like digital autonomous organizations or digital autonomous collectives would be appropriate for this type of ecovillage community…We are kind of more like watching the space right now and then see how they might impact how we work".

The member expressed a further interest in understanding whether value production can be recorded in the Blockchain: "There were a lot of movements in the past with local currencies, community currencies…We tried this ourselves in the ecovillage. We called them labour points basically…It was kind of a database that just collected the hours worked by members for the benefit of the community. We hoped to use them in trade, but that did not work. We found it was manipulated…People who did a lot of hours could easily outstrip others in the community, and there was no sense of how one valued hours of work, which is a difficulty…I am interested to see how blockchain will approach this with the consensus algorithms with which the users and stakeholders of the platform create value in a more transparent way than maybe a local economy can do. I am not sure but I would like to see how that could be utilized…Because you see in communities a lot of things done on a favour basis with no currency transaction whatsoever…But that sometimes runs into the problem of ill-feeling when members of the community consider themselves exploited…And others might see it as leaching off the values created by others…So there is definitely a role for a trustless system that might really value what we are doing, not necessarily monetize, but verify it".

To sum up, the member makes explicit in the interview the tensions and different discourses existing in communities regarding consensus decision-making, value production and distribution. He, therefore, alludes to the potential role of Blockchain technologies in creating a 'trustless' system for validating consensus decision-making process and distributing value either in terms of tokens or reputation [53-54].

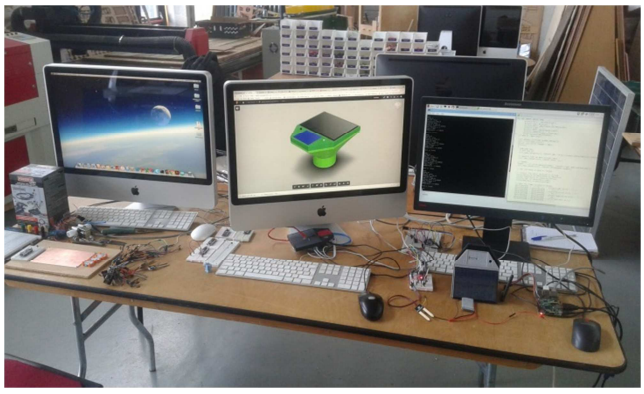

Figure 7. *The Arduino Project (the transmitter, the sensor housing, the Raspberry Pi receiver and the display of the prototype in the open source software FarmOS).*

4.6. Social Entrepreneurship and Eco-tourism

One of the key features of the ecovillage, as prescribed in the Ecological Charter, is the development of a local economy with business opportunities [42]. Kirby, one of the key members of the ecovillage, notes that "at the heart of sustainable living is the ability to generate sufficient income to live well within the ethic of sharing and mutual support" [43]. Some residents commute to nearby towns and some further; others work from home and from the WeCreate enterprise centre, which offers a space for co-working, shared workspaces for local businesses, entrepreneurs and projects. The company that owns the building is North Tipperary Green Enterprise Park Clg. The Fablab, located in the WeCreate enterprise centre, runs courses on digital fabrication technologies for primary and secondary school students. It has been accredited as a 'Discover Primary Science and Maths' centre by Science Foundation Ireland (SFI) allowing visiting schools to claim credits towards SFI awards. The Fab Lab is run by WeCreate Workspace Ltd.

There are a number of enterprises that currently run within or at the edges of the ecovillage. *Django's* is an eco-hostel with 34 beds capacity located at the ecovillage. Tourism linked to education, festivals and events is the mainstay of the hostel. Educating people on sustainability, resilience and community living is a significant source of income. *Riot Rye* is a wood-fired bakery and bread school also located at the ecovillage. Riot Rye is committed to creating and actively fostering a culture of bread without the use of industrial additives or chemicals. It exclusively uses organic flours, natural and wild ingredients in its breads. It employs sustainable production methods with its highly energy efficient wood-fired oven, fuelled by locally sourced timber. Members pay for their home-delivered bread from the Riot Rye bakery on a monthly basis. *Sheelagh na Gig* is a bookshop and coffeeshop on Cloughjordan's main street (Figure 8). It is also the home of *Walnut Books*, the online specialist in books on sustainability, permaculture, green building, and environmental issues. *E-VINE* (Village Internet Network Engineering) provides Internet and telephone services to ecovillage residents. *FEASTA* is a non-governmental organization committed to studying and

promoting the economics of sustainability. *Red Gardens* is a project developed and managed by a member for the purpose of exploring diverse ways of growing food. Finally, the *Cloughjordan Community Farm* provides seasonal food to over 70 members in the Cloughjordan area [43].

4.7. Common-Pool Resources

SPIL is planning the development of a Community Center and of a Business Enterprise Center, which will be used as common areas. As such, they would fall under the category of Commons-based peer production inasmuch they constitute shared resources self-managed by the community for collective and individual purposes. However, due to financial constraints, it has not been possible to build any of these communal buildings thus far. At the moment, the only common areas in the ecovillage are the areas between the houses, the farm, the woodland and the allotments, which are self-managed as Common-pool resources by the community members as described above (4.4).

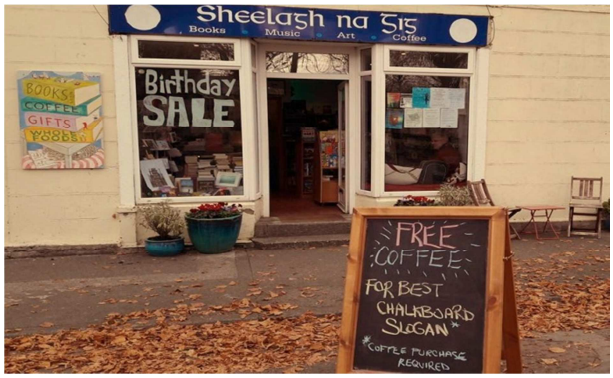

Figure 8. *Sheelagh na Gig: Bookshop and Coffeshop.*

5. Assessing Sustainability and Resilience in the Cloughjordan Ecovillage

In contrast to the weak sustainability approach of the neoclassical environmental economics, the Cloughjordan ecovillage attempts to combine individual with collective interest in adopting a strong sustainability approach that addresses all three dimensions of sustainability: environmental, social and economic.

The evidence of the resilience of the Cloughjordan ecovillage in becoming a sustainable and low-carbon community derives from measuring its ecological footprint (EF), which is widely accepted today internationally as a method of quantifying the amount of carbon emitted by a household through measuring energy consumption, waste assimilation, food and water consumption, built land area and travel impacts. In mid-2014, the Center for Environmental Research at the University of Limerick conducted a survey for measuring the EF of communities in the region. The survey was distributed to all households in the ecovillage to aggregate data. The results showed an EF of 2 global hectares (gHa), the lowest recorded in Ireland. One gHa represents the average productivity of all biologically productive areas on Earth. The average for 79 other settlements included in the study was 4.3gHa. Globally, it is estimated that the maximum EF for each human being is 1.8 gHa. In comparison, the EF for an ecovillage resident is 1.1 gHa [43].

From a socio-economic perspective, the Cloughjordan ecovillage represents an exemplary application of an interdisciplinary, ethics-oriented and transdisciplinary sustainability science, engaging a multitude of institutional actors (EU, State of Ireland, University of Limerick, commercial banks, ethical funds, cooperatives, groups, communities) in the creation of a sustainable and resilient socio-economic model. However, the ecovillage is struggling to adapt and recover from the housing crisis. 47 sites remain still unsold and a number of residents face difficulties in paying their mortgages and meeting their needs. But, despite the financial and operational difficulties the ecovillage has faced due to the economic downturn of the last decade, it has proved resilient enough to self-organise and sustain a community living in a healthy and humane environment. The ecovillage is currently setting up a business strategy to address its challenges. There are plans for rental accommodation, social housing and co-housing that may help solve the problems the ecovillage is facing. The ecovillage has the ambition to further experiment with upcoming models of the collaborative economy such as platform cooperativism and Blockhain-based open value systems.

What distinguishes the Cloughjordan Ecovillage from other ecovillages globally is its delicate balance between eco-social and technological innovation [43, 52]. In general, the Cloughjordan ecovillage is a notable case of rural sustainability and resilience in the collaborative economy, which expands on Commons-based peer production on the model of DG-ML, enhanced by digital platforms and open source technologies. The residents, of course, acknowledge that their vision of the ecovillage has yet to be fully realised. The whole project is a work in progress. Further effort and support is needed to accomplish the initial goals of the ecovillage and create a more robust network connecting rural with urban sustainability on a mission to establish a broader collaborative economy in Ireland and globally.

6. Conclusion

This paper investigated the Cloughjordan Ecovillage, which showcases the collaborative economy in Ireland. It offered an introduction to the key features of the ecovillage. The Cloughjordan Ecovillage promotes sustainability and resilience through consensus-decision making, renewable energy production, green building, community supported agriculture, biodiversity, organic farming, open source technologies and social entrepreneurship.

The research showed that the Cloughjordan Ecovillage is a notable case of a strong sustainability approach, which, contrary to the dominant neoclassical paradigm, combines individual and collective interest with the aim to tackle climate change on the basis of community living. During the

years, the Cloughjordan Ecovillage has evolved into an institutional ecosystem that corresponds to all three dimensions of sustainability. It comprises a number of institutional actors (EU, State of Ireland, University of Limerick, commercial banks, ethical funds, cooperatives, groups, communities) in the creation of a socio-economic network that constitutes an inter/multidisciplinary and ethics-oriented sustainability science. From a purely ecological viewpoint, the Cloughjordan Ecovillage has been widely recognized as a leading European project in the creation of a low-carbon future. Its ecological footprint is the lowest recorded in Ireland. Globally, it is estimated that the maximum EF for each human being is 1.8 gHa. In comparison, the EF for an ecovillage resident is 1.1 gHa.

The ecovillage expands furthermore into Commons-based peer production on the model of Design Global-Manufacture Local, as applied in the GROW project, intended to create a citizen science observatory for environmental purposes. It utilizes digital platforms and open source technologies on a mission to further experiment in the future with platform cooperativism and Blockchain-based value systems.

Further effort and research is called for to build on the success of the ecovillage thus far and contribute towards the accomplishment of the goals set by the organizations active in the whole ecosystem. To this end, the ecovillage needs to create a more robust network connecting rural with urban sustainability on a mission to establish a broader collaborative economy in Ireland and globally.

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