Commons-based peer production for degrowth? - The case for eco-sufficiency in economic organisations

Ben Robra [a],*, Pasi Heikkurinen [b], Iana Nesterova [c]

[a] *Sustainability Research Institute, School of Earth and Environment, University of Leeds, LS2 9JT Leeds, United Kingdom*
[b] *Department of Economics and Management, Faculty of Agriculture and Forestry, University of Helsinki, Finland*
[c] *Independent Researcher, United Kingdom*

ABSTRACT

Degrowth advocates radical reduction in society's matter-energy throughput. Organisations have received little attention in this discourse. In the context of sustainability much emphasis has been put on the concept of eco-efficiency, disregarding the rebound effect. In contrast, eco-sufficiency emphasises producing and consuming enough. This article operationalises eco-sufficiency as an indicator for degrowth and focuses on how eco-sufficiency orientations manifest in a commons-based peer production organisation. The studied case of WindEmpowerment shows only marginal manifestations of eco-sufficiency in its orientation. Commons-based peer organisations must actively aim to reduce matter-energy throughput by adopting an eco-sufficiency orientation to fit degrowth.

1. Introduction

The evidence that the biosphere sets boundaries on human activity (e.g. [68]) signifies that economic growth and current levels of economic activities are not sustainable (by this we mean cannot be prolonged or sustained into the future). To be sustainable current matter-energy throughput of economies and society as a whole must reduce [42,44]. Matter-energy throughput is the metabolic flow which starts with low entropy resources from the natural environment and ends with high entropy waste back into the natural environment [19]. In the time relevant to humans, this flow moves only in one direction, and hence it can be considered irreversible. In-between the input from the environment and output back into it stands society. Matter-energy throughput therefore comprises all resources and energy travelling through society, mainly in the form of economic activity [67].

Economic growth is associated with increasing matter-energy throughput [44]. In order to secure diverse life on Earth, economic activity must be in line with the absolute limits imposed by the biosphere. This signifies that the matter-energy throughput of humans and their societies on the planet must reduce. The precondition of matter-energy throughput reduction for sustainability has led a number of scholars to investigate and imagine socio-economic systems without economic growth (see e.g. [18,22,23,42,79]). While the focus in the post-and non-growth research fields has been mainly on the macro level [35], the micro level, such as organisations, have received less attention [23,72].

Amongst post-growth visions, the call for 'degrowth' is arguably the most radical approach to transforming how human activities and society are organised. A central aim of the degrowth movement is to reduce matter-energy throughput, while increasing human well-being [67]. This is envisioned as a concrete utopia achieved through the transformation of both society and human interaction with the natural environment [44,56]. Degrowth as a field of study has received increasing scholarly attention in the context of potential non-growth or post-growth societies [45]. Despite the call for degrowth having "many implications for management studies and organizations" ([72], p. 1), research on organisations has been marginal. It is critically important to study economic organisations as they influence, and according to Rifkin [66] define, how society produces. So far, organisational efforts in terms of sustainability have been largely reformist [37] in the sense that an attempt is made to make inherently unsustainable practices 'more sustainable', that is, sustainable in relative terms (see [46]).

Current attempts to tackle sustainability on an organisational level focus on eco-efficiency, which exemplifies the reformist approach [40]. An eco-efficiency orientation means producing one unit of a good with fewer resources, energy, and less waste (see e.g. [24]). A reduction in resources also means a reduction in cost per unit. Porter and Kramer [65] argue that eco-efficiency should be adopted to ensure competitiveness. Such a drive for profit and ultimately growth to create even further profit is the reason for the rebound effect when focusing on eco-efficiency in economic organisations [77]. The rebound effect means less reduction than predicted through the efficiency improvement due to

increased overall production driven by the growth imperative. Through the reduction in cost due to the efficiency improvement overall increases in production levels can result in absolute higher resource use (i.e. backfire) [4,23].

While cleaner production is a central tenet for sustainability, an orientation that could revolutionise organisations and address the rebound effect is needed to complement qualitative improvements (see [15,38]). In comparison to eco-efficiency, eco-sufficiency is an orientation that focuses on the overall level of production by emphasising 'enough production' (i.e. sufficient levels). 'Enough' relates in this context to sufficient fulfilment of human needs. By addressing the absolute amount of production, matter-energy throughput is also addressed. Somewhat paradoxically, this means a focus on eco-sufficiency is necessary to make production sustainable, even if the sufficient amount is difficult to determine, be that on a macro or micro level. Even within a degrowth society certain economic organisations and some economic sectors, such as renewable energy, could be allowed to grow to an extent [17], as long as the overall amount of production reduces.

Alternative modes of organisation to business-as-usual are of high importance to the required society-wide paradigm shift that the degrowth movement envisions [17,44,56]. In previous literature, peer production is claimed to be such an alternative [7,53]. It has emerged as a promising and novel mode to produce goods and services since the broad adoption of the internet [11]. In peer productions, contributors freely develop and advance a product by making their knowledge available to other contributors. According to Bauwens [7], peer production could even be considered the harbinger of a new political economy. While Rifkin [66] goes as far as to argue that it could mean the end of capitalism. In this article, capitalism refers to the current societal structure of capital accumulation through profit maximisation resulting in growth and increases in matter-energy throughput [28,70,77].

Peer production differs from the conventional mode of production in being based on knowledge networks and, through the internet, digital knowledge commons, where contributors share their knowledge freely to invent and develop products [11]. Importantly for degrowth, the motivation for partaking in peer production usually relates to social and intrinsic drivers rather than materialistic and monetary incentives [9,10,73]. The future profit incentive of innovation is commonly seen as one of the main drivers of economic growth and the rebound effect [77]. Of particular interest here is commons-based peer production where the created knowledge is regarded as a commons [9]. This means that knowledge is not retained in the form of a patent to make a profit but is instead freely available.

The characteristic of innovation not driven by profit incentives has led Kostakis et al. [53] to suggest that commons-based peer production could be 'neutral' in relation to economic growth and has the potential to challenge the current unsustainable socio-economic system. However, such neutrality does not automatically mean that commons-based peer production organisations might not be keen to grow or indeed adopt eco-sufficiency orientations. The empirical link between commons-based peer production and degrowth is still weak, especially as economic production in the socio-economic structures of capitalism is heavily prone to the rebound effect and backfire. This article aims to empirically investigate the theoretical link between these organisations and degrowth further. It aims to answer the question whether, and if so, how eco-sufficiency orientations manifest in a commons-based peer production organisation. This article seeks to highlight the potential connection of commons-based peer production to degrowth on an organisational level which has not been investigated thus far. The article therefore goes beyond the previous investigation of commons-based peer production's connection to degrowth on the production level (see [53]). This will illuminate how commons-based peer production contributes to and can further contribute to degrowth.

The remainder of the article is organised as follows. The next section will outline the theoretical background that links peer production through the notion of eco-sufficiency to degrowth (Section 2). This is

followed by a qualitative case study description from the renewable energy sector (Section 3). The findings are presented (Section 4) and critically discussed by comparing these to the theoretical background while also connecting this to other literature (Section 5). Lastly, conclusions, limitations, and further research potential are addressed (Section 6).

2. Theoretical background

2.1. Degrowth

The pursuit of economic growth is the main cause of environmental degradation and climate change [23,41], and arguably must come to a halt to attain a state of sustainability. This article uses the definition of sustainability proposed by Goodland and Daly ([32], p. 1002): "[to] keep wastes within assimilative capacities; harvest within re-generative capacities of renewable resources; deplete non-renewables at the rate at which renewable substitutes are developed." Accordingly, this article assumes the need for strong sustainability [15,39]. Under the assumption of strong sustainability, natural and human-made capitals are substitutable to a very limited extent [32,59]. In other words, natural capital cannot be endlessly transformed into human-made capital as the functions of natural capital cannot fully be substituted by human-made capital. Any socio-economic system building on economic growth fails to achieve sustainability, as growth builds on increasing matter-energy throughput by means of increasing the amount of transformation from natural capital to human-made capital. Hence, under the assumption of strong sustainability, economic growth needs to decrease to maintain the required level of natural capital [20,23].

The degrowth movement builds on these assumptions and can be viewed from various angles, as a framework, movement or a paradigm. Degrowth has many focus points including the economy, politics etc. [17,55]. Regardless, all its perspectives share the precondition of a reduction in matter-energy throughput [67]. Ultimately, degrowth aims to completely transform the socio-economic system so that a sustainable degrowth society can be achieved [44,56]. In this article, degrowth is therefore treated as an approach to achieve a sustainable society by reducing matter-energy throughput.

Recently the ideas of degrowth have received considerable attention in the field of ecological economics [35]. While there are insightful studies in the fields of corporate responsibility [37], business ethics [14], and entrepreneurship [75], the degrowth lens has been applied only marginally on the organisational level of analysis (see e.g. [34,47]). Despite the term 'sustainability' having made its way into the majority of businesses [59], and being taught in business schools, many scholars criticise the notion of corporations bearing responsibility for helping improve social equality (such as [6,30]) or sustainability (such as [24,59]). The criticism boils down to the claim that the so-called responsibility agendas are still largely driven by duty towards shareholders' profit maximisation and pursuit of economic growth [31,76] within capitalist structures [6]. Scholars like Gilberthorpe and Rajak [31] have been sceptical of the idea of a 'win-win' situation where profits can be attained and growth delivered, while achieving social and sustainable goals (see e.g. [43,65]). Thus, this notion has been described as both unrealistic [33] and potentially harmful to social causes and the environment [24,59].

2.2. Eco-sufficiency orientation

Dyllick and Hockerts [24] argue that the business case as an approach to sustainability in organisations is inadequate owing to its emphasis on eco-efficiency. Young and Tilley [83] build on this critique and develop sustainable entrepreneurship by introducing an eco-effectiveness approach that goes beyond eco-efficiency. This article complements these approaches by investigating eco-sufficiency as an organisational orientation in relation to degrowth. Sufficiency represents the idea of producing and consuming enough [3]. As such eco-sufficiency is

about producing and consuming only what is needed [38]. This would mean that consumption and production levels would decrease in absolute terms in comparison to the current over production/consumption of society. Hence, reducing matter-energy throughput. In contrast, eco-efficiency aims to reduce resources/energy used per unit. This does not address overall production and consumption levels and leads to the rebound effect in the socio-economic setting of capitalism [77]. Under the growth imperative of capitalism, eco-efficiency counters reductions in production/consumption through the rebound effect and even intensifies natural degradation [4,70].

From a strong sustainability perspective, a society and organisations merely orientated towards eco-efficiency fail to achieve sustainability [15]. This means that eco-sufficiency orientations become crucial in achieving sustainability; when an organisation or society decides to consume less and only uses what it requires (i.e. sufficient consumption/production), natural degradation would be reduced [24]. It is important to note that eco-efficiency orientations can contribute to reaching sufficient levels of consumption/production by reducing the resources/energy per unit, but only if in complement to eco-sufficiency [38]. That is, if eco-efficiency is prevented from causing the rebound effect, it is conducive to sustainability. Coupled with an eco-sufficiency orientation, eco-efficiency could be used to produce less resource intensively if overall production is not increased but decreased. Thus, a focus on eco-sufficiency can be considered a required step beyond eco-efficiency.

Despite the high emphasis on eco-efficiency in organisational studies interested in issues of sustainability [59] and only marginal focus on eco-effectiveness [83], there are substantial gaps in regards to eco-sufficiency. As the eco-sufficiency orientation is in line with the assumption of strong sustainability and degrowth, it calls for reductions in the quantity of production, not only improvements in its quality [38]. It is therefore clear that an economic organisation pursuing eco-sufficiency must be willing to 'sacrifice' potential profits and growth by producing less. Particularly, if coupled with eco-efficiency where the reductions in cost must not be utilised to increase production in absolute terms. This could explain the minimal attention to the topic as such a notion is incompatible with the conventional mantra of growth and profit maximisation. It is nonetheless vital to understand how eco-sufficiency manifests in economic organisations.

Similarly, organisational forms suited for a degrowth society need to abstain from the notion of profit maximisation driving economic growth [44,77]. Thus, researching organisational forms that are not automatically inclined to maximise their profits, or indeed do not have profit maximisation as an organisational aim, is essential. On the one hand, it shows that current 'sustainability' approaches within the corporate responsibility discourse are simply not enough as well as not fit for purpose as profit maximisation is not addressed. On the other hand, this means that it is very unlikely to find traditional businesses in a capitalist economy that would fit such a purpose as traditional businesses reproduce the dynamics of capitalism via capital accumulation and profit maximisation.

2.3. Peer production

Peer production is a mode of production in which contributors freely share their knowledge and ideas. This allows other contributors to build on that knowledge and to modify these ideas in accordance to their local needs and requirements, re-sharing this knowledge again [11]. This creates a somewhat endless pool of knowledge that gets constantly re-shared and re-shaped. Most significant is the fact that this form of innovation and knowledge creation can take place without a clear profit incentive but rather through intrinsic, non-monetary motivation [9]. This does however not mean that peer production organisations are automatically not for profit or do not seek to grow.

Perhaps the most well-known peer production is the operating system Linux, which is free of charge and maintained and developed by

volunteers around the globe. According to Benkler ([10], p.91), "peer production is the most significant organizational innovation that has emerged from internet-mediated social practice". Benkler ([11], p.60) defines it as:

> a new modality of organizing production: radically decentralized, collaborative, and non-proprietary; based on sharing resources and outputs amongst widely distributed, loosely connected individuals who cooperate with each other without relying on either market signals or managerial commands.

As explored in Section 2.1, degrowth implies reduced matter-energy throughput which also translates to abstaining from profit maximisation. Peer production is different to conventional forms of production, as its decentralised nature does not require a clearly defined hierarchy for production [71]. Kostakis et al. [53] see a potential in this mode of production that could help shift society towards a degrowth socio-economic system. To understand this potential, it is important to underline the fact that peer production can be differentiated by two forms, firm-hosted peer production and commons-based peer production [10]. At its simplest, the main difference is whether knowledge property is separated from governance. Under firm-hosted peer production, property of the good is retained by the firm through clear property rights, whereas in commons-based peer production property rights are often not clearly defined and rely on the concept of property commons presented by Ostrom [5,10,11,71]. There is however a difference, as Ostrom [63] speaks of tangible resource commons, whereas commons-based peer production is largely associated with the idea of digital knowledge commons [29,71]. This also means that the concept of open-source is often associated with peer production [11].

Kostakis et al. [54] add that commons-based peer production can go beyond the digital sphere by designing globally and manufacturing locally (DGML). This means digital knowledge commons are created globally and used for tangible local production through for example, new 3D-printing technologies [52]. DGML and the non-profit orientation have led Kostakis et al. [53] to argue that commons-based peer production organisations could in fact help to deliver degrowth. In theory at least, commons-based peer production has several advantages over conventional modes of production in adopting strategies of degrowth [34,53]. Commons-based peer production has the potential not to be driven by market forces, such as prices or supply and demand, but instead rely on intrinsic motivation and local needs [12,21]. Kostakis et al. [53] further argue that commons-based peer productions are not driven by profit and are indifferent to economic growth. Economic organisations with this mode of production are thus arguably better equipped for an orientation without and beyond economic growth.

Peer production is claimed to have another vital advantage regarding the reduction of throughput. With the advent of the 'prosumer', consumption and production are far closer to each other and are in most cases embodied in one and the same individual [49,66]. This signifies that the responsibility for reduction is shared between producer and consumer. Arguably, this could facilitate interventions to reduce overall matter-energy throughput by transcending the blame game between producers and consumers portrayed in the sustainable consumption literature (see [2,57,58]).

Adopting eco-sufficiency on an organisational level entails swimming against the current of orthodox economics, business beliefs, and norms of the socio-economic system of capitalism and growth. Due to the theoretical indifference towards growth [53], commons-based peer production is fitting to study in this context. The reduction of consumption/production levels to sufficient levels will also mean reductions in matter-energy throughput. Eco-sufficiency can therefore be taken as an indicator for degrowth.

It is critically important for the degrowth movement to research eco-sufficiency orientations in the context of commons-based peer production. In line with this, this article uses eco-sufficiency to operationalise degrowth in commons-based peer production organisations.

This article therefore investigates how eco-sufficiency orientations manifest in commons-based peer production organisations. As eco-efficiency can potentially support eco-sufficiency, the article investigates both eco-sufficiency and eco-efficiency aspects. However, any manifestation of eco-efficiency needs to be viewed critically and in connection to eco-sufficiency. If eco-sufficiency does not manifest enough, eco-efficiency aspects cannot help to achieve degrowth through matter-energy throughput reduction in this context. The next section introduces a methodology to study the case of WindEmpowerment [81], a renewable energy commons-based peer production organisation, to understand its potential to contribute to degrowth through eco-sufficiency.

3. Methodology

3.1. Case study

A single case study design was used to be able to understand the organisation in depth [61] and to answer the primary question of whether, and if so, how eco-sufficiency orientations manifests in a commons-based peer production organisation. As described in Section 2.3 this also includes understanding the manifestation of eco-efficiency to support an eco-sufficiency orientation. Case study research is a recommended method to answer how and why questions on contemporary events where control over events is not possible [1,80,82]. Moreover, the design is fitting to research questions relating to organisations [25,26,80]. Yin [82] emphasises that the use of a single case study can improve the likelihood of finding a case where the propositions and circumstances of the proposed study fit. Further, Ackroyd and Karlsson [1] argue that from a critical realist perspective, single case studies can reveal findings that may likely also be present in other places. This paper aligns with the critical realist stance of ecological economics advocated by Spash [74] as the topics of degrowth and strong sustainability can broadly be seen within ecological economics in the context of this article. From a critical realist perspective, insights derived from reality rather than purely via mathematical modelling are indispensable in understanding reality. Hence, data from real-life organisations reveal the operation of organisations as it unfolds rather than what is theorised, believed or imagined to be. When analysing the problem (i.e. of the manifestation of eco-sufficiency and eco-efficiency in the case study organisation as is the case within this investigation), this approach helps reveal the complexity of reality. This article therefore adopted an abductive logic in the case study commonly associated with critical realism [1].

Both an a priori theory understanding and strong criteria for case selection in line with the said theory understanding is needed to conduct case study research [1,80]. The operationalisation of eco-sufficiency and efficiency orientations to achieve degrowth by reducing matter-energy throughput assumed in Sections 2.2 and 2.3 represents the theoretical understanding. An organisation was sought that could specifically provide information on commons-based peer production and their orientation in terms of eco-sufficiency/-efficiency. The following four criteria where used to find an appropriate case.

1 The case needs to fit Benkler's [11] definition of commons-based peer production as this will, according to Kostakis et al. [53], make the case more likely to be neutral towards economic growth. This would also mean that the case organisation can arguably be more inclined towards an eco-sufficiency orientation owing to the supposed absence of a need for profit maximisation [77].

2 The case should employ the concept of designing globally and manufacturing locally (DGML) [54]. This would mean that the case has a more direct connection to energy and resource use, instead of an indirect energy use through the use of the Internet and digital appliances [36,51].

3 This further means a case not digitally based but digitally supported [71].

4 Further, the case should show a potential affinity towards sustainability through its main activities. The argument being that manifestations of an eco-sufficiency orientation would be more likely in such an organisation.

The search for a suitable organisation was carried out using the peer production directory developed by Salcedo et al. [71], as well as key previous research. Initially, two small-scale renewable energy organisations fit the above mentioned four criteria. However, after an initial pilot interview, one of the two potential cases was found to not include DGML as part of its organisational set up. This left the case of WindEmpowerment which fit the four case selection criteria outlined above. Further, the chosen case had the practical advantage of a wide range of potential and willing interviewees, as well as several websites that could be used for document analysis.

WindEmpowerment is an association of several organisations seeking to provide electrification through renewable energy in the form of small-scale wind turbines to rural off-grid communities [81]. The association's wind turbines are based on the work of Hugh Piggott, who developed several do-it-yourself (DIY) wind turbines and is also the founder of WindEmpowerment. The member organisations share their knowledge and best practices relating to small-scale wind turbines to become more effective at supplying rural electrification. The membership includes designers, researchers, manufacturers, and users of wind turbines, and comprises both for-profit and not-for-profit organisations. The peer production element of the association is this network for sharing knowledge on small-scale wind turbines. This knowledge is mainly open-source which further strengthens the peer production aspect. Individuals and other organisations can use the knowledge residing in the network to use and adapt the designs of the association to build wind turbines specific to their local needs and circumstances.

3.2. Data collection and analysis

After establishing contact with WindEmpowerment, snowball sampling or referral sampling helped to build further contacts to extend the number of interviewees in the case study [13]. Data collection involved conducting seven in-depth semi-structured interviews [78] with seven individuals from WindEmpowerment. The interviewees were board members of the association and/or founders or directors of the member organisations. The interviews were each 40 to 60 min long and were conducted using Skype, recorded and transcribed to allow for an in-depth analysis [69]. The questions of the interviews followed two themes, 'eco-sufficiency' and 'eco-efficiency'. The preceding was chosen as the main theme as its manifestation in the organisation represents the core focus of this article's investigation. The latter was also included as a theme to allow for its analysis in support of eco-sufficiency in line with the assumptions outlined in Sections 2.2 and 2.3 Further, eight web pages of WindEmpowerment and its member organisations as well as strategy documents of the association were used to collect data, allowing a qualitative document analysis [16].

In general, in-depth interviews have few standardised techniques for data analysis [8]. Coding interviews can help to find reoccurring themes [69]. In this particular case, however, the conceptual idea of eco-sufficiency was used as a theme. This means that the interviews and documents were analysed to find manifestations of eco-sufficiency orientations (this included eco-efficiency as a proxy to eco-sufficiency) within the case. Hence, the theme of eco-sufficiency was used for the abduction in the data analysis. The criteria for an eco-sufficiency orientation were kept broad to make it possible to operationalise degrowth through them. These eco-sufficiency criteria were:

1 Willingness to reduce production (directly and indirectly)
2 Willingness to reduce consumption (directly and indirectly)

Similarly, eco-efficiency criteria in the data analysis were:

1 Measures to increase efficiency in production

2 Measures to increase efficiency in consumption

Themes related to eco-sufficiency were identified and then compared to the theoretical insights. This made it possible to illustrate and analyse how and why eco-sufficiency orientations manifested in the case organisation. The findings can be best structured around four concrete themes that arose from the data analysis itself. Hence, manifestation and/or lack of eco-sufficiency orientations within the case organisation can be summed up under the following themes:

1 Overall organisational goal
2 Organisational structure
3 Production process
4 Consumption reduction

4. Findings

The findings derive directly from the analysis of the interviews. Interviewees were asked questions regarding their organisation's orientation and production process. Their answers reveal WindEmpowerment's manifestation of eco-sufficiency and eco-efficiency. These findings were further complimented by the analysed documents. The findings are structured in four clear themes which arose from the analysis of the interviewees' responses (as described at the end of Section 3.2). The remainder of this section is structured around these themes. Where applicable, the findings are complemented with direct quotes from the interviewees. Key findings are indicated throughout the following subsections, these are used for a summary of the findings at the end of this section.

4.1. Overall organisational goal

The aim of providing electrification via small-scale wind turbines is consistent throughout the entire association. All interviewees mentioned this as the overall main aim of their organisation, as well as of the umbrella association (key finding 1). Apart from the goal of providing electrification, the aim was to share knowledge and practices within the association to enable best practice in achieving this goal (key finding 2). One of the interviewees summed this up in the following:

Our goal is building small wind turbines based on the Hugh Piggott model; and so what we do as an association, is share those best practices, our difficulties, our struggles, what hasn't worked, what has worked, in the sense of how we deliver our projects or our work, what kind of technology we're using.

The primary goal of Wind Empowerment isn't to reduce carbon emissions as such because we primarily deal with quite small-scale wind power systems. So, the primary purpose of what we do is to provide energy to those who don't have energy access at present.

When asked about sustainability, many of the interviewees stated that sustainability, or provision of eco-friendly energy solutions, was not an overarching aim as such (key finding 3). One of the interviewees particularly mentioned that they were not under the illusion that their wind turbines could solve the climate crisis:

[…] I don't have any real illusions about building one's own wind turbine catering to all the world's sustainability problems. To be honest my motives are mixed. I'm really enthusiastic about renewable energy and so I enjoy doing it, it's a satisfaction from doing it even where it possibly doesn't provide the most sustainable or environmentally efficient solution. So, I'm not very good at selling the idea that building your own wind turbine is going to save the world or solve all our problems. But I do have some sort of ideals about environmentalism as well as just enjoying doing the technology and dealing with the challenges.

Another respondent mentioned that sustainability could be seen as a by-product of their projects, on the grounds that wind energy is a sustainable energy option (key finding 3):

What we do is sustainable in the sense that it is renewable energy technology but that's not our primary goal.

The interviewees saw their work more in terms of catering to social rather than to environmental needs. Similarly, some of the interviewees mentioned that the wind turbines often replaced diesel generators which would result in reduced CO_2 emissions. This was, however, seen more as an environmentally beneficial side effect of their work than as a particular goal.

When asked about sustainability of the association, one interviewee mentioned that the sustainable development goals (SDGs) were being discussed within the organisation at the time of the study (key finding 4):

We're currently trying to focus on how we align ourselves as an organisation or association with the sustainable development goals that the UN has set out. And the main one of those that we're always preaching is the energy access for all.

4.2. Organisational structure

The majority of interviewees stated that even though they were part of the association they had a great deal of autonomy in their decision making and over how to build their particular wind turbines (key finding 5). The association was mainly seen as a knowledge network that could be used and adapted according to local needs and specifications (key finding 6). Knowledge sharing was evident on various analysed webpages. Further, one of the interviewees stated:

So, you know, we use different types of technology as well. I talked about maintenance a little bit, so we kind of talk to each other in that sense, improving different ways of doing things, whether that's on the build processes or the installation processes.

Some interviewees also stated that they encouraged other member organisations to adopt more eco-friendly practices but said that not-for-profit members seemed more open to this message than for-profit members (key finding 6).

4.3. Production process

Some of the member organisations, particularly in countries from the Global North, focus on DIY workshops and educational courses. Other organisations see themselves more as manufacturers and service providers, especially for-profit organisations. Some of the member organisations specialise in building self-sustaining energy grids for rural communities in nations within the Global South. The practitioners from these organisations stated that they tried to involve the communities as much as possible in the projects to ensure the self-sustaining aspect. This meant focusing on local needs and requirements during production (key finding 10).

All the interviewees stated that they try to use recycled materials as well as renewable resources in the construction of the wind turbines but that it was not always possible (key finding 7). One of the practitioners focusing on projects in countries within the Global South said that they try to use local materials as much as possible instead of necessarily focusing on using more eco-efficient construction methods. According to this interviewee the aim was to develop a local value chain that could help the local community to prosper:

The only component of the turbine that we regularly import from another country or even from a nearby city would be the magnets and they're relatively small components. So, importing these is usually not too much of a big deal. But the structure of the metal tower for the wind turbine, the blades, and the nacelle; all of the above,

we try to source as locally as possible. And again, we don't do this specifically for sustainability; we do this to retain the value chain as locally as possible.

Another interviewee said the association encouraged the use of renewable or recycled materials in its workshops but also mentioned time constraints as a factor in opting for less eco-friendly materials (key finding 7):

To give you an example, we're casting the generator with resin, which is something from the chemical industry, and we're trying to reduce its use. But we found something more ecologically friendly but it's taking three days to dry. And the other resin takes half an hour to dry. So, for us it's not possible to use the environmentally friendly one during the workshop. But we have it in mind and if it's getting faster, for sure we'll take the environmentally friendlier way, even if it's more expensive.

Another organisational member mentioned cost as a factor in opting for less eco-friendly parts, if only a certain amount of funding was available for a project:

It's the case of what is the cheapest. How we can most efficiently use our budget. That's usually the way of it.

One of the interviewees publishing manuals and construction plans said they encouraged the use of sustainable materials, but that it was more applicable to publish construction manuals with generic materials and parts even when recycled options might be available. According to this interviewee it would then be up to the builders themselves to decide which parts and materials could be made from recycled scrap (key finding 8):

As the years went by, I found as you are actually describing how to build using scrap parts, from a vehicle for example, you can run into quite a lot of frustration with the readers not being able to get exactly the same things. The trouble is when you go to the scrap yard one day, you'll find one thing and you to a scrap yard another day in another country, you won't find that same thing. You'll find useful things… But really you can't describe in a detailed construction manual how to use whatever you can find, because it's going to be different in every case. So, in terms of my actual manuals for building small wind turbines, I've moved away from using recycled vehicle brake drums or whatever… I mean I do still encourage the use of vehicle wheel bearings because there are some pretty standard ones that I am able to put into the drawings and stuff. But it's better on the whole unfortunately to specify how to build things from new materials in order to be able to do so without frustration.

All the interviewees mentioned that they tried to assess the local need for a community before starting a new project. Several acknowledged that local human needs and the local situation were very important (key finding 10). Particularly in this context, they stated that they would discourage construction of the wind turbines if they believed it was not the most viable option. These interviewees said that they would encourage other renewable energy producing options such as solar and/or hydro instead, but never suggest people to refrain from producing energy (key finding 9).

4.4. Consumption reduction

When asked how they might encourage reductions in consumption, several of the interviewees mentioned that this was not on their agenda. Others specified that the process of building one's own wind turbine showed how much work goes into generating just a little electricity, an understanding that could lead to a greater appreciation of small amounts of electricity. According to these practitioners, this might trigger reduced electricity consumption amongst the individual constructors (key finding 11):

Well I think as much as anything, rather than actually reducing carbon emissions directly a lot of it is about changing people's perceptions. They're just given a chance to think a bit more about energy use. An appreciation of the numbers, appreciation of how valuable a small amount of electricity is compared to a large amount. For example, to appreciate how much effort goes in to producing electricity and to appreciate how much we've lost touch with our ability to actually do these things for ourselves and how much satisfaction you can get from doing them yourself. It's this sort of consciousness I would say that's been more the outcome of my work as more in terms of people's consciousness of the situation rather than the numbers of how many kilograms of CO_2 have been saved by making wind turbines.

Other interviewees mentioned that they actively encouraged more environmentally friendly lifestyle choices that meant less consumption during their workshops. For instance, by saving electricity, eating less meat, and reducing water usage (key finding 12):

I do encourage it, because it's cheaper, basically. I'm not a vegetarian, I've friends who are vegan, but at our workshops everything is vegan and it's strongly encouraged depending on the people.

When asked whether they thought other member organisations would also encourage such practices, they stated that these were more initiatives within their own organisation rather than initiatives that are encouraged across WindEmpowerment. When probed further on the areas of reduced consumption and production, even the interviewees supporting the aim of energy reduction, conceded that it is only a very marginal part of their agenda (key finding 12).

4.5. Summary of findings

Table 1 summarises the key findings under the four themes mentioned in Section 3.2 and shows their respective eco-sufficiency related findings. The key findings of Sections 4.1, 4.2, 4.3 and 4.4 correspond with the numerations in the table.

Overall, Table 1 shows that eco-sufficiency manifests only marginally within WindEmpowerment. Only a few interviewees of the association indirectly encouraged reduced consumption and production of energy. Hence, a few individuals did mention some of the aspects of eco-sufficiency (e.g. reducing consumption in one's life in general) but these did not seem to be organisational level aims. Within the aims of the association, sustainability in general plays a smaller role than the other aims. Rather, the main goal was clearly defined as providing electricity to off-grid rural communities and share knowledge. Further, consumption and production levels are generally not problematised. The member organisations in the case study could freely decide which manufacturing plans, materials, and techniques they used, as well as how much to produce. This meant that any potential eco-sufficiency practises were not guaranteed to be shared or adopted. The findings show that eco-efficiency (as the supporting second theme) was particularly present in relation to the production process. This is where eco-efficiency is clearly manifested within the association. However, through a lack of eco-sufficiency to prevent the rebound effect, a reduction of production and consumption seems unlikely. The emphasis on local needs and viable production shows signs of eco-sufficiency but seems to be outweighed by other aspects in the production process.

5. Discussion

WindEmpowerment as the studied case organisation, like many other producers, not only lacks a clear eco-sufficiency orientation, but a sustainability orientation in general. Heikkurinen and Bonnedahl [37] have previously problematised the lack of a sustainability orientation in organisations. Kohtala [48] similarly emphasises the need to orientate towards sustainability in maker communities such as peer productions. The missing sustainability-related orientation has a profound impact

Table 1
Summary of key findings and related eco-sufficiency findings.

Theme 1 – Overall organisational goal	
Key findings	**Eco-sufficiency insights**
1. Aim to manufacture and supply small scale DIY wind turbines in order to electrify rural off-grid communities. 2. Aim to share knowledge on manufacturing/production process. 3. Sustainability is not seen as an aim as such within the association but as a by-product. 4. Aim to align the association with the SDGs	Amount of production and consumption is not problematised in the aims of the organisation. Reductions in both are essential for eco-sufficiency.

Theme 2 – Organisational structure	
Key findings	**Eco-sufficiency insights**
5. Members are autonomous in decision making. 6. Members have freedom in regards to what knowledge they adopt/share in accordance with local needs and requirements.	Autonomy of members can potentially harm organisation wide adoption of eco-sufficiency. There is no guarantee that eco-sufficient practices are adopted.

Theme 3 – Production process	
Key findings	**Eco-sufficiency insights**
7. Intention to use recycled materials and renewable resources. 8. Constraints in published construction material to encourage recycled materials due to loss of applicability. 9. Recommendation of alternatives (e.g. hydro or solar) if wind energy is not a viable option. 10. Emphasis on local needs and requirements during projects.	Use of renewable and recycled materials represent a manifestation of eco-efficiency. This can potentially support eco-sufficiency. However, without clear eco-sufficiency manifestations there is no safeguard against the rebound effect. Emphasis on local needs as well as discouraging production if not viable can be aligned with eco-sufficiency. This can represent reductions in production as well as consumption.

Theme 4 – Consumption reduction	
Key findings	**Eco-sufficiency insights**
11. Personal construction of wind turbine might lead to better understanding/appreciation of energy production process – potentially resulting in reduced energy consumption. 12. Partial encouragement of less consumerist life-styles during workshops.	Reduction of consumption levels have a key role to play in eco-sufficiency as these would represent a direct reduction in matter-energy throughput. However, the indirect potential of reduction is no guarantee of actual manifestation.

on the activities within the organisation. In the case studied, the lack of eco-sufficiency orientations signified that an increase in matter-energy throughput was not problematised. Although the organisation did elicit a limited exchange about 'more sustainable' activities and a very marginal eco-sufficiency orientation, such discourses seemed to be particularly restricted to not-for-profit organisational members. Further, most sustainable practices focused on eco-efficiency measures rather than the reduction of used resources and energy on a whole. This is very similar to the findings Kohtala and Hyysalo [50] present in the context of maker communities in general. The authors [50] argue that if sustainability considerations were made in these communities that the focus would heavily be on technology in the form of eco-efficiency. Without eco-sufficiency playing an essential part in organisational aims, commons-based peer productions offer another means of organised activity but do not question organisational ends. Similarly, without an orientation of eco-sufficiency, resource use per unit may be addressed in production, but not in terms of absolute reductions [38].

The potential of peer production as an alternative mode of organisation and its utilisation of digital commons as a solution to the climate crisis might be overstated owing to its emphasis on means rather than directing attention to the ends it is to serve. For degrowth, it is important not only to change the mode of production in terms of quality, but also in terms of quantity. Ossewaarde and Reijers [62] go as far as to argue that it is a fallacy to believe that digital commons could lead to alternative

economies, which could challenge the growth paradigm and capitalism. However, such a perspective fails to acknowledge that digital commons are not the harbingers of an alternative to growth system, but more closely resemble a platform that might enable such a shift [51]. Similarly to avoiding digital solutionism and a techno-fix mentality [36], it is important to understand that commons-based peer production is not a harbinger to the climate crisis in itself. It is a question of how the platform provided by digital commons and the mode of organisation that is commons-based peer production is utilised. In the case of WindEmpowerment, sustainability in general was regarded more as a by-product of the organisation's actual aims. This echoes Kohtala's ([48], p. 375) findings in regard to makerspaces where "[e]nvironmental issues were intertwined with other ideological concerns, but they were rarely promoted in their own right"; further emphasising the need for environmental orientations to come to the fore. Commons-based peer production does not translate into an automatic adoption of eco-sufficiency orientations if the aims and goals of the organisation are not aligned with it. Indeed, Benkler [10] argues that peer production should be incorporated into more traditional business models to drive economic growth through increased efficient innovation. This means if growth and profit maximisation are the aim of an economic organisation peer production could help to achieve this.

Commons-based peer production can be utilised as a means for degrowth, but this requires the adoption of an explicated and operationalised eco-sufficiency orientation. However, as the studied case also

demonstrated, even in very alternative modes of organisation, such as a commons-based peer production organisation, an eco-sufficiency orientation is not automatically adopted. It is important to understand that commons-based peer production organisations are still embedded in a highly influential and complex socio-economic system. That is, socio-economic structures of growth-based capitalism where profit maximisation and capital accumulation are desired and rewarded [27,70,77]. Eco-sufficiency orientation's key insight of 'enough' is in stark contrast to capitalism's concept of more in form of infinite growth. The adoption of eco-sufficiency as an aim seems implausible in the socio-economic structures of capitalism. This implausibility, however, does not deny the absolute need for a shift to an eco-sufficiency orientation to reduce matter-energy throughput. It is therefore vital to understand the barriers and enabler for such a shift in organisations.

It might be easy to point the finger at the socio-economic structures of capitalism as the barriers to adapting an eco-sufficiency orientation, but a more nuanced analysis is needed. Even though commons-based peer production organisations are not the harbingers of societal shifts that will achieve degrowth through eco-sufficiency, they have a role to play [44]. Although organisations could be considered more influential than individuals [2], this does not mean that organisations operating in a niche have the necessary power to make the whole of society degrow in terms of matter-energy throughput. This is not to say that commons-based peer production organisations should not help to shift norms, but their limitations should be acknowledged. Caution concerning claims to have discovered a silver bullet should equally be exercised. To consider, as Rifkin [66] does, that solely the emergence of the necessary new modes of production will shift society might be to disregard the complexity of social systems and their structures [64]. Commons-based peer production organisations thus have to work in combination with other leverage points in the socio-economic system to bring about paradigm shifts and reduce matter-energy throughput [56,60]. The adoption of eco-sufficiency aims is a necessary start.

6. Conclusion

This article investigated the potential of commons-based peer production to contribute to degrowth in terms of matter-energy throughput reduction. Eco-sufficiency was used in this context as an indicator for degrowth. The article therefore focused on whether, and if so, how eco-sufficiency orientations manifested within the commons-based peer production of WindEmpowerment. Data was collected through in-depth interviews with members of the association as well as document analysis of various webpages and decision documents provided by the association. While this article's research method afforded access to a real-life organisation, thus part of social reality, it should be noted that it also imposed a limitation. This is to say that findings are specific to this case, and further research is still needed in comparable organisations to enhance our understanding of the link between commons-based peer production and degrowth.

The findings emphasise the conclusion that eco-sufficiency orientations manifested only marginally in the studied case, if at all. Manifestations of eco-efficiency orientations were more prominent. However, without an eco-sufficiency orientation, which may prevent the rebound effect, alternative modes of organisation would be unable to lead to absolute reduction in matter-energy throughput.

This article found that an interest in or an affinity towards sustainability does not necessarily translate into sustainability. While commons-based peer production organisations might theoretically be more likely to be able to contribute to degrowth, they are by no means a silver bullet. In other words, it is inadequate to change the means to commons-based peer production unless organisational orientation in terms of sustainability is also reframed. The article hence proposes that commons-based peer production organisations have the potential to contribute to degrowth if organisations adopt an explicit eco-sufficiency orientation to reduce matter-energy throughput.

It is however cautioned that an organisational focus on eco-sufficiency orientations means going against the principles of the current socio-economic system of growth-based capitalism. It is vital to understand how organisations might adopt eco-sufficiency in a complex system geared towards the opposite. Future studies should therefore look at barriers and enablers for adopting an eco-sufficiency orientation in commons-based peer production organisations, as well as consider what is actually 'sufficient'. Further, the changes required to societal structures to facilitate such a shift also need to be scrutinised and better understood in this context. Identifying those changes and the circumstances required for eco-sufficiency to be implemented, require further studies of economic organisations embedded in social systems and in relation to degrowth. Nevertheless, the current study represents a much-needed step in the conversation on organisational forms and modes of production within the field of degrowth.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

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