International Journal of the Commons

Prosuming Alone or Together: A Bisectoral Approach to Conceptualizing the Commons Prosumer

RESEARCH ARTICLE

CHRISTIAN RITZEL
STEFAN MANN
VERENA VAN ZYL-BULITTA
*Author affiliations can be found in the back matter of this article

ubiquity press

ABSTRACT

The aim of this study was to combine the concept of prosumerism with the theory of the commons to develop the concept of commons prosumer (co-prosumer) in distinction to private prosumer (p-prosumer). While the p-prosumer prosumes for himself, the co-prosumer creates a social environment for social capital. We use energy and agriculture as two cases in point to illustrate that the concept of the prosumer's role appears in different contexts with varying attributes such as self-efficacy, sufficiency, or autarchy. However, independence and socially fragmented structures might lead to less resilience, whereas dependence structures could confer collective benefits. We propose a building block to fill the gap in the prosumer setting and balance individual and collective interests. By positioning the p-prosumer on a commons-based foundation, we make more explicit the dependence structures that build communities or networks to showcase possibilities that pave the way for shared and socially innovative structures of self-empowerment for infrastructure decision-making at different levels.

CORRESPONDING AUTHOR:
Christian Ritzel
Agroscope, CH
christian.ritzel@agroscope.admin.ch

KEYWORDS:
commons economy; conceptual combination; energy system; agricultural system

TO CITE THIS ARTICLE:
Ritzel, C., Mann, S., & van Zyl-Bulitta, V. (2022). Prosuming Alone or Together: A Bisectoral Approach to Conceptualizing the Commons Prosumer. *International Journal of the Commons*, 16(1), pp. 295–309. DOI: https://doi.org/10.5334/ijc.1185

1. INTRODUCTION

Since Toffler (1980) introduced the concept of prosumers, who produce and consume a specific good, changes in production and consumption behaviors towards prosumption have been observed. In the recent decades, prosumption activities in the agricultural and energy sectors have become highly popular (Chen et al. 2018; Jerome, 2017), leading to a potential societal transformation from a "commodity regime" to a "commons regime" (Byrne et al., 2009), fostering peer-to-peer (P2P) and new socio-technical frameworks that come with new ecosystems of value creation (Bauwens, 2019). While individual prosumption such as home gardening or energy supply supposedly fulfills purely individual needs, collective (community-based) and self-organized prosumption activities such as community gardening (CG) or energy neighborhoods (ENs) are aimed at sharing food, energy, or storage capacities among the members of a given community (Kathryn et al., 2012; Lombardi & Schwabe, 2017; Mengelkamp et al., 2018).

Within the collective and self-organized prosumer collectives, common-pool resource management principles appear to be manifested (Lerch, 2009; Ostrom, 1994). On the basis of shared social norms, reciprocity, trust, and self-generated rules, a limited number of agents (prosumers) may provide (prosume), in addition to food and energy, sustainability functions such as community building or ecosystem services. The sustainability functions of prosumption activities may overreach system boundaries by generating positive effects on society. These hypotheses motivated the authors to expand the prosumer's scientific horizon by combining the concept of prosumerism with the theory of the commons to develop the concept of commons prosumer (co-prosumer) in distinction to private prosumer (p-prosumer). Choosing a mesoeconomic perspective that acknowledges the importance of sectoral differences, we selected two elementary but different sectors for this task:

- energy, which is always the platform for most research about prosumers, and
- food, which has been the foundation of prosumption for centuries (Toffler, 1980).

Selected case studies in the energy and agricultural sectors, such as home energy supply, ENs, home gardening, and community-supported agriculture (CSA), were identified through a literature review and then linked to the concept of the prosumer (i.e., individual/private vs. collective). In this context, the main aim of this study was to highlight case studies that demonstrated commons-based prosumption. Both food and energy are necessary to supply our basic needs. Therefore, they are convenient test beds for examining the role of different kinds of prosumerism in creating a better and more sustainable economy. In this context, individual and collective prosumption activities have the potential to enable people to reclaim energy and food sovereignty (García-Sempere et al., 2019; Hoover, 2017; Menconi et al., 2016; Rodon et al., 2021).

Research about prosumers has been typically biased in favor of prosumption, whereas more skeptical colleagues have often ignored them. This led to the prosumer being described, often implicitly, as one who brings about innovation (Seran & Izvercian, 2014), provides common goods (Roulier, 2014), and reduces environmental degradation (Park et al., 2018). However, evidence that prosumers have systematically changed these realms for the better has been extremely scarce. By conceptualizing co-prosumers, we aimed to expand the research agenda in transition studies to contribute to the emerging scientific discussion on the post-capitalistic economy of the commons (Helfrich et al., 2010) to ask which prosumption is oriented toward collective management.

To answer this question, in Section 2, we present our methodological approach (Subsection 2.1) and the development of the co-prosumer (Subsection 2.2). In Section 3, on the basis of selected case studies, we provide answers for the energy (Subsection 3.1) and agricultural sectors (Subsection 3.2). Section 4 highlights emerging patterns of prosumption by defining and conceptualizing the role of co-prosumers in comparison with the roles of consumers and p-prosumers. Finally, Section 5 presents our conclusions and the future direction of research on this topic.

2. COMBINING THE CONCEPT OF PROSUMERISM AND THE THEORY OF THE COMMONS TO DEVELOP THE CONCEPT OF CO-PROSUMER

2.1 CONCEPTUAL COMBINATION: COMBINING PROSUMERISM WITH THE THEORY OF THE COMMONS

On the basis of the fundamental works of Lambing (2012) and van Zyl-Bulitta (2019), the aim of this study was to refine the concept of co-prosumer. For this purpose, we systemically combined the concept of prosumerism with the theory of the commons by following the basic principle of conceptual combination (Figure 1).

According to Schubert (2021), the driving principle of conceptual combination is not that new concepts/theories are formed but rather that existing concepts/theories are combined in a novel fashion. Combining concepts is an

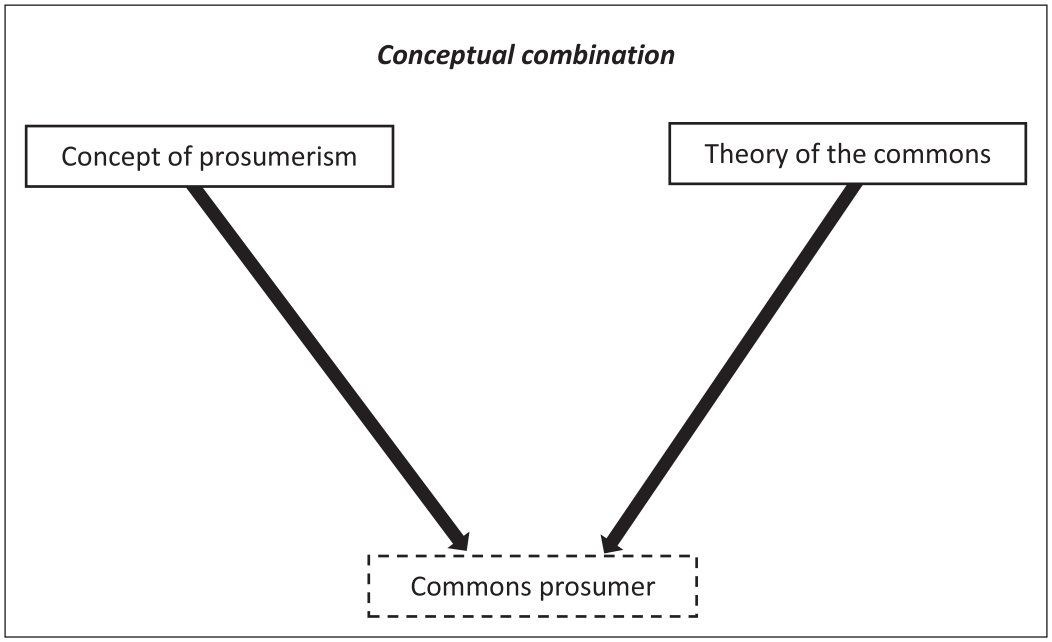

Figure 1 Combining the concept of prosumerism and the theory of the commons.

essential ability of humans, and various approaches have been developed to explain the mechanisms responsible for this ability (Wu & Barsalou, 2009). In this context, Kohn et al. (2011) argued that combining concepts/theories is a complex cognitive process resulting from creativity.

When we analyzed technological and organizational infrastructures and their resulting impacts on society and the environment of different energy production systems (van Zyl-Bulitta et al., 2019), we found that some prosumer-based energy production systems apply common-pool resource management principles. In subsequent discussions, we indicated that some prosumer-based agricultural production systems likewise apply common-pool resource management principles. This process led us to the idea of combining the concept of prosumerism and theory of the commons for the energy and agricultural sectors.

2.2 DEVELOPING THE CONCEPT OF CO-PROSUMER

2.2.1 Prosumption between individual and collective actions in the energy and agricultural sectors

The prosumption activities in the agricultural and energy sectors range from individual to collective action. Figure 2 presents stylized types of prosumption activities for (a) the level of transaction costs and (b) the level of cooperation between agents. The circle around "prosumer collectives" represents a continuum of various (collective) prosumption activities, whereby transaction costs and cooperation may represent overhead or inherent system properties that can be integrated into normal functioning to a smaller or larger extent.

In the individual prosumer household, as long as there is no need to cooperate with others, no additional transaction costs are incurred. By contrast, collectively organized prosumers are characterized by a high level of cooperation and resulting high transaction costs.

The arrow connecting the first and third quadrants in Figure 2 indicates that the invention and implementation of new technological innovations are likely to reduce transaction costs and affect the level of cooperation in collective settings. Internet of Things (IoT)-based smart technological innovations are comprised of a broad range of technology and software applications connected through local and global networks, partially relying on cloud-based data storage (Ji et al., 2014; Powells & Fell, 2019; Noura et al., 2019) and bearing the potential to foster participation (Helbing, 2013). Examples of such technical improvements include virtual biogas plants (Lansche & Müller, 2012), sensor-controlled robots (Kondo & Ting, 1998), virtual organizations using cooperative networks (Camarinha-Matos, 2016), and computer algorithms for complex optimization problems (Soares et al., 2014, 2016).

Table 1 compares examples of individual prosumption and collective sharing systems for food and energy. These range from the individual to the common provision of several infrastructure services for food and energy.

The articles referring to the case studies presented in Table 1 were searched via Google Scholar using i) simple search terms such as "zero energy building," "energy neighborhoods," "community supported agriculture," or "community garden," and ii) combined search terms such as "energy neighborhoods + peer-to-peer trading," "energy

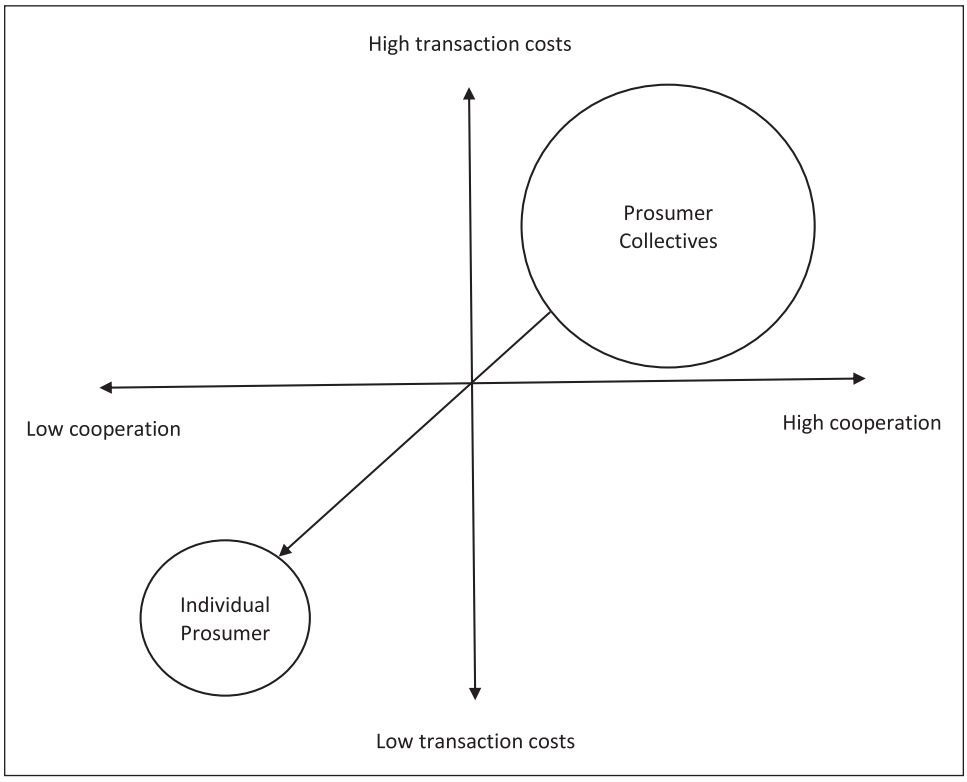

Figure 2 Stylized types of prosumption activities: between individual and collective action.

ORGANIZATIONAL FORM	ENERGY	AGRICULTURE
Individual	Home Energy Supply	Home Gardening
Collective	Energy Neighborhoods	Allotment Gardening
	Virtual Power Plants	Community-supported Agriculture
	Stromallmende (Electric Commons)	Community Gardening

Table 1 Case studies of individual and collective prosumption.

community + organization," "allotment gardens + rules" or "sustainability + community gardening." Publications for a detailed analysis were sampled during a two-stage process: First, we reviewed the title, abstract, and keywords to check whether the publication at hand was suitable for our purposes. Publications not suitable for our purposes were rejected. Second, we read the entire text of a publication to determine relevant text passages. The organizational aspects and sustainability functions of the selected case studies were then linked to the concept of the prosumer (i.e., individual/private vs. collective). In this context, the main aim of this study was to highlight case studies that demonstrated commons-based prosumption.

2.2.2 A brief outline on the theory of the commons

Prosumer collectives can be considered a potential social dilemma, particularly a give-and-take-some dilemma (Budescu & McCarter, 2012; Mariano & Correira, 2015). The dilemma (or tragedy) of the commons could be a result of low or no contribution of work effort or improper handling of resources on the one hand (the give-some production component) and disproportionate appropriation of production shares on the other hand (the take-some consumption component). The experimental game theory says that trust and reciprocity (Chaudhuri et al., 2002; Komorita et al., 1993) clearly defined rules for social and economic exchange (Szolnoki & Perc, 2009; van Dijk & Henk, 1995), and mechanisms to punish non-cooperative behavior (Niu et al., 2017; Van Miltenburg et al., 2014) can solve social dilemmas. This approach applies especially to the research undertaken by Ostrom (2015) that generated groundbreaking findings in the form of eight design principles[1] for a successful (self-organized) governance of the commons beyond markets and states. As soon as

institutions are developed in a self-organized manner, the assumed pure selfish behavior of the homo economicus (Frey & Benz, 2007) appears to find its behavioral corrective (Müller, 2012). However, in practice, governing the commons is sometimes not as straightforward as predicted by the experimental game theory and the field research conducted by Elinor Ostrom. The findings of Fabricius and Collins (2007) indicate that serious conflicts regarding the establishment of formalized decision structures or the design of conflict resolution procedures, especially in the early stage of a community project, can occur. Furthermore, maintaining long-term cooperation within communities represents a serious challenge owing to a lack of institutional innovation, investment in organizational capital, and recombination of capital assets (Lobo, 2021; Willis, 2012).

The associated social practice of sharing resources[2] such as food or energy, which is based on a self-organized development process of rules and norms for (non-commercial) collective prosumption, is called "commoning" (Helfrich et al., 2010). In the practice of commoning, the ownership of resources and rights to use them are associated with social relations and relationships to ecosystems, non-human life, and future generations (Helfrich, 2019). Another type of access and use in the form of "relational having" proposed by Helfrich and Bollier (2019) is flexible, adaptive, seasonal, and appropriate to the local social and cultural context. Thus, the principles that guide the commons economy are strongly influenced by the work undertaken by Elinor Ostrom on the successful collective management of common-pool resources (Beckenkamp, 2012). The domains from which agents originate affect the possible types of relationships, contracts, or coordinating mechanisms.

2.2.3 Comparison of p-prosumer and co-prosumer

A collectively organized citizen group for either food or energy might incorporate a format for services or functions from the commercial realm and still retain co-prosumption characteristics.

To further differentiate between p-prosumer and co-prosumer, a closer examination at their influences on society can be helpful. As we have established beforehand, co-prosumers share a similar mindset within their specific group. This is quite often an ideological or political point of view. Therefore, we could argue that their prosumption activity is situated not only in the reality of the market but also in a political system. To show the importance of this fact, we can draw on the concept of consumerlocalism (Kostakis & Giotitsas, 2020) or political consumerism, as used by Holzer (2006). Holzer argues that consumption can be seen as a political decision where an actor can influence politics through a vote. Therefore, a consumer can influence the market through his consumption choices. Nevertheless, this power is limited for individual actors, as a singular decision for or against a product cannot be recognized by the producers. Instead, individuals have to bond together to empower their consumption in the market system. Pressure on producers can only be achieved through a shared institution, which formulates their political agenda. This can be seen as a bridge between the systems of economy and politics (Luhmann, 2002). Therefore, p-prosumers cannot strengthen any political agenda, even if they have one, whereas co-prosumers can use their network of likeminded actors and their shared institution to positively influence, as they imagined, the existing system of economy. The shared political agenda could also explain the lack of deflection in CSAs and similar agro-political communities.

Value creation and co-creation of supply infrastructures from such a perspective still go beyond a market logic and enterprise lens like that of Hünerberg et al. (2009). They also used the term *co-prosumer* but defined it as relating to the cooperation between a role and relationship that is more individually shaped and bound to a commercial organization. Even in this context, the relational value is highlighted, and the information and active nature of roles are appreciated. The co-prosumer is a link to the larger society or, depending on the context, larger local community networks. The trend is toward more collective and not necessarily commercial modes of management, governance, and organization. In the case of energy systems, the term *prosumager* is used to describe a prosumer that also has storage and the ability to shift and better manage when and how much energy is consumed while making better use of the variable solar generation. By contrast, the so-called nosumer is a prosumager who uses zero net kilowatt-hours from the network on an annual basis (Sioshansi, 2019). The ways such roles either administer themselves or collectively organize and control the systems in which they are embedded have effects on their governance and sustainability.

3. CASE STUDIES: FROM INDIVIDUAL TO COLLECTIVE PROSUMPTION IN THE ENERGY AND AGRICULTURAL SECTORS

3.1 ENERGY

With the global energy turnaround or transition, photovoltaic and integrated energy storage systems are currently one of the most popular forms of home energy (Zhou et al., 2016). While the smart grid solutions used in zero-energy buildings promise full autonomy (Attia et al.,

2012; Sartori et al., 2012), traditional smart grid solutions offer p-prosumers connection to the power utility grid (Zafar et al., 2018). For the traditional photovoltaic p-prosumer, power shortages in winter must be covered by the utility grid, whereas power surpluses during the summer can be returned to the grid (Gautier et al., 2018). For bidirectional exchanges, a contract with a traditional energy provider is mandatory. However, automatized load management systems and smart meters enable the bidirectional exchange of information on prices and energy with a traditional energy utility. Therefore, the communication and coordination requirements and level of cooperation are usually relatively low.

On the collective side are the smart grid innovations for energy applications proposed by Kotilainen et al. (2016a, 2016b, 2017). Prosumer roles revolve around four methods: virtual co-creation, living laboratories, crowdsourcing contests, and prosumer communities. Concerning the fourth method, Parag and Sovacool (2016) discussed stylized prosumer communities from an organizational and partly technical perspective. In US urban areas, ENs emerged as a response to frequent energy blackouts (Mengelkamp et al., 2018; Rupp, 2016). The primary aim of such systems is to foster self-sufficiency and local resilience. For instance, by using peer-to-peer solar electricity trading, the p-prosumer has evolved into a co-prosumer (see Wörner et al. [2019] for a list of existing EN projects that implement peer-to-peer trading). Although some EN projects are managed by companies engaged in the energy sector, the modus operandi of such grassroots projects is self-organized (Wolfram, 2018).

However, EN based on peer-to-peer trading is associated with high levels of cooperation and transaction costs (Parag & Sovacool, 2016). Smart home energy management systems (SHEMS) for prosumer communities are based on optimization algorithms such as the artificial cooperative search algorithm or approaches that can assist in grid services and self-sufficiency levels.[3] The former algorithm allows for SHEMS to reduce the level of cooperation and transaction costs of energy prosumer communities. For instance, to optimize economic costs and environmental performance, optimization algorithms for energy prosumer communities are coupled with weather forecasts and a time evolution model. This coupling enables the prediction of future energy production and consumption and the monitoring of the physical state of the buildings involved. The optimization algorithm computes the amount of use for each installed device for production (e.g., a photovoltaic system) and storage (e.g., a lithium-ion battery) to ensure that the energy production and demand in the energy prosumer community are met (van Zyl-Bulitta et al., 2019).

Another model of energy prosumer communities is the virtual power plant (VPP), which can contribute to the renewable and decentralized production, consumption, and control functions (Funcke & Bauknecht, 2016). For prosumers distributed over a region, an energy cooperative may serve as an intermediary between prosumers/prosumers and between prosumers/consumers. To support administrative and intermediary functions, the energy cooperative charges a fee (e.g., per kilowatt-hour). Prosumers (and consumers) can participate in the cooperative as members with the right to attend annual general meetings and decide on purchase and selling prices. An institution that assumes the intermediary function reduces the levels of cooperation and transaction costs (van Zyl-Bulitta et al., 2019). The type of intermediaries and desirable level of cooperation in the EN and VPP will influence the diffusion of the co-prosumer role (Bauknecht et al., 2020).

The function of fostering citizen and municipality participation, as suggested by Debor (2018), creates heterogeneity in the actor landscape of the bottom-up energy transition. He et al. (2013) also proposed a plurality in role partitioning, stressing the variety of intermediaries and their impacts on consumers that engage in specific services from the electrical power system. They believe that different players (commercial or consumer cooperatives) could equally play the role of service provider. Several organizational structures across the collective, cooperative, and commercial spectra are possible. Along with intermediaries from the commercial arena, each organization could be weighed against the option of joining structures (private, state, or cooperatives) that operate across the country. Furthermore, Bauknecht et al. (2020) classified the types of participation in energy contexts according to procedural, democratic representative, and financial participation dimensions, and distinguished them according to their decentralization levels.

Some ENs entail private investment in energy production, storage, and distribution. The construction and maintenance of the infrastructure (e.g., the physical connection of the system to individual buildings) are community tasks and functions, with the ENs invested collectively. In such settings, where the production technology and infrastructure are common properties and the rules for the exchange and storage of power are self-organized, energy co-prosumers can be found in their purest form. In ecovillages, collective investment (common property) and co-prosumption are established practices. In an ecovillage or intentional community, a group of people co-habit and collectively organize themselves around principles such as lighter footprint and sustainable food systems or by following similar political interests.

Lambing (2012) described his vision of a transition to a new industrial society as "Stromallmende" (electricity commons). However, various options are available for financing processes, installation, and maintenance, as they can but must not necessarily be collective and democratically designed. For example, preset parameters in the system operation can be a collective decision and encoded in automated systems that control and report. Thus, social interaction around this is necessary when there is a need to monitor demand and its distribution over time. The communal system and, possibly, also larger societies benefit from this as long as individuals in a group are flexible, considerate of the system capacity, or self-sufficient enough to forgo some consumption. This can foster energy and flexibility capital and justice (Powells & Fell, 2019).

Independence from a centralized energy production and distribution system that produces significant adverse external impacts appears to be the primary motivation for people engaged in energy co-prosumption. Although a pure energy autarchy is rare, p- and co-prosumers can decouple from traditional centralized energy supply systems. The energy co-prosumer engaged in both generation and consumption can engage in different technology or information sharing options either on an individual scale or along a social continuum of connectedness and disconnectedness. This sharing of responsibilities and rights allow for different levels of involvement and collectivity, in contrast to dissociation or passiveness. Thus, technology can both be a disabler or enabler of participation options and functions.

The need to reconsider economic valuation and market systems with commons as institutional innovations that embed energy systems in public instead of private governance logic was previously discussed by Giotitsas et al. (2020), who proposed a political economy based on the commons for electric infrastructures. Market options that cater to prosumers involve ways of playing an active role and of being organized and aggregated (e.g., via a VPP). Individual prosumers may interact with a market competitively as, for example, prosumers to interconnected or islanded microgrids, or community microgrids, which can be designed as "open-source, lower cost, adaptable, socially responsible and sustainable technology" (Giotitsas et al., 2022), organized prosumer groups, or peer-to-peer networks. These represent different levels of technical connectedness and types of organizations (Parag & Sovacool, 2016). Giotitsas et al. (2022) aimed to fruitfully connect engineering and social sciences through commons and, similarly to Göpel (2016), critique the inappropriateness of mainstream economic tools for radical transformations. Circles around interconnected prosuming agents could represent the option of pooling resources in organized prosumer collectives. In addition, regionally extending toward more extensive selections or collectives could enable the fulfillment of more wide-reaching connections that can materialize the provision of grid services or increasing shares of renewable energies. Shared responsibility and more incentives can help in considering the needs of larger systems such as flexibilization functions, interconnection requirements, and consideration of the local distribution or entire grid. Hence, the level of collectivity depends on the technological infrastructure context, institutional possibilities, and preferences. The operationalization of the latter is thus constrained by technology and regulations, which are political or political-economic with a social and socio-technical component.

3.2 AGRICULTURE

Cultivating a household garden is an individual way of growing food without strictly prescribed rules set by authorities, such as allotment associations (Conway, 2016). Consequently, the levels of transaction costs and cooperation are low. Even though a single gardener, as a typical p-prosumer, does not need to follow the rules on how and when to cultivate the land, the activity itself and its frequency may be driven by external factors (e.g., time) or the intrapersonal formation of rules (e.g., gardening without pesticides). The internal process of forming rules that potentially influence the manner and frequency of household gardening is not addressed in the existing scientific literature.

As a consequence of industrialization and urbanization, the allotment gardens movement began in countries such as Germany and the United Kingdom nearly 200 years ago (Drescher, 2001; Flavell, 2003). Regulations and practices vary by country. However, their common purposes trend toward recreation, food security (with a specific meaning in the context of wars), urbanization, and sovereignty. Individuals or families can lease allotment plots, typically organized in allotment associations with strictly prescribed rules (the allotment garden law). However, members of the association have certain democratic rights in the decision-making on the allotment site (Breuste & Artmann, 2015). Even though food prosumption activities are individual, maintaining the general infrastructure (e.g., clubhouse and parking spaces) is a collective task (Thomas et al., 2016). This shared maintenance creates social meaning and community.

A co-prosumer discourse that has recently gained momentum is CSA[4] (Lang, 2010), which has its origins in Europe and Japan (Cone & Kakaliouras, 1995). In Europe

and Japan, CSA emerged as a societal reaction to the socioeconomic and ecological crises caused by the increasing industrialization and urbanization (Blättel-Mink et al., 2017). In general, CSA production is based on the agroecological concept aiming at changing agronomy and society into more sustainable configurations (Galt et al., 2012; Hvitsand, 2016). In contrast to traditional producer-consumer relationships, CSA members make a predefined financial contribution to a farmer in advance of the actual food production. Hence, the member is not merely buying produce but supporting a local farmer (Bloemmen et al., 2015). In many CSA projects, members are actively involved in farming by contributing labor, organizing community events, or distributing food (Groh & McFadden, 1997). Consumers evolve into prosumers (Cox et al., 2008). Accordingly, a CSA can be organized in various ways, whereby boundaries between consumers and prosumers are frequently fluid (Flora & Bregendahl, 2012; Hvitsand, 2016). In this sense, CSA can be considered a form of collective eco-entrepreneurship. The entrepreneurial risk is shared between the farmer and the members (Bruch & Ernst, 2010; Quarter et al., 2018). The various institutional settings of the division of labor between the farmer and the members, and the distribution of food are developed in a self-organized manner (European CSA Research Group, 2016).

CG,[5] primarily in urban areas, gained additional momentum through the Transition Towns movement beginning in 2005. The movement spread from its origin in the United Kingdom across the world (Kenis & Mathijs, 2014). CG is likewise rooted in post-capitalistic movements, aimed at achieving local autonomy (Starr & Adams, 2003) and creating public spaces (Ghose & Pettygrove, 2014) by transforming urban areas into commons (Mancebo, 2016). CG reflects anarchistic conceptions about the organization of collective prosumption (Robinson, 2009; White & Williams, 2014). The rules on how to cultivate, what to grow, and how to share the harvest among members are developed in a self-organized manner by the community itself (Ela, 2016; Müller, 2012). Accordingly, the traditional grasp of organizational hierarchies and power relations might be dissolved completely (Aptekar, 2015). In this context, Göttl & Penker (2020) conducted a comparative analysis of 51 urban community gardens in Anglo-Saxon and German-speaking countries. The authors acknowledge that not a single blueprint exists for organizing CG. However, self-organization or nested forms of organization and more or less open social boundaries are central pillars of CG.

Besides purely harvesting food, the different types of prosumption activities in the agricultural sector presented in Table 1 provide additional socioeconomic and environmental functions for society. These functions can be considered positive externalities, whose impacts partially extend beyond system boundaries. Accordingly, a wide range of functions is acknowledged, including social inclusion (Mmako et al., 2018), ecosystem services (Cabral et al., 2017), local resilience and food security (De Zeeuw et al., 2011; Kotright & Wakefield, 2011), education and development of skills (Duchemin et al., 2008; Wight, 2016), and social cohesion and community building (Hinchliffe & Whatmore, 2006; Purcell, 2002). Obviously, some of these functions such as social inclusion and community building are exclusively provided by community-based types of prosumerism in the agricultural and gardening sectors. The ecosystem service, education, and skill development functions are likewise provided by non-collective types of prosumption, such as home gardening. Some of these functions may have a mutual relationship with the socioeconomic and natural environment of non-commercial prosumption activities. For instance, ecosystem services such as regulation of climate conditions or conservation of agro-biodiversity may have positive effects beyond system boundaries. Other ways of managing gardens may also have adverse effects on the environment (Lindemann-Matthies & Marty, 2013).

4. EMERGING PATTERNS OF PROSUMPTION

Table 2 synthesizes the characteristics of the co-prosumer in comparison with those of the consumer and p-prosumer.

The traditional consumer, characterized as the rational utility-maximizing homo economicus, is embedded in the neoliberal economic system steered by the invisible hand. The consumer's function in this system is evident: consuming to fulfill purely individual needs and accumulating private property.

The p-prosumer focuses on strong autonomy from traditional value chains without intending an absolute change in consumption behavior to reduce material and energy flows. Although eco-efficiency might be achieved, the rebound effect eliminates potential gains in eco-efficiency (Binswanger, 2001). Consequently, the p-prosumer remains rooted, at least in part, in the logic of the homo economicus. By contrast, the commons/de-growth economy aims at fundamentally changing production and consumption patterns by substantially reducing material and energy flows (i.e., the sufficiency strategy of sustainability) (Paech, 2011).

Through their interactions and sharing, co-prosumers increase common welfare, even though cooperation is associated with considerable transaction costs and potential time investment. The social capital built from

CHARACTERISTIC	CONSUMER	INDIVIDUAL P-PROSUMER	COLLECTIVE CO-PROSUMER
Political philosophy	Neoliberalism	Green economy	Commons / De-growth Economy
Role	Rule-taker	Rule-taker	Rule-maker
Motivation	Utility maximization	Independence, autonomy	Common welfare maximization
Theory of action	Homo economicus	Homo economicus	Homo cooperativus
Focus	Individuality	Strong individuality	Community (sharing)
Property	Private	Between private and common	Common
Access to resources	Restricted Rules given by law	Restricted External law and self-generated rules	Restricted Self-generated rules
Transaction costs	Low	Between low and medium	High
Cooperation	None	Low	High
Functions	Consumption	Multifunctional	Multifunctional
Effects	Negative externalities	Positive externalities	Positive externalities

Table 2 Synthesis of the characteristics conceptualizing the co-prosumer in comparison with the consumer and p-prosumer.

the social structures of prosumption can be compared (Helfrich, 2020) with underlying (infra-)structures like those in a forest. Metaphorically, the commons can be compared with the roots and the mycelium of the trees, not the trees themselves. These are the necessary building blocks to sustain the tree system and forest. In this context, the co-prosumer must be considered a rule-maker because governance is coordinated and negotiated at the co-prosumer level. The theory of the commons is about self-designed and enforced rules (Ostrom, 2015). Only a few actors define institutions guiding individual and collective actions in a self-organized manner, potentially alleviating or solving the take-and-give-some dilemma. Thus, the co-prosumer economy can provide multiple sustainability functions if the rule systems and motivations and goals of the system participants are aligned. In energy systems, there can be a mismatch with national rules in that punishment or additional costs are incurred if contributions to the grid stability are voluntary.

To some extent, sustainability functions overreach system boundaries by creating positive externalities in the environment and society. The self-driven motivations of the homo economicus can then transition to the altruistic and common-welfare oriented motives of the homo cooperativus, balancing individual and collective interests. In a way, the logic of the commons reverses the power and hierarchical structures by assigning decision-making, design, and self-determination to the infrastructure systems. These changes are accompanied by responsibilities, burdens, and investments.

The agricultural sector, especially the organizational forms such as CG, is largely able to decouple from traditional markets, value chains, and official regulations. In such institutional settings, the emergence of the "pure" co-prosumer can be empirically observed. However, within the energy sector, the rule-making co-prosumer must be shaped more carefully. Completely self-sufficient energy co-prosumers are scarce because the energy co-prosumer is more firmly dependent on regulatory frameworks. Moreover, energy co-prosumers display a sharper focus on technological innovations. For instance, the exchange of solar energy or flexibility within ENs is primarily based on digital market platforms. Markets based on auction mechanisms are now associated with high levels of cooperation, transaction costs, and automation. Involving experience in participants' utility functions in pricing mechanisms could lead to a more efficient allocation of energy in EN based on digital market platforms (Mengelkamp et al., 2018). Consequently, cooperation and transaction costs could be reduced. In this context, open access to and shared knowledge of sustainable technological innovations emerging from commons-based peer production are considered promising alternatives to the profit-maximizing peer-to-peer production of the digital economy (Aryan et al., 2020; Bauwens & Pantazis, 2018; Cosmolocalism, 2022).

Co-prosumers' self-determination and the opportunity to encode their preferences, behaviors, and willingness for behavioral change can save investments in analytics and predictions of behaviors because preferences are already encoded in the system and need not be found out indirectly. Their willingness can enable the status quo to be adapted or transformed more comprehensively because one's behavioral patterns is more likely to be adapted when they are not imposed from above.

Bauwens, M., & **Pantazis, A.** (2018). The ecosystem of commons-based peer production and its transformative dynamics. *The Sociological Review*, *66*(2), 302–319. DOI: https://doi.org/10.1177/0038026118758532

Beckenkamp, M. (2012). Der Umgang mit sozialen Dilemmata: Institutionen und Vertrauen in den Commons. In: S. Helfrich, & Heinrich-Böll-Stiftung (Eds.): *Commons: Für eine Politik jenseits von Markt und Staat*.

Binswanger, M. (2001). Technological progress and sustainable development: What about the rebound effect? *Ecological Economics*, *36*, 119–132. DOI: https://doi.org/10.1016/S0921-8009(00)00214-7

Blättel-Mink, B., Boddenberg, M., Gunkel, L., Schmitz, S., & **Vaessen, F.** (2017). Beyond the market—New practices of supply in times of crisis: The example community-supported agriculture. *International Journal of Consumer Studies*, *41*(4), 415–421. DOI: https://doi.org/10.1111/ijcs.12351

Bloemmen, M., Bobulescu, R., Tuyen Le, N., & **Vitari, C.** (2015). Microeconomic degrowth: The case of community supported agriculture. *Ecological Economics*, *112*, 110–115. DOI: https://doi.org/10.1016/j.ecolecon.2015.02.013

Breuste, J. H., & **Artmann, M.** (2015). Allotment gardens contribute to urban ecosystem services: Case study Salzburg, Austria. *Journal of Urban Planning and Development*, *141*(3). DOI: https://doi.org/10.1061/(ASCE)UP.1943-5444.0000264

Bruch, M. L., & **Ernst, M. D.** (2010). A Farmer's Guide to Marketing through Community Supported Agriculture (CSAs). http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.433.7515&rep=rep1&type=pdf

Budescu, D. V., & **McCarter, M. V.** (2012). It's a game of give and take: Modelling behavior in a give-or-take-some dilemma. *Group Processes & Intergroup Relations*, *15*, 649–667. DOI: https://doi.org/10.1177/1368430212442106

Byrne, J., Martinez, C., & **Ruggero, C.** (2009). Relocating energy in the social commons: Ideas for a sustainable energy utility. *Bulletin of Science, Technology & Society*, *29*(2), 81–94. DOI: https://doi.org/10.1177/0270467609332315

Cabral, I., Keim, J., Engelmann, R., Kraemer, R., Siebert, J., & **Bonn, A.** (2017). Ecosystem services of allotment and community gardens: A Leipzig, Germany case study. *Urban Forestry & Urban Gardening*, *23*, 44–53. DOI: https://doi.org/10.1016/j.ufug.2017.02.008

Camarinha-Matos, L. M. (2016). Collaborative smart grids: A survey on trends. *Renewable & Sustainable Energy Reviews*, *65*, 283–294. DOI: https://doi.org/10.1016/j.rser.2016.06.093

Chaudhuri, A., Sopher, B., & **Strand, P.** (2002). Cooperation in social dilemmas, trust and reciprocity. *Journal of Economic Psychology*, *23*(2), 231–249. DOI: https://doi.org/10.1016/S0167-4870(02)00065-X

Chen, T., Alsafaseh, Q., Pourbabak, H., & **Su, W.** (2018). The next-generation U.S. retail electricity market with customers and prosumers—A bibliographical survey. *Energies*, *11*(1). DOI: https://doi.org/10.3390/en11010008

Cone, C. A., & **Kakaliouras, A.** (1995). Community supported agriculture: Building moral community or alternative consumer choice. *Culture and Agriculture*, *15*(51–52), 28–31. DOI: https://doi.org/10.1525/cuag.1995.15.51-52.28

Conway, T. M. (2016). Home-based edible gardening: Urban residents' motivations and barriers. *Cities and the Environment*, *9*(1), Article 3.

Cosmolocalism. (2022). Cosmolocalism: Design global, manufacture local, EU Project. https://www.cosmolocalism.eu/

Cox, R., Holloway, L., Venn, L., Dowler, L., Rickets Hein, J., Kneafsey, M., & **Tuomainen, H.** (2008). Common ground? Motivations for participation in a community-supported agriculture scheme. *The International Journal of Justice and Sustainability*, *13*(3), 203–218. DOI: https://doi.org/10.1080/13549830701669153

De Zeeuw, H., van Veenhuizen, R., & **Dubbeling, M.** (2011). The role of urban agriculture in building resilient cities in developing countries. *The Journal of Agricultural Science*, *149*(1), 153–163. DOI: https://doi.org/10.1017/S0021859610001279

Debor, S. (2018). Multiplying mighty Davids? The influence of energy cooperatives on Germany's energy transition. Cham, Switzerland: Springer International. DOI: https://doi.org/10.1007/978-3-319-77628-6

Drescher, A. W. (2001). The German allotment gardens: A model for poverty alleviation and food security in Southern African cities? *Published in the Proceedings of the Sub-Regional Expert Meeting on Urban Horticulture*, Stellenbosch, South Africa.

Duchemin, E., Wegmuller, F., & **Legault, A.-M.** (2008). Urban agriculture: Multi-dimensional tools for social development in poor neighbourhoods. *Field Actions Science Reports*, *1*, 43–51. DOI: https://doi.org/10.5194/facts-2-1-2009

Ela, N. (2016). Urban commons as property experiment: Mapping Chicago's farms and gardens. *Fordham Urban Law Journal*, *42*(2), 479–508. DOI: https://doi.org/10.2139/ssrn.2744294

European CSA Research Group. (2016). Overview of Community Supported Agriculture in Europe (1st ed.). http://urgenci.net/wp-content/uploads/2016/05/Overview-of-Community-Supported-Agriculture-in-Europe-F.pdf

Fabricius, C., & **Collins, S.** (2007). Community-based natural resource management: Governing the commons. *Water Policy*, *9*(S2), 83–97. DOI: https://doi.org/10.2166/wp.2007.132

Flavell, N. (2003). Urban allotment gardens in the eighteenth century: The case of Sheffield. *The Agricultural History Review*, *51*(1), 95–106.

Flora, C. B., & **Bregendahl, C.** (2012). Collaborative community-supported agriculture: Balancing community capitals for producers and consumers. *The International Journal of Sociology of Agriculture and Food*, *19*(3), 329–346.

Frey, B. S., & **Benz, M.** (2007). Die psychologischen Grundlagen des Marktmodells (Homo oeconomicus). In: L. von Rosenstiel & D. Frey (Eds.). *Marktpsychologie*. Göttingen: Hogrefe Verlag.

Funcke, S., & **Bauknecht, D.** (2016). Typology of centralised and decentralised visions for electricity infrastructure. *Utilities Policy*, *40*, 2–9. DOI: https://doi.org/10.1016/j.jup.2016.03.005

Galt, R. E., O'Sullivan, L., Beckett, J., & **Hiner, C. C.** (2012). Community supported agriculture is thriving in the Central Valley. *California Agriculture*, *66*(1), 8–14. DOI: https://doi.org/10.3733/ca.v066n01p8

García-Sempere, A., Morales, H., Hidalgo, M., Ferguson, B. G., Rosset, P., & **Nazar-Beutelsbacher, A.** (2019). Food sovereignty in the city? A methodological proposal for evaluating food sovereignty in urban settings. *Agroecology and Sustainable Food Systems*, *43*(10), 1145–1173. DOI: https://doi.org/10.1080/21683565.2019.1578719

Gautier, A., Jacqmin, J., & **Poudou, J.-C.** (2018). The prosumer and the grid. *Journal of Regulatory Economics*, *53*, 100–126. DOI: https://doi.org/10.1007/s11149-018-9350-5

Ghose, R., & **Pettygrove, M.** (2014). Urban community gardens as spaces of citizenship. *Antipode*, *46*(4), 1092–1112. DOI: https://doi.org/10.1111/anti.12077

Giotitsas, C., Nardelli, P. H. J., Kostakis, V., & **Narayanan, A.** (2020). From private to public governance: The case for reconfiguring energy systems as a commons. *Energy Research and Social Science*, *70*(May). DOI: https://doi.org/10.1016/j.erss.2020.101737

Giotitsas, C., Nardelli, P. H. J., Williamson, S., Roos, A., Pournaras, E., & **Kostakis, V.** (2022). Energy governance as a commons: Engineering alternative socio-technical configurations. *Energy Research and Social Science*, *84*(July 2021), 102354. DOI: https://doi.org/10.1016/j.erss.2021.102354

Göpel, M. (2016). The great mindshift: How a new economic paradigm and sustainability transformations go hand in hand. Cham: Springer International Publishing. ISBN 978-3-319-43766-8 (eBook). DOI: https://doi.org/10.1007/978-3-319-43766-8

Göttl, I., & **Penker, M.** (2020). Institutions for collective gardening: A comparative analysis of 51 urban community gardens in anglophone and German-speaking countries. *International Journal of the Commons*, *14*(1), 30–43. DOI: https://doi.org/10.5334/ijc.961

Groh, T., & **McFadden, S.** (1997). Farms of tomorrow revisited: Community supported, farm supported communities. East Troy: Biodynamic Farming and Gardening Association.

He, X., Keyaerts, N., Azevedo, I., Meeus, L., Hancher, L., & **Glachant, J.-M.** (2013). How to engage consumers in demand response : A contract perspective. *Utilities Policy*, *27*, 108–122. DOI: https://doi.org/10.1016/j.jup.2013.10.001

Helbing, D. (2013). Overcoming 'Tragedies of the Commons' with a Self-Regulating, Participatory Market Society (July 17, 2013). https://ssrn.com/abstract=2403683 or DOI: https://doi.org/10.2139/ssrn.2403683

Helfrich, S. (2019). Haben nahe dem Sein. In: Oya 56/12-2019–02-2020, Hüten statt Haben, Oya Medien eG.

Helfrich, S. (2020). Böll event: Anders Wirtschaften Jetzt! On 11th June 2020. https://calendar.boell.de/de/event/anders-wirtschaften-jetzt?dimension1=startseite

Helfrich, S., & **Bollier, D.** (2019). Frei, fair und lebendig – die Macht der Commons. PDF-ISBN 978-3-8394-4530-3. Bielefeld: Transcript Verlag. DOI: https://doi.org/10.14361/9783839445303

Helfrich, S., Kuhlen, R., Sachs, W., & **Siefkes, C.** (2010). Gemeingüter – Wohlstand durch Teilen. Berlin: Heinrich-Böll-Stiftung.

Hinchliffe, S., & **Whatmore, S.** (2006). Living cities: Towards a politics of conviviality. *Science as Culture*, *15*(3), 123–138. DOI: https://doi.org/10.1080/09505430600707988

Holzer, B. (2006). Political consumerism between individual choice and collective action: social movements, role mobilization and signalling. *International Journal of Consumer Studies*, *30*(5), 405–415. DOI: https://doi.org/10.1111/j.1470-6431.2006.00538.x

Hoover, E. (2017). "You can't say you're sovereign if you can't feed yourself": Defining and enacting food sovereignty in American Indian community gardening. *American Indian Culture and Research Journal*, *41*(3), 31–70. DOI: https://doi.org/10.17953/aicrj.41.3.hoover

Hünerberg, R., Mann, A., Müller, S., & **Töpfer, A.** (Eds.) (2009). Ganzheitliche Unternehmensführung in dynamischen Märkten: Festschrift für Univ.-Prof. Dr. Armin Töpfer (Forum Marketing). Wiesbaden: Gabler Verlag. ISBN-10: 3834912441, ISBN-13: 978-3834912442. DOI: https://doi.org/10.1007/978-3-8349-8787-7

Hvitsand, C. (2016). Community supported agriculture (CSA) as a transformational act: Distinct values and multiple motivations among farmers and consumers. *Agroecology and Sustainable Food Systems*, *40*(4), 333–351. DOI: https://doi.org/10.1080/21683565.2015.1136720

Jerome, G. (2017). Defining community-scale green infrastructure. *Landscape Research*, *42*(2), 223–229. DOI: https://doi.org/10.1080/01426397.2016.1229463

Ji, Z., Ganchev, I., O'Droma, M., Zhao, L., & **Zhang, X.** (2014). A cloud-based car parking middleware for IoT-based smart cities: Design and implementation. *Sensors*, *14*(12), 22372–22393. DOI: https://doi.org/10.3390/s141222372

Kathryn, J. A., Hamm, M. W., & **Litjens, C. M.** (2012). The city as an "agricultural powerhouse"? Perspectives on expanding urban agriculture from Detroit, Michigan. *Urban Geography*, *33*(3), 348–369. DOI: https://doi.org/10.2747/0272-3638.33.3.348

Kenis, A., & **Mathijs, E.** (2014). (De)politicising the local: The case of the transition towns movement in Flanders (Belgium). *Journal of Rural Studies*, *34*, 172–183. DOI: https://doi.org/10.1016/j.jrurstud.2014.01.013

Komorita, S. S., Chan, D. K. -S., & **Parks, C.** (1993). The effects of reward structure and reciprocity in social dilemmas. *Journal of Experimental Social Psychology*, *29*(3), 252–267. DOI: https://doi.org/10.1006/jesp.1993.1011

Kohn, N. W., Paulus, P. B., & **Korde, R. M.** (2011). Conceptual combinations and subsequent creativity. *Creativity Research Journal*, *23*(3), 203–210. DOI: https://doi.org/10.1080/10400419.2011.595659

Kondo, N., & **Ting, K. C.** (1998). Robotics for plant production. *Artificial Intelligence Review*, *12*(1–3), 27–243. DOI: https://doi.org/10.1023/A:1006585732197

Kostakis, V., & **Giotitsas, C.** (2020). Intervention: "Small and Local Are Not Only Beautiful; They Can Be Powerful." Antipode Online. Accessed December 6, 2021. https://antipodeonline.org/2020/04/02/small-and-local/. DOI: https://doi.org/10.36548/jitdw.2020.4

Kotilainen, K., Mäkinen, S. J., & **Järventausta, P.** (2017). Understanding prosumers' intrinsic and extrinsic motivations to become active participants in smart grid innovation ecosystem. *IEEE PES Innovative Smart Grid Technologies Conference Europe*. DOI: https://doi.org/10.1109/ISGTEurope.2016.7856261

Kotilainen, K., Makinen, S. J., Järvetausta, P., Rautiainen, A., & **Markkula, J.** (2016a). The role of residential prosumers initiating the energy innovation ecosystem to future flexible energy system. *International Conference on the European Energy Market, EEM*, 2016 July. DOI: https://doi.org/10.1109/EEM.2016.7521325

Kotilainen, K., Jarventausta, P., & **Aalto, P.** (2016b). Prosumer centric co-creation in Smart Grid innovation ecosystem. *IEEE PES Innovative Smart Grid Technologies Conference Europe*, 884–889. DOI: https://doi.org/10.1109/ISGT-Asia.2016.7796502

Kotright, R., & **Wakefield, S.** (2011). Edible backyards: A qualitative study of household food growing and its contribution to food security. *Agriculture and Human Values*, *28*(1), 39–53. DOI: https://doi.org/10.1007/s10460-009-9254-1

Lambing, J. (2012). Stromallmende: Wege in eine neue Industriegesellschaft. In: S. Helfrich & Heinrich-Böll-Stiftung (Eds.), *Commons: Für eine neue Politik jenseits von Markt und Staat*.

Lang, K. B. (2010). The changing face of community-supported agriculture. *Culture & Agriculture*, *32*(1), 17–26. DOI: https://doi.org/10.1111/j.1556-486X.2010.01032.x

Lansche, J., & **Müller, J.** (2012). Life cycle assessment of energy generation of biogas fed combined heat and power plants: Environmental impact of different agricultural substrates. *Engineering in Life Sciences*, *12*(3), 313–320. DOI: https://doi.org/10.1002/elsc.201100061

Lerch, A. (2009). Die Tragödie der "Tragedy of the Commons." In: S. Helfrich & Heinrich-Böll-Stiftung (Eds.), *Wem gehört die Welt? Zur Wiederentdeckung der Gemeingüter*.

Lindemann-Matthies, P., & **Marty, T.** (2013). Does ecological gardening increase species richness and aesthetic quality of a garden? *Biological Conservation*, *159*(1), 37–44. DOI: https://doi.org/10.1016/j.biocon.2012.12.011

Lobo, I. D. (2021). Commons-based enterprises: Organisational challenges of entrepreneurial development in the context of the rural commons. In: X. R. Fajardo, M. G. Arnold, J. N. Muthuri, & S. Gold, (Eds.), *Base of the Pyramid Markets in Latin America Innovation and Challenges to Sustainability*. London: Routledge. DOI: https://doi.org/10.4324/9780429424168-4

Lombardi, P., & **Schwabe, F.** (2017). Sharing economy as a new business model for energy storage systems. *Applied Energy*, *188*, 485–496. DOI: https://doi.org/10.1016/j.apenergy.2016.12.016

Luhmann, N. (2002). Einführung in die Systemtheorie. Heidelberg: Carl-Auer-Systeme Verlag.

Mancebo, F. (2016). Urban agriculture, commons and urban policies: Scaling up local innovation. *Challenges in Sustainability*, *4*(1), 10–19. DOI: https://doi.org/10.12924/cis2016.04010010

Mariano, P., & **Correira, L.** (2015). The give and take game: Analysis of resource sharing game. *International Journal of Applied Mathematics and Computer Science*, *25*(4), 753–767. DOI: https://doi.org/10.1515/amcs-2015-0054

Menconi, M. E., dell'Anna, S., Scarlato, A., & **Grohmann, D.** (2016). Energy sovereignty in Italian inner areas: Off-grid renewable solutions for isolated systems and rural buildings. *Renewable Energy*, *93*, 14–26. DOI: https://doi.org/10.1016/j.renene.2016.02.034

Mengelkamp, E., Gärttner, J., Rock, K., Kessler, S., Orsini, L., & **Weinhardt, C.** (2018). Designing microgrid energy markets: A case study: The Brooklyn Microgrid. *Applied Energy*, *210*, 870–880. DOI: https://doi.org/10.1016/j.apenergy.2017.06.054

Mmako, N. J., Capetola, T., & **Henderson-Wilson, C.** (2018). Sowing social inclusion for marginalised residents of a social housing development through a community garden. *Health Promotion Journal of Australia*, *30*(3), 1–9. DOI: https://doi.org/10.1002/hpja.225

Müller, C. (2012). Reiche Ernte in Gemeinschaftsgärten: Beim Urban Gardening findet der Homo oeconomicus sein Korrektiv. In: Helfrich S., & Heinrich-Böll-Stiftung (Eds.), *Commons: Für eine Politik jenseits von Markt und Staat*.

Niu, X., Xu, J., & **Deng, Z.** (2017). Conditional punishment resolves social dilemma in spatial network. *Chaos, Solitons & Fractals*, *105*, 256–259. DOI: https://doi.org/10.1016/j.chaos.2017.10.016

Noura, M., Atiquzzaman, M., & **Gaedke, M.** (2019). Interoperability in Internet of Things: Taxonomies and open challenges. *Mobile Networks and Applications*, *24*(3), 796–809. DOI: https://doi.org/10.1007/s11036-018-1089-9

Ostrom, E. (1994). Neither Market Nor State: Governance of Common Pool Resources in the Twenty-First Century (Lecture Series No. 2). Washington, DC: International Food Policy Research Institute.

Ostrom, E. (2015). Governing the Commons—The Evolution of Institutions for Collective Action, 9781107569782. Cambridge, UK: Cambridge University Press. DOI: https://doi.org/10.1017/CBO9781316423936

Paech, N. (2011). Nachhaltiges Wirtschaften jenseits von Innovationsorientierung und Wachstum: Eine unternehmensbezogene Transformationstheorie. Marburg: Metropolis Verlag.

Parag, Y., & **Sovacool, B. K.** (2016), Electricity market design for the prosumer era. *Nature Energy Perspective*, 16032. DOI: https://doi.org/10.1038/nenergy.2016.32

Park, L. W., Lee, S., & **Chang, H.** (2018). A sustainable home energy prosumer-chain methodology with energy tags over the blockchain. *Sustainability*, *10*(3), 658–678. DOI: https://doi.org/10.3390/su10030658

PHLP. (2009). Establishing Land Use Protections for Community Gardens. https://waynefoods.files.wordpress.com/2008/11/communitygardenpolicies.pdf

Powells, G., & **Fell, M. J.** (2019). Energy research and social science flexibility capital and flexibility justice in smart energy systems. *Energy Research & Social Science*, *54*(March), 56–59. DOI: https://doi.org/10.1016/j.erss.2019.03.015

Purcell, M. (2002). Excavating Lefebvre: The right to the city and its urban politics of the inhabitants. *GeoJournal*, *58*(2), 99–108. DOI: https://doi.org/10.1023/B:GEJO.0000010829.62237.8f

Quarter, J., Mook, L., & **Armstrong, A.** (2018). Understanding the social economy: A Canadian Perspective (2nd ed.). Toronto: University of Toronto Press.

Richardson, L. (2015). Performing the sharing economy. *Geoforum*, *67*, 121–129. DOI: https://doi.org/10.1016/j.geoforum.2015.11.004

Robinson, C. M. (2009). The continuing significance of class: Confronting capitalism in an anarchist community. *Journal of Labor and Society*, *12*(3), 355–370. DOI: https://doi.org/10.1111/j.1743-4580.2009.00243.x

Rodon, T., Nachet, L., Krolik, C., & **Palliser, T.** (2021). Building energy sovereignty through community-based projects in Nunavik. *Sustainability*, *13*(16), 9061. DOI: https://doi.org/10.3390/su13169061

Roulier, M. (2014). Place-based practices shape the healthy communities movement. *National Civic Review Spring*, 2014, 4–10. DOI: https://doi.org/10.1002/ncr.21164

Rupp, S. (2016). Circuits and currents: Dynamics of disruption in New York City blackouts. *Economic Anthropology*, *3*(1), 106–118. DOI: https://doi.org/10.1002/sea2.12048

Sartori, I., Napolitano, A., & **Voss, K.** (2012). Net zero energy buildings: A consistent definition framework. *Energy and Buildings*, *48*, 220–232. ISSN 0378-7788. DOI: https://doi.org/10.1016/j.enbuild.2012.01.032

Schubert, E. (2021). Creativity is optimal novelty and maximal positive affect: A new definition based on the spreading activation model. *Frontiers in Neuroscience*, *15*, 612379. DOI: https://doi.org/10.3389/fnins.2021.612379

Seran, S., & **Izvercian, M.** (2014): Prosumer engagement in innovation strategies. *Management Decision*, *52*(10), 1968–1980. DOI: https://doi.org/10.1108/MD-06-2013-0347

Sioshansi, F. (2019). Consumer, Prosumer, Prosumager: How Service Innovations will Disrupt the Utility Business Model (1st ed.). Cambridge, MA: Academic Press. ISBN: 9780128168363.

Soares, A., Henggeler Antunes, C., Oliveira, C., & **Gomez, A.** (2014). A multi-objective genetic approach to domestic load scheduling in an energy management system. *Energy*, *77*, 144–152. DOI: https://doi.org/10.1016/j.energy.2014.05.101

Soares, J., Fotouhi Ghazvini, M. A., Vale, Z., & **de Moura Oliveira, P. B.** (2016). A multi-objective model for the day-ahead energy resource scheduling of a smart grid with high penetration of sensitive loads. *Applied Energy*, *162*, 1074–1088. DOI: https://doi.org/10.1016/j.apenergy.2015.10.181

Starr, A., & **Adams, J.** (2003). Anti-globalization: The global fight for local autonomy. *New Political Science*, *25*(1), 19–42. DOI: https://doi.org/10.1080/0739314032000071217

Szolnoki, A., & **Perc, M.** (2009). Promoting cooperation in social dilemmas via simple coevolutionary rules. *The European Physical Journal B*, *67*(3), 337–344. DOI: https://doi.org/10.1140/epjb/e2008-00470-8

Thomas, N., Oehler, P., & **Huber, T.** (2016). Allotment Gardens in Switzerland: The Challenges of Self-governing Communities in Transforming Cities. http://www.vssg.ch/documents/160910_Growing-in-Cities_Full-Paper-FileRd.pdf

Toffler, A. (1980). The Third Wave. New York: William Morrow.

Van Dijk, E., & **Henk, W.** (1995). Coordination rules in asymmetric social dilemmas: A comparison between public good dilemmas and resource dilemmas. *Journal of Experimental Social Psychology*, *31*(1), 1–27. DOI: https://doi.org/10.1006/jesp.1995.1001

Van Elsen, T., & **Kraiss, K.** (2012). Solidarische Landwirtschaft: Community Supported Agriculture (CSA) in Deutschland. In: AgrarBuendnis e.V. (Eds.): Landwirtschaft 2012: Der kritische Agrarbericht. https://kritischer-agrarbericht.de/fileadmin/Daten-MS/Externer_Download/KAB_2012.pdf

Van Miltenburg, N., Buskens, V., Barrera, D., & **Raub, W.** (2014). Implementing punishment and reward in the public goods game: the effect of individual and collective decision rules. *International Journal of the Commons*, *8*(1), 47–87. DOI: https://doi.org/10.18352/ijc.426

Van Zyl-Bulitta, V. H. (2019). Framing commons for society: Technology for electric infrastructure supply systems. *Transdisciplinary Journal of Engineering & Science*, *10*, 28–38. DOI: https://doi.org/10.22545/2019/0113

Van Zyl-Bulitta, V. H., Ritzel, C., Stafford, W., & **Wong, J. G.** (2019). A compass to guide through the myriad of sustainable energy transition options across the global North-South divide. *Energy*, *181*, 307–320. DOI: https://doi.org/10.1016/j.energy.2019.05.111

White, R., & **Williams, C.** (2014). Anarchist economic practices in a 'capitalist' society: Some implications for organisation and the future of work. *Ephermera: Theory and Politics in Organization*, *14*(4), 947–971.

Wight, R. A. (2016). Community supported agriculture as public education: networked communities of practice building alternative agrifood systems (thesis summary). *Environmental Education Research*, *16*(3), 456–457. DOI: https://doi.org/10.1080/13504622.2015.1118756

Willis, P. (2012). Engaging communities: Ostrom's economic commons, social capital and public relations. *Public Relations Review*, *38*(1), 116–122. DOI: https://doi.org/10.1016/j.pubrev.2011.08.016

Wolfram, M. (2018). Cities shaping grassroots niches for sustainability transitions: Conceptual reflections and an exploratory case study. *Journal of Cleaner Production*, *173*, 11–23. DOI: https://doi.org/10.1016/j.jclepro.2016.08.044

Wörner, A., Meeuw, A., Ableitner, L., Wortmann, F., Schopfer, S., & **Tiefenbeck, V.** (2019). Trading solar energy within the neighborhood: Field implementation of a blockchain-based electricity market. *Energy Informatics*, *2*(S1), 1–12. DOI: https://doi.org/10.1186/s42162-019-0092-0

Wu, L., & **Barsalou, L. W.** (2009). Perceptual simulation in conceptual combination: Evidence from property generation. *Acta Psychologica*, *132*(2), 173–189. DOI: https://doi.org/10.1016/j.actpsy.2009.02.002

Zafar, R., Mahmood, A., Razzaq, S., Ali, W., Naeem, U., & **Shehzad, K.** (2018). Prosumer based energy management and sharing in smart grid. *Renewable and Sustainable Energy Reviews*, *82*(1), 1675–1684. DOI: https://doi.org/10.1016/j.rser.2017.07.018

Zhou, B., Li, W., Chan, K. W., Cao, Y., Kuang, Y., Liu, X., & **Wang, X.** (2016). Smart home energy management systems: Concept, configurations, and scheduling strategies. *Renewable and Sustainable Energy Reviews*, *61*, 30–40. DOI: https://doi.org/10.1016/j.rser.2016.03.047

TO CITE THIS ARTICLE:
Ritzel, C., Mann, S., & van Zyl-Bulitta, V. (2022). Prosuming Alone or Together: A Bisectoral Approach to Conceptualizing the Commons Prosumer. *International Journal of the Commons*, 16(1), pp. 295–309. DOI: https://doi.org/10.5334/ijc.1185

Submitted: 07 February 2022 **Accepted:** 05 November 2022 **Published:** 01 December 2022