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## COLLABORATION BETWEEN GOVERNMENT AND AGRIBUSINESS FOR BIOGAS PRODUCTION: BALANCED DEVELOPMENT OF RURAL SUSTAINABILITY

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**Annotation.** *Throughout the last half a century, rural development policy has experienced many transformations in the name of industrialization, including the mechanization of work process in agriculture, the installation of irrigation and amelioration systems, the electrification of farms, the application of chemical production technologies, increased productivity, and a myriad of other developments. Present questions of balanced sustainability and the minimization of negative impacts with regard to quality of life are taking leading positions in agricultural policy debates. The results of previously implemented agribusiness support measures are beginning to signal a disastrous future for ongoing agricultural policy, which has over accelerated rural development and thus caused significant changes in rural landscapes and the lives of rural residents. Therefore, future agriculture requires new models and innovative decisions, as well as good political will in the field. The main aim of this paper is to propose future directions for collaboration between government and agribusinesses using an innovative circular bio-economy economy approach for attaining the balanced development of rural sustainability. Qualitative data were collected in summer and autumn of 2018 using semi-structured interviews in Lithuanian livestock farms and government institutions. These are the key players in biogas production, as from one side they act as biogas producers (livestock farms) and from the other act as actual decision-makers (government institutions). The results of the research demonstrate that future agribusiness is highly dependent on the role taken by government in accelerating prospective innovations, even though they happen in a field of activity that is supported by*

*public funds. Collaborative political decisions made to support the circular bio-economy economy approach in biogas production might be helpful for the future development of livestock agribusiness that is less polluting and of more benefit to society. It is suggested to broaden the use of the circular bio-economy economy approach in fostering the balanced development of rural sustainability in the European Union's Common Agricultural Policy after 2020.*

**Reikšminiai žodžiai:** bendradarbiavimas, darnus kaimo vystymas, valstybės institucijos, ūkininkai, žiedinė bioekonomika, biodujų gamyba.

**Keywords:** collaboration, sustainable rural development, government, farmers, circular bioeconomy, biogas production.

## Introduction

Rural development policy experienced many transformations throughout the second half of the twentieth century. It has undergone industrialization, involving the mechanization of work process in agriculture, the installation of irrigation and amelioration systems, the electrification of farms, the application of chemical production technologies, increased productivity, and a multitude of other developments. The current period of EU regional policy is tightly interconnected with the concept of a 'knowledge society' (Tovey 2016). In a 'knowledge society', the sustainable development of rural regions highly depends on their ability to use innovative solutions and approaches as critical success factors (Landabaso 2014; Naldi et al. 2015). The modern and creative use of knowledge in collaboration therefore becomes crucial for the development of European regions in future (Dimitris 2006; McCann and Ortega-Argilés 2013; Curran and Storey 2016; Dragoi and Balgar 2017; Marsden 2017).

The present questions of balanced sustainability and the minimization of negative impacts with regard to quality of life are taking leading positions in agricultural policy debates (Schröder et al. 2019). The results of agribusiness support measures that have previously been implemented begin to signal a disastrous future of ongoing agricultural policy, which has over accelerated rural development and thus caused significant changes in rural landscapes and the lives of rural residents (e.g., European Commission 2014; Stam 2015; Jones et al. 2016; Hanna 2017, etc.). Therefore, future agriculture calls for new models and innovative decisions, for example circular bio-economy based models. One of these innovations is biogas production from bio waste in agricultural companies (Bao et al. 2019; Imeni et al. 2019; Welsh et al. 2019).

The main raw material for biogas production is organic waste of various origins (Hagos et al. 2017; Zhang et al. 2019). Some wastes are difficult to decompose and produce less biogas; others are lighter and result in higher biogas content with higher methane concentrations. Organic waste from agriculture or livestock farming, and sludge and process waste from food processing plants (unless used for feed or other purposes) are used for biogas production (Bao et al. 2019; Imeni et al. 2019; Welsh et al. 2019). At the

same time, the scientific literature stresses that collaboration for regional development in the field of circular bio-economy based innovations – biogas production from agricultural wastes – cannot prosper without good political will for developing and maintaining prospective circular and bio-economy based national strategies and collaborations with agribusiness in the field (e.g., Yazan et al. 2018; Patinvoh and Taherzadeh 2019). Thus, the key stakeholders for the balanced development of rural sustainability based on an innovative circular bio-economy approach, namely biogas production from side outputs (wastes) in agribusiness, are livestock farms and governments.

The main aim of this paper is to propose future directions for collaboration between government and agribusiness using an innovative circular bio-economy economy approach for attaining the balanced development of rural sustainability. Qualitative data was collected in the summer and autumn of 2018 using semi-structured interviews with key stakeholders in the circular bio-economy in Lithuania. These included livestock farms and government institutions which act as key players in the production of biogas from agricultural waste (livestock farms), whilst at the same time acting as key decision makers (government institutions) in the field. Afterwards, the focus group method was used to elicit in-depth explanations of the gaps that had been observed among expectations for and experiences with collaboration between agribusiness companies and the government in the field of biogas production.

### **Theoretical background: collaboration and the circular economy as a balanced development approach for rural sustainability**

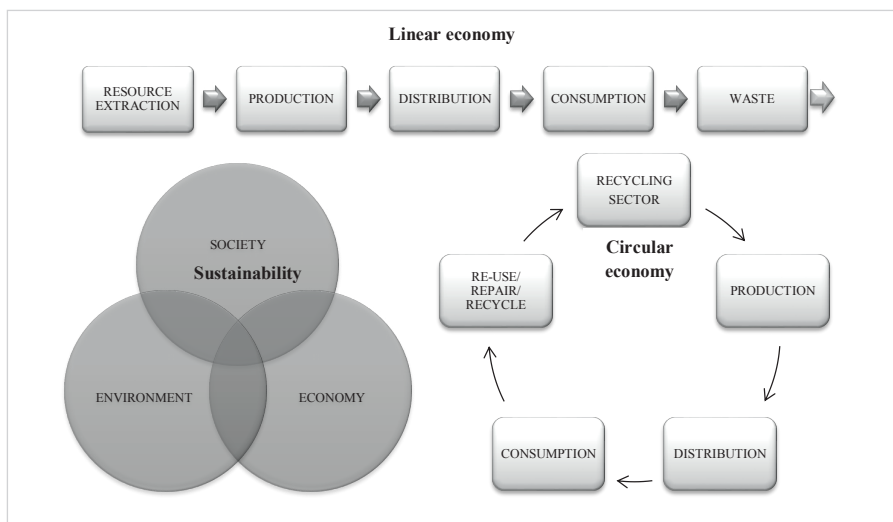
In recent scientific and political debate, sustainability and balanced development is often placed next to the emerging concepts of circular and bio-economies, and collaboration between stakeholders plays a crucial role in achieving progress (e.g., Omann and Schutter 2018; Patermann and Aguilar 2018; Hempel et al. 2019;). It is often stressed that the relationship between the concepts of sustainability (the nexus of society, environment, and economy) and circular and bio-economies is not made explicit, thus blurring their conceptual contours and constraining the efficacy of using these approaches in research and practice (Geissdoerfer et al. 2017).

Critics of the concept of the circular economy claim that it means many different things to different people (Kirchherr et al. 2017). In the most general sense, a circular economy should be understood as opposite to the concept of a linear economy. Thus, all three of these paradigms contradict each other and cannot be used interchangeably in any scientific or political debate (see Figure 1). The main feature of the bio-economy is that it is grounded in the use of renewable instead of fossil fuel resources (Hempel et al. 2019). The implementation of a bio-economy wherein bio resources are used as part of a circular economy is seen as the most promising combination for future sustainable regional and general development (Omann and Schutter 2018; Patermann and Aguilar 2018). Thus, it is worth using the concept of a circular bio-economy in this research as this best corresponds to the context of this research objective: collaboration between government and agribusiness for the balanced development of rural sustainability.

Circular bio-economy aims to redefine growth, focusing on positive society-wide benefits (Dahiya et al. 2018). It entails gradually decoupling economic activity from the consumption of finite resources, and designing waste out of the system. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural, and social capital. It is based on three principles:

1. Design out waste and pollution
2. Keep products and materials in use
3. Regenerate natural systems.

Some scholars state that circular bio-economy as a phenomenon received great interest from scientists and practitioners because it is viewed as an operationalization for businesses to implement the much-discussed paradigm of sustainable development (Ghisellini et al. 2016; Murray et al. 2017). Whereas sustainability used to be criticized for being too broad in its scope to become a reality as it does not refer to any concrete tools that might help realize it in practise (e.g., Naudé 2011, etc.), balanced development as a strategy for regional development is recognized as a promising approach for rural sustainability (Bochko 2015; Gu et al. 2016). At the same time, it is often stressed that the collaboration of stakeholders is crucial to making these strategies work, and for enabling them to meet the priorities of Europe 2020: becoming a smart, sustainable, and inclusive economy (Naldi et al. 2015). These ambitions require special attention to encouraging collaboration and networking, especially in terms of prospective innovations such as bio-gas production from manure and wastes, which are the main side outputs of livestock farming activities.



**Figure 1. Contradicting paradigms of linear economy, circular economy, and sustainability**

Source: created by authors

Scientific investigations have already been done that take the principles of a circular economy into action, e.g., zero-waste biogas production in livestock farms purely to serve the above ambitions of the EU (Czekala 2018). However, agribusinesses alone cannot make the dream of sustainability come true without appropriate support from policymakers. Representatives of government institutions have sought to address these concerns by encouraging the development of networks and collaboration between actors and firms in rural areas, on the basis that such activity may bring advantages for such prospective achievements (Tregear and Cooper 2016). At the same time, the government should adhere to its primary responsibility to serve the public need, and take equally active collaboration approaches in implementing circular economy practices that enable the sustainable and balanced development of rural regions.

### Research methodology

Based on the theoretical background for this research, balanced development using the circular bio-economy approach as a strategy for regional development is recognized as a promising approach for rural sustainability (Bochko 2015; Gu et al. 2016; Dahiya et al. 2018; Omann and Schutter, 2018; Patermann and Aguilar, 2018; Hempel et al. 2019), and the collaboration of stakeholders is crucial in forming these strategies and enabling them to meet the priorities of Europe 2020: becoming a smart, sustainable, and inclusive economy (Naldi et al. 2015). These conditions propose promising methodological foundations for this research, taking into account stakeholder analysis based on a business strategy approach, i.e. the stakeholder salience model (Mitchell 1997). This model enables us to measure the joint efforts of key players in the selected area of the circular bio-economy – biogas production in livestock farms – which has a direct impact when creating favourable conditions for the balanced development of rural sustainability.

Based on this, the research consisted of several stages, and different methods at each stage were applied to validate the results:

1. Mapping of stakeholders – key players of biogas production in Lithuania;
2. Interviews with selected key players of biogas production – agribusiness and government representatives;
3. Data analysis;
4. Focus groups meeting for validation of results and deeper analysis of relevant factors.

#### *Stage 1: Creation of a map of key players' for biogas production in Lithuania.*

A stakeholder map was created using the stakeholder salience methodology, after Mitchell (1997), which was adapted to macro level analysis. Mitchell's (1997) methodology proposes that the potential role of stakeholders in developing value chains is measured through the following main dimensions (attributes):

- the *urgency* is the stakeholder's claim on the value chain. Urgency calls for immediate attention or pressing action. The dynamics of a value chain are caused by the need to enhance productivity through the search for an optimal allocation of resources.

- the stakeholder's *power* to influence the development of the value chain. Power is a relationship among social actors in which one social actor, A, can get another actor, B, to do something that B would not have otherwise done. Powerful stakeholders may be companies or institutions which control money, knowledge, rules, decisions, or other crucial resources.
- the *legitimacy* of the stakeholder's relationship with the value chain. Legitimacy is a generalised perception that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions.

Using the methodology described, the two key groups were identified as the key players able to shape the balanced development of rural sustainability in regions through biogas production in Lithuania:

- 1) Agribusiness companies (actual producers of biogas from agricultural bio wastes);
- 2) Government institutions (ministries responsible for the development of the circular bio-economy in Lithuania, including within the biogas sector).

The rest of the stakeholder groups in the ongoing research were eliminated due to the objective of measuring the interaction among political will and actual implementers of biogas production, aiming to propose future directions for collaborative agribusiness using the circular bio-economy approach for the balanced development of rural sustainability.

Stakeholders were selected based on 3 criteria: measuring the power (P), urgency (U), and legitimacy (L) of each stakeholder to influence the development of a circular bio-economy in biogas production in Lithuania. The results of the mapping of stakeholders (see Table 1) were then used for the selection of the most relevant interviewees.

**Table 1. Assessed stakeholder influence to shape the development of a circular bio-economy in the field of biogas production in Lithuania**

	Urgency (U)	Power (P)	Legitimacy (L)
<b>Agribusiness companies</b>	2	1	1
<b>Government</b>	2	2	2

Scale from 0 to 2: 0 = no urgency, legitimacy, and power; 1 = some urgency, legitimacy, and power; 2 = high urgency, legitimacy, and power.

*Stage 2: Interviews with selected stakeholders.* A structured questionnaire was used for the interviews, aiming to assess the experiences of stakeholder groups from agribusiness and government institutions in the fields of biogas production, distribution, consumption, and regulation (see Table 2).

**Table 2. The assessed aspects of collaboration between agribusiness companies and government institutions**

Assessed area	Measured mismatch between collaboration expectations and experience
Expectations and experiences in:	- national collaboration - international collaboration
Collaboration with:	- business - government
Collaboration in:	- regional development (infrastructure, logistics, land-use) - regarding innovation network (business development, employment affairs, advice) - regarding future ventures (events, education, knowledge/export-oriented activities)

*Source: created by authors*

Interviews took place from May to September, 2018.

*Stage 3: Data analysis.* The data received from the interviews was analysed, with the aim of receiving answers to the following research questions:

- Do agribusiness companies and the government value the importance of collaboration in the process of biogas innovation as a tool to balance the development of rural sustainability?
- How big is the mismatch between agribusinesses' and the government's expectations and actual experiences of collaboration for innovation in biogas?

*Stage 4: Focus group meeting.* The focus group meeting was organized as a structured dialogue on collaboration analysis, problems in connectivity, and possible good practices between the four groups. The meeting helped to uncover additional information relating to the research questions.

## Research results and discussion

*General description of the biogas sector in Lithuania and motivation for empirical research.* Biogas has been produced in Lithuania for more than 20 years. The production of biogas has been promoted since 2011, after the introduction of the Law on Renewable Energy of The Republic of Lithuania. In January 2013, the winners of the first biogas auction fixed the electricity purchase tariff with an approved quota of 18 MW (megawatts). However, further promotion of biogas production was stopped. There were 36 biogas plants operating in Lithuania in 2018: agricultural waste (14) 13.3 MW; landfill waste (9); sewage sludge (8); and Biowaste and Industrial waste (5). In total, 36 power plants in Lithuania provide a capacity of 9.481 MWth (megawatts thermal) and 30.218 MWe (megawatts electric). In the agricultural sector, biogas plants have been established for a decade. At the same time, the agricultural sector is the main biogas producer in Lithuania

(61.68%) (Statistics Lithuania, 2018). Biogas production from agricultural, landfill, and sewage sludge waste in 2016 exceeded 67.6 million m<sup>3</sup> in total, whereas annual natural gas consumption in Lithuania exceeds 2.3 billion m<sup>3</sup>. The production of biogas in the year 2017 fulfilled only 4.3 percent of all energy produced in Lithuania.

Despite the rapidly developing biogas sector, Lithuania remains in the lower echelon of biogas producers in the EU. For this reason, the development of biogas production from agricultural waste and residues has been identified as one of the priorities of Lithuania's Smart Specialization strategy. However, such an important tool in a post-industrial economy as collaboration for the balanced development of rural regions has not been taken into account during the formulation of strategy, nor in the action plan for implementation.

It therefore becomes crucially important to investigate the state of collaboration in Lithuanian agribusiness, and whether it aims to propose future directions for collaboration between agribusiness and government using the circular economy approach as a balanced development tool for rural sustainability.

*The importance of collaboration in the process of biogas innovation as a tool to balance the development of rural sustainability.* The number of innovation partners vary significantly among Lithuanian agribusiness companies and government institutions, both at national and international levels (see Table 3). Most agribusiness companies maintain collaborative relations for innovation with up to 20 actors, both at the national and international level. Hence, is it important to state some particular observations. On an international level there are weak collaborative relations for innovations in biogas among agribusiness companies and international governmental institutions. This indicates that agribusinesses do not interact with public bodies at an international level, and tend to implement innovations in biogas with national partners from other companies as well as government on demand.

**Table 3. The distribution of innovation partners among agribusiness companies and government institutions at the national and international level**

		Agribusiness companies	Government institutions			
National level	Agribusiness companies	2.0	1.7	International level	2.0	1.3
	Government institutions	2.0	2.7		1.8	2.7

Scale from 1 to 5: 1 = no partners, 2 = from 1 to 10 partners, 3 = from 11 to 20 partners, 4 = from 21 to 50, 5 = over 50 partners

*Data source: own calculations according to research results*



However, the stated importance of innovation partners in biogas elucidates particular significant insights, especially for policy makers (see Table 4).

**Table 4. The distribution of the importance of innovation partners among agribusiness companies and government institutions at the national and international levels**

		Agribusiness companies	Government institutions			Agribusiness companies	Government institutions
National level	Agribusiness companies	9.3	4.3	International level	Agribusiness companies	9.5	0.0
	Government institutions	9.0	9.0		Government institutions	8.3	0.0

Scale from 1 to 10: 0 = no partnership; 10 = very important partnership

*Data source: own calculations according to research results*

For agribusiness companies, the most important innovation partners are from other companies both at the national and international levels. However, the situation with regard to government institutions at the international level is completely different. Totally unimportant innovation partners for agribusiness companies are found in the shape of international public organizations (0.0). Additionally, national government institutions also do not see any advantage for collaboration in biogas with government institutions at an international level (0.0). This therefore demonstrates the closed position of Lithuanian government representatives regarding shared experiences in biogas as an option for balanced sustainability in rural regions as well as the adequate, timely, and qualitative development of the sector using international advice and international support measures.

*Collaboration expectations, experiences, and gaps.* The research results summarized, on collaboration expectations, experiences, and absences among agribusiness companies and government institutions, propose that there exist significant differences between both sides in understanding expectations and experience of performing actual collaboration both at the national and international level.

Collaboration expectations are much higher from the agribusiness companies towards government institutions, both at the national and international level, whereas the inverse situation is completely different (see Table 5).

**Table 5. Assessed collaboration expectations for innovation in biogas in Lithuania**

	National level	International level
<b>Agribusiness companies</b>	9.5	6.9
<b>Government</b>	5.6	0.0

*Data source: own calculations according to research results*

The greatest mismatch at the national level was found among agribusiness companies (U2-L1-P1) which expect almost double the level of collaboration with government institutions (U2-L2-P2) (9.5) than government institutions expect of them (5.6). At the international level, government representatives (U2-L2-P2) did not mention any expectations regarding collaboration with agribusiness companies in the field of biogas, whereas agribusiness companies (6.9) identified quite high expectations towards government institutions (U2-L2-P2) for collaboration.

Compared to actual collaboration experiences, expectations are higher than ongoing practices (see Table 6).

**Table 6. Assessed collaboration experiences for innovation in biogas in Lithuania**

	National level	International level
<b>Agribusiness companies</b>	6.9	6.6
<b>Government</b>	3.4	0.0

*Data source: own calculations according to research results*

At the national level, government institutions (U2-L2-P2) are very passive in such practices. Agribusiness companies note somewhat positive (above midpoint) experiences of actual collaboration practices regarding innovation in biogas. At the international level, government representatives (U2-L2-P2) did not mention any experiences regarding collaboration in biogas production. Agribusiness companies identified quite high expectations (6.9) towards governments (U2-L2-P2) for collaboration at the national level.

The findings described above enable the calculation of gaps among collaboration expectations and actual experiences for biogas (see Table 7).

**Table 7. Assessed collaboration gaps between agribusiness companies and government for innovation in biogas in Lithuania**

	National level	International level
<b>Agribusiness companies</b>	2.6	0.3
<b>Government</b>	2.1	0.0

*Data source: own calculations according to research results*

When measuring the expectation–experience collaboration gaps summarized above, there exists a gap (2.6) among agribusiness companies (U2) and government institutions at the national level. At the international level, government institutions express a match between expectations and experiences with agribusiness companies. In other words, there is no need and no will (!) to collaborate internationally for innovation in biogas.

## Conclusions

1. Theoretical findings suggest that there already exist prospective inventions in the field of economics, business, management, and governance. Scientific discussion leads to the possibility of using appropriate collaboration models for reaching the balanced development of rural sustainability. These collaboration models empower the advanced principles of a circular economy. Thus, the scientific evidence arrives at how the future of agribusiness becomes highly dependent on the role taken by the government in accelerating prospective innovations, even though they occur in a field of activity supported by public funds. Collaborative political decisions made to support a circular economy approach in biogas production become promising for the future development of livestock agribusiness that is both less polluting and of more benefit to society.
2. Collaboration models for a prospective circular economy in the field of biogas production might successfully work if all collaborating parties are equally devoted to the same purpose. However, empirical investigations from Lithuania suggest that the passive and isolated role of government institutions, themselves being key legislative bodies related to the biogas sector, cause the greatest difficulties for collaboration in biogas production for the development of a circular economy. This demonstrates the actual need to accelerate Lithuanian governmental institutions as key players to be more open for collaboration regarding innovations.
3. The overall findings underline one of the characteristic features of an immature democracy, which hinders the balanced development of rural regions in Lithuania. Therefore, it is suggested to broaden the use of the circular economy approach in fostering balanced development among the dimensions of rural sustainability in the European Union Common Agricultural Policy after 2020. This can serve to accelerate Lithuanian policymakers to improve qualifications and implement prospective decisions regarding

biogas production and exploitation in livestock farms for the balanced development of rural sustainability.

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## **Vyriausybės institucijų ir ūkininkų bendradarbiavimas biodujų gamyboje: subalansuota kaimo tvarumo plėtra**

Santrauka

Kaimo vystymo politika praėjusio amžiaus antroje pusėje patyrė daugybę transformacijų dėl vykusių industrializacijos procesų, apimančių darbo žemės ūkyje mechanizavimą, melioracijos ir drėkinimo sistemų įrengimą, elektrifikaciją, cheminių gamybos technologijų, didinančių produktyvumą, vystymą ir kita. Tačiau pastaruoju metu subalansuotos kaimo plėtros, nukreiptos į žalingo poveikio aplinkai mažinimą ir gyvenimo kokybės gerinimą, klausimai užima pirmaujančias pozicijas kaimo politikos mokslinėse diskusijose. Anksčiau įgyvendintų agroverslo rėmimo priemonių rezultatai pastaruoju metu atskleidžia pražūtingą vykdomos žemės ūkio politikos ateitį. Pernelyg spartinus kaimo plėtrą remiantis produktyvizmo filosofija, kaime ėmė ryškėti akivaizdūs neigiami pokyčiai, kurių ryškiausi – destruktivus kraštovaizdžio kitimas ir gyvenimo kokybės blogėjimas. Todėl ateities žemės ūkio ir kaimo plėtros politikai būtini nauji modeliai ir novatoriški sprendimai.

Pagrindinis šio straipsnio tikslas – pasiūlyti subalansuotą kaimo tvarumą užtikrinančius modelius naudojant bendradarbiaujančio agroverslo žiedinėje ekonomikoje koncepcinę priegą. Kokybiniai tyrimo rezultatai, iliustruojantys siūlomus bendradarbiavimo modelius biodujų srityje, surinkti 2018 m. vasarą ir rudenį naudojant pusiau struktūrizuotus interviu. Sprendimų priėmimo pusę biodujų gamybos srityje Lietuvoje reprezentuoja informantai, atstovaujantys susijusias ministerijas (Lietuvos Respublikos Žemės ūkio, Aplinkos apsaugos ir Energetikos), o praktinių įgyvendintojų pusę reprezentuoja kiaulių augintojų ūkiai.

Tyrimo rezultatai suponuoja, kad žemės ūkio ir kaimo ateitis ženkliai priklauso nuo vyriausybės priimamų sprendimų pobūdžio. Bendradarbiaujant kartu su ūkininkais priimami inovacijų diegimo sprendimai ženkliai paspartintų jų vystymąsi tose srityse, kurios kritiškai svarbios užtikrinant gyvenimo kokybę kaime, ypač, kai šie sprendimai remiami iš viešųjų lėšų. Bendradarbiaujant priimami politiniai sprendimai įveiklinant žiedinės ekonomikos principus biodujų gamybos srityje gali būti naudingi kuriant mažiau taršius, bendruomenei draugiškus ir tokiu būdu gyvenimo kokybę kaime ilguoju laikotarpiu užtikrinančius gyvulininkystės ūkius. Todėl siūloma plėsti žiedinės ekonomikos principų taikymo spektrą formuojant žemės ūkio ir kaimo politikos sprendimus subalansuotam ir tvariam kaimo vystymui Europos Sąjungoje po 2020-ųjų.

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