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THE LATVIAN BIOGAS NETWORK

LINSA Case Study report: Latvia

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Executive summary

The Latvian Biogas network was formed about six years ago to develop production of biogas, in response to renewable energy policy goals and availability of generous public funding. The network is rather small and dispersed, interactions are motivated by the need of technological, economic, agricultural learning to localise the use of borrowed biogas technologies. There are several centres of knowledge sharing, and a lot of controversy on what is acceptable practice. The development of biogas production depends on availability of public funding, which is now suspended. However, the network has diffculties to mobilise itself for a joint response.

The LINSA develops around a radical technological innovation with related social and organisational innovations. Structurally it is a network of networks. The LINSA is constituted by a **diverse range** of actors: biogas producers, scientists, equipment suppliers, service providers, investors, consultants, banks, municipalities, environmental agencies, NGOs. The entities involved in the LINSA may be estimated at 100, where the number of biogas producers (farmers and enterprises) may be estimated at about 35-40. The **active core** of producers linked in network and the Latvian Biogas Association is around 12-20 entities. The **central nodes** are the Latvian Biogas Association, Vecauce study farm, Ecodoma energy consultants, some of the more active producers, applied research projects developed within the Latvian Agriculture University.

The story of the LINSA is one of a fast up-scaling and then a hiatus, following controversial developments in the socio-technical regime. A crucial stimulus for development was the political decision in 2009 to provide state support for green energy and distribute quotas to biogas producers at a higher-than-market price for 10 years, with decreasing support for the subsequent 10 years. The LINSA responded by forming a grass-root niche. Later on the drivers for biogas sector were mostly political and top-down (quotas, financial support mechanisms). However, it is now considered that the public support mechanisms failed to achieve a balance of energy production, environmental protection and efficiency considerations. Support is being reconsidered by the Ministry of Economy; this contributes to an already controversial image of biogas production. Thus the sector is now in a hiatus; it cannot yet function according to market principles. However production continues within the previously gained quotas, and learning needs are as topical.

Collective and organised learning is mostly project-based (e.g. organised by the Association); there is little coordination of learning in LINSA. The approach works only because of the relatively small scope of the network. A new knowledge need is related to managing social relationships and public relations in biogas sector. However, the relatively sheltered niche of biogas production (up to now) has not been conducive to extensive and open collective activities. Now the need for more coordination has been repeatedly voiced by some key actors.

Contribution to sustainability of the LINSA is ambivalent; with differences between groups of agents (landless investors, agricultural producers, researchers). The shared concern is for the localisation of borrowed technologies.

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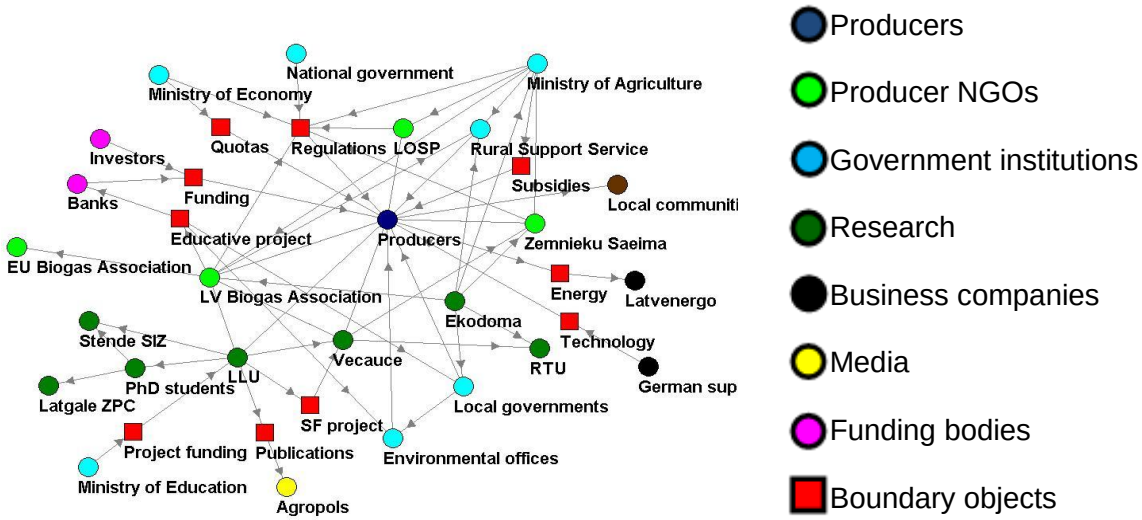
1 INTRODUCTION

The LINSA actor composition and relations between them are represented in Figure 1.

1. Figure Biogas network (the lines between nodes stand for knowledge flows)



Technically, the **coverage** is national, since there are biogas plants all over the country. There are relations to foreign knowledge sources, e.g. the Latvian Biogas Association partner is the German Biogas Association.

One of the **most central actors and drivers** for the whole network development is the study farm “Vecauce”, a pioneering biogas producer and research station, possessing considerable experience and knowledge, carrying out research and knowledge dissemination activities. This study farm also acts as **co-learner** together with interested producers and **promoter** of sustainable biogas production at political level. The Latvian Biogas Association is another formally structured platform in biogas network, which engages in public communication, awareness raising, education and policy work. The Association also acts as a boundary spanner to raise awareness of public and market benefits of biogas production, as it involves in its educational projects banks, municipalities, and policy makers.

Communication in the LINSA mostly occurs through individual sub-networks, as well as organized project events (training, dissemination of research results, field days, etc.), however LINSA does not influence much the whole policy network around biogas production. The **communication infrastructures** are formal: mostly **web-based** (homepages of research organisations and Association), or project based training activities (demonstrations, training seminars); as well as **informal** – peer to peer exchange of experience among producers or informal direct consultations between the producers and

researchers. There are also publications for practitioners and policy related meetings organised by the Biogas Association.

The Table 1 below summarizes the biogas LINSA across the characteristics which influence the learning and innovation processes. Those network properties form the context in which innovation takes place.

LINSA	Network characteristics						
	Number of members	Degree of innovation	Age of network	Governance and learning	Structural composition	Public financial support	Sustainability outcomes
Biogas	100	Radical	Young	Top-down, individualistic with emerging collective coordination platforms	Hybrid, split modes of production	High	Controversial impact on environmental and social sustainability

1. Table Learning and innovation context in Fruit LINSA

2 METHODS

This study combines a transdisciplinary case study approach (Stauffacher et al 2006) with action research (Stinger 2007) and grounded methodology (Glaser and Strauss 1967). We interacted with LINSA during a two year period in a series of research and learning activities, using different methods: workshops, questionnaires, participant observation, network mapping and other. Some of the more traditional research methods used were interviews with biogas producers, researchers, policy makers and the Latvian Biogas Association; attendance of applied research conference “Renewable energy and energy efficiency”; grey literature review; scanning of websites and policy documents.

These methods allowed us to explore the composition, evolution and governance of the network, map the stakeholders, establish their learning methods and determine knowledge flows between actors. As the biogas LINSA has about 100 members, we established closer links with smaller groups of producers (sub-networks) to deepen insight into their learning and interaction practices over time. To build trust and promote the development of the LINSAs, we acted on jointly determined issues of interest, e.g. organised a workshop to discuss the controversial developments in the biogas production sector and possible LINSA responses, providing a non-partisan platform for stakeholder exchanges. This enhanced LINSA members’ participation in joint learning activities and raised their interest to collaborate with SOLINSA researchers.

The research plan was flexible and evolving. We tried to adjust our collaborative research and learning activities with LINSA to their events and avoid ‘artificial’ interaction with LINSA. Instead we looked for contexts in which to organically include and probe new methods of interaction, adjusting them to LINSA topicalities. Interactions in LINSA are very situated and we as ‘external’ agents

could not intervene and impose our agenda unless it had come up organically meeting the LINSA needs, e.g. to discuss a complicated situation involving a range of stakeholders, to facilitate the dialogue between the Association and the Ministry of Economics. Thus the research was adjusted to LINSA events, timing and agenda. Validation of preliminary results and joint planning of next activities (e.g. the network mapping, workshops) made LINSA members co-authors and appreciated their expertise.

Comparing with the beginning phase of research mutual trust was increased especially with several key network actors.

3 RESULTS OF THE ANALYSIS

3.1 Constraints and opportunities for LINSAs within their particular context and the support needs for successful LINSAs

Opportunities: The development of the network started in 2008 with the study farm "Vecauce" (of Latvian University of Agriculture) as a focal point and the first biogas plant in Latvia. The expansion of biogas sector since 2009 was fostered by a political decision to support biogas production, within the context of broader agricultural, rural and energy sector developments. Favourable policy created structural opportunities for entrepreneurs to enter the renewable energy field. The network expanded rapidly: while in 2008 there were only 7 producer stations, in 2011 after introduction of state support there were already 36.

The LINSA has a diverse composition: this is a valuable resource; however the participants do not form a "well -integrated network' yet. It seems that the biogas network is in the process of defining some of the ground concepts; e.g. what is a sustainable practice in biogas production; who are biogas producers vis-a-vis the state and the public; what are the network's internal rules of conduct.

The activities of LINSA originate from several nodal actors proactively – accessing and generating new knowledge necessary for biogas producers, and reactively – mobilizing producers individually and collectively to respond to government incentives the in renewable energy sector. A group of the more experiences biogas producers have accumulated considerable experience in localising technologies; owing to multi-year funding, local innovative activities on biogas issues have been developing at several research sites. Several successful knowledge brokers have evolved in the LINSA.

The LINSA is oriented towards renewable energy market and profit making of individual producers. The other major function of LINSA is technological learning. Sustainability is the function that still needs to be negotiated and enacted in this LINSA.

Constraints and current challenges: Currently the alignment of network participants on technical and especially social and sustainability aspects is far

from complete. This can be attributed to the considerable diversity and social distance of stakeholders and distortions caused by the high level of state support. There is little interaction across two key kinds of biogas producers (landless investors and agricultural producers).

Several negative consequences have become apparent in the sector's boosting development: landless investors out-compete local farmers-biogas producers, biogas production pushes up land prices, local farming and ecosystems are challenged by the production of biomass monocultures, consumers pay a higher price for electricity, and much of the produced heat energy is unutilised.
Currently the network is struggling with a largely unfavourable public image and its future is uncertain as policy makers consider reducing the state support. The hitherto individualistic approaches to technical and economic learning cannot be continued and governance, organisational and communication issues stand out in biogas network learning. The new learning issues are localization of technologies (e.g. experimenting with raw materials, applications of heat) and social innovation (e.g. coalitions between farmers and investors, energy producers and municipalities).

The politically sheltered biogas production in 2009-2012 did not require much operational cooperation among producers and other stakeholders (researchers, investors, equipment suppliers) either in learning, or development of the market for produced electricity and heat, or legitimating the input of the sector to environmental sustainability and rural development.

The whole network (larger LINSA) so far has been mobilised only periodically by the NAO and lead organisations for negotiation and joint decision-making on state support. The current crisis in the sector, the government plans to curb public support and negative public image requires more intensive coordination in the LINSA. The NAO will have to become more participatory; more "network-maintenance" is needed. The LINSA is at a crossroads – either it will consolidate internal (norms) and external (sector-wide) governance, or it will remain fragmented, which will block further innovation in biogas production.

An attempt to discuss divergent interests and align LINSA participant frames was made in early 2013 to bring landless investors into a dialogue with farmers. The discussion workshop was facilitated by non-partisan social scientists (BSC), thus providing space for airing differences and raising awareness about shared long-term development interests.

3.2 Mechanisms of network development, learning and innovation processes and connections with the formal AKS systems

The LINSA contains both more **formally** structured entities (The Latvian Biogas Association, Latvia University of Agriculture and its subsidiaries, biogas producers, investors etc), and more **informal** knowledge exchange or decision-

making networks (groups of producers, smaller alliances between researchers and producers).

The LINSA presents itself as an **arena of intersecting**, both complementary and conflicting interests and practices. There is little general agreement on network norms presently. The commonality might be related to the shared awareness that all biogas solutions have to be localized. The need for more communication is acknowledged. **Complexity** of the LINSA is manifested in the existence of several sub-networks. Most of the networking happens within more limited individual networks.

Some structural divides in biogas LINSA (there are two groups of producers – those who are farmers themselves and those who are landless investors and operators) hamper the integration of LINSA structure and coherent learning

Several mechanisms can be discerned that stimulate coordinated action and network formation: common knowledge needs, joint learning activities, possibilities to access information through LINSA, policies and public support that mobilises LINSA around joint (economic) interests, several overarching ideas ("frames") that form a loose basis for interaction in the network (for example, the need to 'localise technologies'). Common rules and norms in the LINSA are developing gradually in collective interactions. At the same time there is no written or implicit code of practice among biogas producers; producers compete for land and outbid each other without internal regulation (especially investors hold an opportunistic attitude). Decision making in the Biogas Association is done within a narrow range of actors, others have little involvement.

The need for public recognition is another driver for the network members to come together. They are increasingly aware that more communication is needed on the market potential, contribution to sustainability of biogas production, but few agents except the Biogas Association seem to be actually promoting the public image of the sector.

There is **no overall coordination**, activities originate from several nodal actors proactively –accessing and generating new knowledge necessary for biogas producers, and reactively – mobilizing producers individually and collectively to respond to government incentives in renewable energy sector.

We observe that **less participation** is characteristic of those who are interested in achieving high economic outcomes to the detriment of following acceptable practices, or who are unwilling to share their problems and hoard their knowledge. In addition, landless investors seem to form a somewhat separate subset, differing from those whose biogas production is linked to own agricultural activities. All in all, the "joint-ness" of biogas LINSA appears developing, yet not present to a degree sufficient to identify this LINSA as a community of practice. The network is loosely structured and represents the interests of distinctly diverse groups. The repertoire is not completely shared, knowledge sources vary from local to foreign, from practitioner to scientific.

Learning and innovation processes: The network addresses the learning needs of participants related to technological learning, interaction with the market and the local communities, and maintaining a political dialogue. The network responses so far have been knowledge transfer from research institutions to practitioners, adoption of foreign technologies, and predominantly individual learning from key knowledge sources: demonstration farm 'Vecauce', the Latvian Biogas Association, research institutions, and more experienced biogas producers. Those LINSA members who are in / close to the central nodes and maintain peer-to-peer learning activities benefit the most. Knowledge on economic performance is less readily shared. The knowledge provided by traditional AKIS organizations may not always be relevant to producers and meeting their practical needs, meanwhile the role of knowledge brokers is considerable: these are persons whose structural position allows them to be independent, flexible, and responsive and thus promote interaction and learning. Most often these are researchers and consultants from small private institutes or demonstration farms rather than university researchers.

Learning in the LINSA is promoted by several entities, the Latvian Biogas Association, the Latvia University of Agriculture, the study farm "Vecauce", and the Latvian Rural Advisory and Training Centre. In addition, there is learning in smaller individual networks (CoPs), which is ad hoc and mostly emerges from day-to-day interaction. Notable channels of knowledge to producers are providers of equipment (German, Scandinavian).

Importantly, landless investors and agricultural producers address their technological learning needs differently. The agricultural producers established relations with biogas researchers from Latvia University of Agriculture and 'Vecauce' demonstration farm to source the necessary technical knowledge. They also aligne in smaller peer-to-peer learning groups to exchange hands-on knowledge. For this group, technical learning is centered on effective use of biomass provided by their own farms. These plants are embedded in local farming systems. Experience exchange with peers is part of 'what reasonable producers do', and environmental sustainability concerns form a part of what an acceptable 'mode of production' is.

For landless investors, biogas plant projects often have been copy and paste projects from similar plants in Germany. They are more reliant on technical advice from equipment providers, and more interested in sourcing biomass from elsewhere even at higher price, thus putting strain on farming systems and land use regionally. Acceptable 'mode of production' does not necessarily include sustainability concerns. Large-scale landless project developers are usually not part of the learning network, and do not consult with researchers, farmer-producers, or local communities. Often these are cases of a business operation poorly integrated in the local production system.

The Latvian Biogas network represents a complex, multidimensional **innovation**. The very process of biogas production is a **radical innovation**, as it requires considerable changes in energy production (new energy sources and

technologies and services, waste sorting, recycling) and consumption practices (utilisation of electricity and heat produced in biogas stations, the readiness of consumers to pay for it). Although biogas production is based to a great extent on borrowed technologies developed abroad (which is more characteristic to incremental innovations), an important aspect of this innovation is arriving at locally viable solutions (technologies). The need for local solutions induces interactions, gradual networking and new coalitions resulting in local knowledge creation. At this point, the innovation is largely supported by the state policies (which represent a larger scale (landscape) opportunities), but is to some extent contested by the public opinion.

The **AKIS** system in biogas includes: the study farm „Vecauce“ of the Latvia University of Agriculture (LUA); the renewable energy research group at the LUA; the Institute of Physical Energy; private research and consultancy companies (BUPF, Ecodoma, KPMG Baltics, Fidea Consultants, Prudentia Energia); Rural Advisory and Training centre; as well as foreign technology providers.

The links between LINSA and AKIS are based on individual contacts. Relations between producers and researchers are mostly informal. Producers are usually the initiators of collaboration. There are some boundary organisations (and persons), especially the study farm „Vecauce“ and its director, who bridges different groups of producers, researchers, and other public actors.

The links from AKIS towards producers are not well institutionalised. Recent applied research programs tried to coordinate biogas researchers in a collaborative multi-year project and disseminate the results in the community of practitioners. The barriers between LINSA and the AKIS include: differing foci of interest (the researchers are interested in experiments in laboratory conditions, while practitioners need fast solutions to practical problems in real conditions of production); different value systems (the researchers being more concerned with biodiversity, sustainability, promotion of scientific knowledge, while producers are more concerned with economic performance); organisational barriers (some producers blame researchers for passivity in responding to their proposals to carry out joint research in real production situation).

The ability of AKIS to meet LINSA needs depends also on the formulation of research tasks and the way of research implementation – whether it is applied, collaborative and producers' problem oriented.

The ability of AKIS to meet producers' needs is quite limited. Therefore the role of foreign research companies and technological advice providers is notable. There is a parallel technological advice system offered by equipment companies.

Because of intensive circulation of highly complex technological information, the network participants have to rely on specific actors to validate information relevance. The trusted agents in biogas are those who have been in operation

for 3-4 years now and are the most active participants of knowledge sharing, closely related to researchers either from the University of Agriculture, the study farm “Vecauce” or the young scientists from BUFPI.

Local expertise in biogas has been generated only recently, therefore **trust relations** between researchers and producers are not as strong; however the producers are eager to obtain locally produced and verified knowledge. The ability of AKS actors to provide for the knowledge needs is hampered by the project-based funding of their activities (for researchers), sometimes by insufficient ability to find common ground (researchers-practitioners), as well as the somewhat fragmented state of the network.

3.3 Learning approaches, methods and tools used in LINSAs

Learning needs are intensive as biogas is a new and radical innovation for the most of actors and it demands considerable technological, social and organizational changes. Much knowledge is imported from other countries as there was little local expertise in biogas; however, knowledge is continuously being localised through research/experimentation both on technological process of biogas production and biomass.

The learning develops in **several interrelated domains**: biogas technologies, economic performance issues, the relations with local communities and local authorities, relations with the government in policy formulation and implementation. Not all LINSA participants are involved in all domains to an equal degree. The domains most pertinent to all are technological learning and economic performance.

Producers pursue their learning needs on a varying scope – from those who interact only with their geographically closest fellow producers and occasionally use the information provided electronically, to those who use virtually every opportunity to learn and interact, and have extensive knowledge networks all over the regions and use a variety of knowledge sources. If the expertise is not available locally, they consult foreign research companies or technology providers. The problem is that foreign technological advice is usually not locally adapted, and producers have to adapt technology to local conditions by experimenting or consulting the closest peers.

Thus, learning happens in different forms:

- Informal exchanges of experience between producers,
- Field days and training seminars organised by the study farm “Vecauce” and LUA,
- Direct consultations between researchers and producers,
- Regional training seminars about technological issues organised by the Latvian Biogas Association,
- Specific projects related to biogas research and their dissemination events at Latvia University of Agriculture.

Still, producers' approach to learning remains quite individualistic. It appears that experiential, hands-on learning is favoured by practitioners because it helps to obtain solutions for problems arising from the practice. Producers contact scientists only occasionally and on one-to-one basis.

Knowledge needs unite many of the stakeholders on both knowledge demand and supply sides. Technological aspects receive much attention from producers in particular, as they condition farm/company economic performance and competitiveness. At the same time, new technologies are examined with caution.

3.4 Tasks, roles and emerging quality needs for the knowledge and skills of actors and institutions

The **emerging needs** are related to three groups of issues 1) technological solutions: adaptation of foreign technologies to local conditions, technologies for heat production and utilisation of the by-products of biogas production (e.g. digestate as organic fertiliser), 2) economic solutions (how to produce the energy at the lowest cost possible), 3) social solutions – how to manage relationships with local communities and local governments, as well as demonstrate the "good deeds" of the sector to the general public.

Learning is a high priority in the LINSA, however the **specific needs** may differ considerably, based on the type of biomass used (manure, maize, waste; self-grown or bought), the type of equipment and its suitability for local conditions, the scope of production, etc. Thus the needs are also highly individual. The network participants also have quite divergent situations as to ability to meet their production quota.

Identification of learning needs is carried out both by formalised means (e.g. the Rural Advisory and Training Centre has questionnaires on knowledge needs) and through on-going interaction by key practitioners (several of whom are on the Association board). Sometimes knowledge needs are identified by researchers driven by their own interests, e.g. doctoral students.

Alongside with technological and economic learning, new knowledge needs seem to relate to **managing social relationships** and public relations in biogas sector. Much more coordination seems to be needed in this regard.

3.5 Support measures which are most effective and cost efficient

Details of support received by LINSA: The development of this LINSA is a response both to green energy policies and a new area of economic production. Following the EU bioenergy goals, the national policy was developed with the goal to increase the proportion of renewable energy in national energy production. The principles included both those relating to energy goals

(increased independence from the fossil sources) and environmental goals (improve the quality of environment, decrease and control pollution, biodiversity), as well as rural development (e.g. disposal of waste, productive land use).

The implementation of these principles required a coordinated set of mechanisms (technology and infrastructure development, capital investment, waste sorting, research and development, public education, logistical solutions, decisions about type of raw materials, etc.).

The support manifested in:

- distribution of production quotas to biogas producers;
- setting a higher price for procurement of electricity produced;
- political decision to charge the price difference from electricity consumers as 'obligatory procurement component' of renewable energy;
- investment subsidies for construction of new biogas plants.

The legislation and support measures (40% subsidized investment in biogas plants, distribution of production quotas, 10 year guarantees for high procurement price for electricity) set favourable preconditions for the sector's take off. The support mechanism is characterized as *feed-in system* (administratively provided rights to sell the produced energy at a higher rate, the expenditures being compensated by all end users in proportion to their consumption). A **safe business niche** has been created for a limited number of producers. The distribution of quotas involved political scandals.

According to an evaluation study carried out in 2012, the biogas producers received 86 million Lats (123 million EUR) in subsidies in 2007 – 2012 through compulsory electricity procurement component paid by the end consumers.

The **outcome** of the prominent support provided has been largely economic gains for biogas operators, increase of production volume. The LINSA saw a marked **up-scaling** starting from 2008 (the start of massive state support), and the number of biogas plants rapidly increased four-fold. More **disputable outcomes** are an increased electricity price paid by enterprises and private households, and certain distortions in land use and rural development.

Recently **unintended and controversial consequences of public support** become visible and disputed in policy discussions and media. One of the most vivid controversies manifest in the case of investors who enter biogas production from outside agriculture, do not possess land or necessary knowledge, but develop a business proposal and seek matching farmers or land owners to build a new biogas station. This has been considered by politicians and farming community as deviation from the original idea to connect biogas production with the existing agricultural farms. This process has created a group of 'landless' operators who compete for land, push up land prices, transport biomass for long distances, etc., and put pressure on the existing agricultural production systems.

The original idea of biogas production was associated with the use of agricultural residues, processing of manure, reduction of greenhouse gas emissions, introduction of localised heat supply systems and side production of fertilisers. These public benefits were seen as justification for the substantial public support. In reality permissions to open biogas stations were issued to operators outside agriculture with no land and engagement in farming. The geographical placement of stations was poorly controlled and electricity and heat production regulations were separated. The **public gains** of innovation are marginal whereas the **sustainability outcomes** questioned. In the end electricity consumers pay the cost of protected business. Most of gains were captured by a few private producers with many negative externalities to the rest of rural community and consumers at large.

The level of support has been very high, while the benefits derived have been ambiguous. In the opinion of the LINSA, some distortions were caused by the government policy itself, e.g. inclusion of co-generation stations (using natural gas for production of electricity) in the same support system. Also, there was a lack of control mechanisms and consistent criteria for the implementation of biogas projects, which increased risks, distortions in operation location distribution. The biogas policy lacked coordination with rural development policy, with numerous plants concentrated in areas with a high competition for land use.

Excessive and one-sided support: The up to now sheltered mode of production (quotas, guaranteed procurement, subsidized price) was not conducive to pursuing joint interests and especially – the long term sustainability of the sector. It seems that excessive and one-sided production support does not stimulate LINSA development if it is not combined with educational, organisational, social and other measures of network strengthening.

3.6 Evaluation criteria used for assessing the effectiveness and cost-efficiency of support measures that are exploited by LINSA

Evaluation criteria used: In 2012 the Ministry of Economy started to review the **actual impact** of prior support measures. Certain reconsideration of hitherto support policies was undertaken also by the Ministry of Agriculture. Various groups of consumers and media drew attention to the rising electricity price and publicly unjustifiable levels of support. The influential farmers' organisation "Zemnieku Saeima" claimed that biogas plants should be more strictly controlled with regard to inputs and sustainability criteria.

In 2012 the Ministry of Economy commissioned a study on effectiveness of public support to biogas production carried out by the research company

"Ekodoma". This study assessed some of the hitherto support measures as unsustainable and inadequate: the number of distributed production quotas was assessed as to high; the government support commitments were evaluated as unsustainable; the prior policy measures were evaluated as inadequate for developing a viable sector; the estimates showed that biogas stations would be inefficient in an open market competition without state support.

These evaluations made the Ministry of Economy to reconsider its former support policies and bring the distribution of new production quotas to standstill until 2016. The minister of economy made a statement "Latvia has to support the green energy production; however it cannot be done at the expense of other sectors and consumers."

Thus the evaluation suggested that the actual policy implementation was distorted by mostly focussing on subsidising the production, and not paying enough attention to environmental and rural development goals.

As a result of these evaluations and discussions the new guidelines for more sustainable and efficient support to biogas production are being elaborated by the Ministry of Economy. These include:

- Stricter control over the implementation of biogas investments projects and fulfilment of production quotas;
- Halt in distribution of new production permits and quotas;
- Stricter control over the kind of biomass used in biogas planst (preference should be given to agricultural residues and waste);
- Balanced development of green energy and food production avoiding unsustainable competition for land among biogas producers and farmers;
- Support to market development for the produced heat energy through encouraging collaboration between biogas producers, municipalities and other business companies.

These policy guidelines have been publicly discussed at Biogas Forum. The actual new support measures and instruments that are claimed to be more cost efficient and more sustainability oriented are in the process of elaboration, whereas the future development of currently operating and planned stations remains unclear.

3.7 Operational tools that AKS actors could use to improve support for LINSA and to enhance the capacity of involved actors, in order to foster successful LINSAs

The need for boundary persons to connect LINSA and AKIS: LINSA members evaluate AKIS as a useful, but 'standing apart' body which is not fully responding to producer's needs. 'The researchers stew in their own juice,' commented one LINSA member. At the same time biogas LINSA in incapable to great extent to formulate knowledge demand collectively and propose

collaborative mechanisms to researchers. Facilitators who act as boundary spanners would help to establish closer links between AKIS and LINSA.

Promote young researchers interested in collaborative research and innovation: The interest of AKIS representatives to collaborate with LINSA practitioners seems to be especially evident in the case of young researchers who need the practitioners as catalysts and users of their research. The same is true in case of small independent research and consultancy companies which try to be responsive to practitioners needs.

4 CONCLUSION

Biogas production in Latvia was politically (top-down) initiated with the arguments of energy and agricultural sustainability. The biogas LINSA is developing at the interplay of individual, collective and structural factors, such as policies and economic interests. Presently, the network is integrated by structural factors (politically created niche for the development of biogas production) and intensive knowledge needs. While the LINSA is concerned with renewable energy production; however, so far it has served mostly economic interests and has even aggravated some aspects of agricultural sustainability. All along the network development, business interests and sustainability issues clashed. There persists a controversy with regard to public and private benefits of biogas production in Latvia.

As a way of knowledge production and dissemination biogas LINSA does depart from the traditional way of knowledge production and dissemination governed by formal institutions. Although a traditional division of roles persists, it is evident that producers are active participants in knowledge production and dissemination. The producers predominantly use foreign knowledge sources (German, etc.). Contribution of Latvian scientists in the development of the biogas sector is constrained by limited funding and human capital, and not all biogas producers communicate with them. Sometimes scientists and producers do joint experiments on new technological solutions, and the initiative may come from both sides.

Biogas LINSA demonstrates also new diversified composition of agricultural knowledge networks. Traditionally important national agricultural advisory service has a limited presence in the biogas LINSA. Instead, individual researchers and technology and service providers have considerable influence on farmers' choices. Moreover, biogas LINSA introduces a new member of agricultural knowledge networks – investors. Their role and influence is ambivalent: on the one hand they stimulate technology transfer and technical learning; on the other hand their business model in many respects hampers valorisation of local knowledge and development of locally adjusted technologies.

Innovation and learning strategies in biogas LINSA are quite individualistic, although the intensive knowledge needs drive cooperation in smaller knowledge

sub-networks. Knowledge needs are mostly expressed regarding technological aspects of biogas production, but they involve also economic, organizational, political aspects.

This LINSA may be seen as a social, relational space of learning, where participants can (potentially) share their contexts and create new meanings. Connections among agents are activated when a shared need or interest emerges and they may lead to long-term collaboration (e.g., research or capacity building projects, experiments, financial contracts etc). However, the activities among the various agents are not coordinated closely enough.

This LINSA does not seem to possess the traits of a CoP to a substantial degree. Rather the Latvian Biogas network displays the traits of a constellation of practices, with few common rules, typical boundary interactions and some cross-disciplinary projects. Cooperation and coordination of is poorly developed, joint decisions are taken rarely. However all members admit the need for closer communication. There are a couple of agents in the LINSA (in particular, the study farm “Vecauce” and Biogas association), which perform as brokers within and beyond the network. They also create space for boundary interactions and development of common frames.

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