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Country Report

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Cross-clustering partnership for boosting eco-innovation by developing a joint bio-based value-added network for the Danube Region

Framework Conditions for Cluster Development in bio-based industry in **Slovakia**

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Introduction

Description of the region

Slovakia is a landlock country with the territory od 49 035 km2 and the population of 5,4 million people. Due to long tradition and favorable national resources, it has a strong agriculture, whereby the utilized agricultural area represented 1 921 563 ha in year 2015. Moreover, Slovakia belongs to countries with largest forest area in the EU with 41% share of total land area, whereby only 10 countries have higher share. Therefore we can say that Slovakia has good opportunities for production of biomass due to the large amount of available forest and agricultural land. In addition, Slovakia has strong primary biomass sector and energy sector. On the other hand, it is necessary to research and focus on more sophisticated areas, such as biochemical, phytopharmaceuticals or polymers.

Primary biomass – agriculture and food sector

The agriculture and food sector are not only important producers of food, but they are also the suppliers of materials that can be further exploited as the renewable energy sources. The agricultural biomass suitable for the combustion represents more than 2 million tons with energy potential 28 PJ. The highest energy potential has the cereal straw, corn stover and then rape and sunflower straw. From this point of view, the agricultural biomass can be classified into three groups of exploitation: the combustion, the production of biofuels and the production of biogas. In spite of potential of the straw, there is only one experimental power plant on straw burning in Zvolen, whereby the straw is used mainly for agricultural purposes or it is exported to Austria. The agricultural biomass is exploited within biogas stations that are supported by the Program of Rural Development. Furthermore, the production of biogas in Slovakia began in 1192 and nowadays there are three companies dealing with the production of bioethanol, seven power plants were built to produce bio-petroleum. In addition, gas station OMV Slovakia, Ltd. is a single one distributor of bio-oil in Slovakia, but the sales are still relatively small.

Wood biomass

In Slovakia, the wood biomass from forest and non-forest areas is one of the most important sources of renewable energy. In recent years, there was significant increase of domestic demand for fuel wood biomass due to the growing prices of fossil fuels, tighter emission limits and also investment incentives in this area. Currently, the overall exploitable potential of fuel wood biomass per year is 2,91 million tons, whereby it is exploited approximately by 49%.

Figure 1: Amount of wood biomass for energy production

Year	Chips[1]		Fuelwood and others[2]		Total	
	Thousands tons	TJ	Thousands tons	TJ	Thousands tons	TJ
2010	250	2375	695	6602	945	8977
2015	615	5843	835	7933	1450	13776

Source: NLC, 2015
Notes: 1) Chips and woody biomass for the production of chips
2) Fuelwood and wood used for energy from woody reside, felling debris and dead

Nowadays, the supply of forestry biomass covers 1,8% of the consumption of primary energy sources in Slovakia. Furthermore, the supply of wood chips from material produced in forest areas covers approximately 30% of yearly fuelwood consumption for needs of electric power plants, heating plants and others.

Waste

According to the Program of waste management in Slovakia for years 2016-2020, the country produces 9,5 million of tons of waste. The majority of the waste is produced in industrial sector (2,7 million of tons per year), in construction sector (1,67 million of tons per year) and in the area of the supply of electricity and gas (937 thousands of tons per year). In relation to increased protection of the environment and the necessity to reduce the production of landfill gas, Slovakia also set a goal to reduce the landfilling of biologically degradable waste.

Figure 2: Total production of waste in Slovakia in years 2010-2013

Category of waste	2010	2011	2012	2013
Municipal waste (t)	1 808 506	1 766 990	1 747 569	1 744 428
Annual increase/decrease (%)	+3,61%	-2,30%	-1,10%	-0,18%
Industrial waste	7 294 942	8 137 713	6 548 981	7 750 050
Annual increase/decrease (%)	+15,92%	+11,55%	-19,52%	+18,34%
Industrial toxic waste	430 450	379 714	371 553	364 541
Annual increase/decrease (%)	-11,19%	-11,79%	-2,15%	-1,89%
Total	9 533 898	10 284 418	8 668 103	9 859 021
Annual increase/decrease (%)	+11,86%	+7,87%	-15,72%	+13,74%

Source: MŽP SR

The composition of municipal waste must be understand as the share of individual components in municipal waste, it means potential amounts that can be separated. It can be expressed in quantitative way in following table:

Figure 3: The quantitative expression of municipal waste's composition, 2002-2008

Years	2002	2003	2004	2005	2006	2007	2008
Paper	198 173	207 919	191 766	202 574	211 030	216 924	232 790
Glass	121 952	127 9560	118 010	124 661	129 865	133 492	143 255
Plastic	106 708	111 956	103 259	109 078	113 631	116 805	125 348
Metals	45 732	47 981	44 254	46 748	48 699	50 059	53 721
Bio-waste	579 274	607 763	560 547	592 140	616 856	634 086	680 463
Toxic components	15 244	15 994	14 751	15 583	16 233	16 233	17 907
Residual waste	457 321	479 813	442 537	486 992	486 992	486 992	537 207

Source: MŽP SR

In 2015, Slovakia produced more than 1,7 million tons of municipal waste, which represents 348 kg per inhabitant. In comparison to other EU countries, Slovakia belongs to countries with lowest production of municipal waste per year. According to recent studies, the bio-waste produced within the EU represents approximately 40% of overall production of waste in EU, which represents 60 million tons per year. When we take into consideration that bio-waste includes paper, paper-board, edible oils, biodegradable kitchen and restaurant waste, green waste and wood, the percentage share of bio-waste in municipal waste represents in Slovakia approximately 51%.

Energy

Slovakia, together with other European countries, has committed to achieve the goal to mitigate the rate of climatic change. From this point of view, the most important measures are the reduction of energy consumption and the increase of share of renewable energy sources from the overall state consumption of energy. In 2013, the share of renewable energy sources represented 10,9% from the overall energy consumption in Slovakia. However, only 6,3% of the overall potential of biomass is exploited for the production of heat, fuels, biogas and electric energy. It is necessary to improve this situation, because Slovakia has committed to increase the share of energy from renewable sources to 14% till 2020 and up to 24% till 2030, from the overall consumption of energy. Furthermore, the biggest share from renewable energy sources in Slovakia, but also in the whole EU comes from biomass, especially from wood biomass. In next 5-10 years, the biomass has the biggest technical potential within renewable energy sources, but its exploitation is not sufficient these days. The energetic potential of biomass in Slovakia is described in the figure below:

Figure 4: Energetic potential of biomass

Type of biomass	Amount (t)	Energetic potential (PJ)
Agricultural biomass for combustion energy	2 031 000	28,6
Forestry biomass	2 432 000	26,8
Wood industry	1 835 000	22,0
Biomass for the production of biofuels	200 000	7,0
Municipal wood waste	300 000	3,6
Moldings and stillage within production of biogas	400 000	8,4
Excrements of farm animals	13 700 000	10,0
Purposely grown biomass for production of energy	4 050 000	40,6
TOTAL	**24 948 000**	**147,0**

Source: Action plan of the biomass exploitation for years 2008-2013, 2008

Bio-medicine and bio-technologies

Nowadays, the bio-medical research in Slovakia is less efficient, mainly in its final – translational phase, as a result of weak motivation of young scientific workers and weak commercialization of scientific results. In addition, the transfer of information to diagnostic and clinical practice is less developed too, due to the insufficient infrastructure for the realisation of such practices. In spite of these factors in the area of bio-medical research in Slovakia, there are several excellent teams with good quality results, international connections and huge potential in the future. The biggest success of Slovak industrial bio-technologies was the production of antibiotics, lysine and dextran. However, the production of goods with the highest added value, such as recombinant peptides and proteins, is in minimal level in the country. On the other hand, there are good quality research teams in the area of development and optimisation of bio-catalysts and bio-processes. The aim of the bio-technological research is to support three main areas of bio-technologies – pharmaceutical, industrial and environmental.

The priority areas of bio-medicine are the tumour diseases, the heart, vascular and brain diseases, endocrine and metabolic disorders, infectious diseases of bacterial and viral origin, the regenerative and transplant medicine and the allergies and allergens. Furthermore, the priority areas of bio-technologies are as follows:

- Pharmaceutical bio-technologies – production of recombinant peptides and proteins, the construction of new microbial strains and organisms through modern methods of synthetic biology and genomics, the preparation of bio-catalysts and bio-polymers
- Industrial bio-technologies – the scale up of fermentation processes for production of biologically active substances, the development of bio-separating processes for industrial technologies and the bio-catalysis of bio-transformation of products

Moreover, we have identified approximately 20 companies that are dealing with the sphere of bio-medicine and bio-technologies.

Bio-based industry key assets in Slovakia

Due to the long tradition of particular sectors and conditions of natural resources in the region, country's key assets in relation to bio-based industry are mainly in the sector of primary biomass, food and feed and energy sector. For this reason, majority of the cluster organisations, strong enterprises and also national policies and programs are focused in this area. In terms of the stage of development, strong sectors in Slovakia are in the age of mature production, which can be visible in the figure below.

Stage of development (Initial stage and take off (IS), Drive to maturity stage (DMS), Age of mature production

Figure 5: The stage of development of relevant industries

Key asset	Primary biomass sector	Food & Feed	Pulp & Paper	Chemicals	Polymers	Phyto-pharma	Textile & Clothing	Energy	Construction
Initial stage and take off						X			
Drive to maturity stage				X	X		?		X
Age of mature production	X	X	X					X	

Current situation in the region

I. Key driver, Innovation landscape

In Slovakia, the key driver is the primary biomass sector, mainly due to its long tradition and rich natural resources in the region. In terms of innovation landscape, the research infrastructure is in good state, as there are many Centres of Excellence and considerable amount of research institutions, such as Agrobiotech, Slovak Academy of Sciences, Water Research Institute or Food Research Institute. On the other hand, the knowledge is missing in some areas, whereby for appropriate working conditions the funding is necessary. Furthermore, there is weak support of clusters and cluster policies in Slovakia, thus there is small amount of clusters not only in this area, but also in general speaking.

II. Cluster development/cluster landscape

Clusters
There are approximately 10-15 clusters existing in Slovakia. In relation to bio-based industry, there are 6 clusters, from which the most significant is Slovak Plastic Cluster that is also dealing with biodegradable plastics. Their project, called Biodegradable materials and their processing, is testing the processing of biodegradable material using the technology of injection moulding. The co-authors of the project are the Institute of Polymer of Slovak Academy of Science and the Institute of polymer materials of Faculty of chemical and food technology of Slovak Technical University. There are also 3 energy clusters in this region, especially Energy Cluster of Presov Region, Energy Cluster – West Slovakia and National Energy Cluster NEK. In addition, Cluster for Support to Innovative and Green Technologies was established as a result of a cross-border cooperation project between Slovakia and Czech Republic with aim to provide information and consultation services on green and innovative technologies, as well as the institutional strengthening of innovation potential of the cross-border region West Slovakia/South Moravia through exchange of experience and know-how and support of cooperation between businesses.
Moreover, Bioeconomy Cluster is the first organisation in Slovakia that connects policy makers, researchers and business enterprises in bioeconomy sector within strong agricultural region with effect on the whole country. Despite the fact that Bioeconomy Cluster is a young organisation that was established in 2015, it was formed several years and it has already actively engaged in European policies, such as SCAR SWG for Sustainable Bio-resources for growing bioeconomy.
In addition to clusters, there are also different associations and informal partnerships, some of them may be better partners than clusters in this stage of the project. For example, National Forest Centre is cooperating with Pulp and Paper Research Institute, currently they have introduced universal paper machine using new generation of control system, which will allow the establishment of Just In Time system in the paper industry. Given research intention is fully in line with the objectives of the industrial revolution 'INDUSTRY 4.0', which is focused on the optimisation of technology of paper's production.

Enterprises
Due to historical development of entrepreneurial environment in Slovakia, there is not so many innovative businesses in the field of bio-based industry. However, some established businesses are very competitive and have strong potential, but it is necessary to identify them, make innovative audit and subsequently network/cluster them.

Policy makers
There is no coherent Cluster Policy in Slovakia resulting in very few existing functioning cluster organisations with very limited and not sustainable public support.

Knowledge institutes
Due to Structural funds, there is relatively strong support and thus availability of research infrastructure (in some cases world-class). In addition several Centres of Excellence, Science Parks, Competence Centres and other technological centres were established in recent years. However, its excellence would have to be examined.
Human resources in research and SME area are generally of low quality with some exceptions where excellent research teams usually linked with SMEs could be observed.
Co-operation and knowledge and technology transfer is still insufficient, however current policy strongly supports cooperation between research and SMEs and technology transfer.
Recently, all the Slovak Academy Institutes were assessed by independent foreign experts and the results showed that the Polymer Institute of SAS is among the best in the Europe.

Biomass supply
The agriculture, forestry sector, the pulp and paper, the processing of secondary raw materials are very strong in the country, thus there is significant biomass supply. However, it is important not to produce biomass on arable soil, but exploit it from waste that is suitable for the exploitation.

Competitive bio-based industry product
The most competitive products within bio-based industry in Slovakia are chips, or biodegradable packaging. Slovak Technical University in the cooperation with companies Panara and Envirocare established the Centre for Applied Research of environmentally friendly polymeric materials (CEPOMA) dealing with biodegradable plastics. In 2013 it registered a worldwide patent and now it is dealing with the possibility to adjust material according to customer needs and in the main time process them on standard production lines used for plastics.

Funding
Operational program Research and Innovation 2014-2020
Rural Development Programme 2014-2020 – European innovation partnerships
National funds (Envirofond, Agency for Science and Research Support)
Moreover, energy efficiency is supported by several programmes (Integrated Regional OP, OP Quality of Life, ...)

Policies, Programs and Regulations
Country has a good quality document "Strategy of Research and Innovation for Intelligent Specialisation" (RIS3). However, frequently changing political environment in Slovakia causes that even long-term strategies are not respected and thus become not reliable. This is related also to role of clusters, which are strongly emphasized in the RIS3, but no call was published to support clusters, yet.

Key asset	Primary biomass sector	Food & Feed	Pulp & Paper	Chemicals	Polymers	Phyto-pharma	Textile & Clothing	Energy	Construction
Cluster organisation	X				X			X	
Enterprises	X	X	X				?	X	
Policy makers	X	X						X	
Knowledge institutes	X	X	X	?	X	X		X	
Biomass supply	X		X						
Competitive bio-based industry product on the market	X		X		X (?)			X	
Funding	X	X						X	
Policies, programs and regulations	X				X	X		X	

III. Where has a given region/country relevant strengths and opportunities

In relation to bio-based industry, the business environment in Slovakia is focused mainly on the sectors of primary biomass, food and feed, pulp and paper, and energy sector. The main reason is the long tradition of these sectors in the country, whereby they are also supported by various policies.

According to SWOT analysis conducted by Research and Innovation Strategy for Smart Specialisation of the Slovak Republic (RIS3) (2013), the country's relevant strengths are as follows:

- Good results in selected scientific and technological disciplines, with concentrated research teams and workplaces (materials and nanotechnologies, information and communication technologies, biomedicine and biotechnologies, industrial technologies, energetics and energy, environment and agriculture, social sciences and humanities)

- The quality of human resources in the competitive production sectors stemming from the tradition

Furthermore, the relevant opportunities of Slovakia can be summarized as follows:

- Broadening the connection of domestic sub-suppliers to global supplier MNC chains
- Creation of linkages between MNCs' R&I and domestic business R&I framework
- Deeping the dialogue between academic and industry sectors
- Potential for using land and strategic domestic natural resources (water, timber) in innovative economy
- Support for the conversion to green technologies, materials and products due to legislation and undesirable ecological changes
- Insufficiently used agriculture and water resources management potential
- Potential in terms of biodegradable materials

Regional Bio-based industry Strategy

Criteria	Indicator	Region	
		2010	2015
Land use	Forestry land (% of total land area)	41,0% (2 010 817 ha)	41,2% (2 014 731 ha)
	Agricultural & horticultural land (% of total land area)	39,2% (1 921 961 ha)	39,4% (1 930 570 ha)
Biomass availability	Agricultural biomass production (kg/capita]	3 702 kg/capita	
	Blue biomass production (kg/capita)	NA	NA
	Forestry biomass production (kg/capita)	175,1 kg/capita	267,1 kg/capita
	Waste production (kg/capita)	328 kg/capita	348 kg/capita
Innovation	SME birth rage (% of total firms in region)	6,56% (53 077)	11,93% (95 242)
	R&D expenditure (index (EU = 1))	0,34 (1,838% EU; 0,62% SVK)	0,46 (1,95% EU; 0,9% SVK)
	R&D employment (% of total employment in region)**	0,77%	
Cluster size	Firms in total bio-based industry sectors (% of total firms in region)	5,22%	5,3%
	Employment in total bio-based industry sectors (% of total employment in region)	8,4%	7,54%
	Firms in primary biomass sector (% of total firms in region)	3,77% (25 757)	3,98% (27 833)
	Employment in primary biomass sector (% of total employment in region)	3,37% (73 081)	3,24% (73 353)
	Firms in food & feed sector (% of total firms in region)	0,38% (3 073)	0,36% (2 873)
	Employment in food & feed sector (% of total employment in region)	1,47% (43 208)	1,33% (38 307)
	Firms in paper & pulp sector (% of total firms in region)	0,04% (318)	0,04% (294)
	Employment in paper & pulp sector (% of total employment in region)	0,26% (7 726)	0,25% (7 153)

Criteria	Indicator	Region	
		2010	2015
Cluster size	Firms in chemicals sector (% of total firms in region)	0,03% (283)	0,04% (319)
	Employment in chemical sector (% of total employment in region)	0,31% (9 158)	0,31% (9 028)
	Firms in polymers sector (% of total firms in region)	0,20% (1 585)	0,19% (1 495)
	Employment in polymers sector (% of total employment in region)	0,95% (27 699)	1,07% (30 588)
	Firms in phytopharma sector (% of total firms in region)	0,003% (26)	0,003% (26)
	Employment in phytopharma sector (% of total employment in region)	0,08% (2 244)	0,08% (2 170)
	Firms in textile sector (% of total firms in region)	0,76% (6 123)	0,63% (5 001)
	Employment in textile sector (% of total employment in region)	1,28% (36 768)	0,63% (35 127)
	Firms in energy sector (% of total firms in region)	0,04% (294)	0,06% (487)
	Employment in energy sector (% of total employment in region)	0,68% (20 034)	0,63% (18 104)
Quality of workforce	Secondary & Tertiary education in bio-based industry (% of total population in region)		2,8% (151 124)

I. Is there a specific regional Bio-based industry strategy? On which pillars is the strategy focused? Is there a smart specialization strategy? Is the strategy focused on Value Chains?

There is no specific Bio-based industry strategy in the country. On the other hand, there is RIS3, whereby it is not primarily focused on Value Chains; they are just mentioned within the strategy. The main objective of given Strategy is to encourage a structural change in the Slovak economy towards growth based on increased innovation abilities and excellence in Research and Innovations with the aim to promote a sustainable increase in incomes, employment and quality of life.

II. How is Bio-based industry supported?

Bio-based industry in Slovakia is supported through various policies, such as Operational program Research and Innovation, Program of Rural Development, Enviro-fund, Operational Program Quality of environment, Program of waste management in Slovakia for years 2016-202, Recycling fund.

Furthermore, there is significant amount of other strategies and concepts related to the issue of bio-based industry, such as: the Action plan of the biomass exploitation, the Bio-waste strategy, The Green report 2016, the Agricultural and Food Report in Slovakia, the Innovation Strategy of Agrobiotech, the Priority Area of Biomedicine and Biotechnology

III. Who are the authors of the strategy? Which clusters are involved?

The authors of the Research and Innovation Strategy for Smart Specialisation of the Slovak Republic (RIS3) are the Ministry of Education, Science, Research and Sport of the Slovak Republic and the Ministry of Economy.
Clusters are involved in the Strategy, i.e. they are eligible applicants, but currently there were no calls oriented toward them, thus clusters in Slovakia have not exploited any advantages from the Strategy yet.

Strategy implementation

The clusters are eligible applicants within the RIS3, but no calls were oriented toward them yet, thus cluster are not currently supported in Slovakia.
In case of promoting innovation and improving the infrastructure, Slovakia aims to increase the share of total expenditures on R&I to at least 1,2% of GDP. To meet this objective, it is necessary to support structural changes in R&I by enhancing cooperation between research centres and businesses, to consolidate and expand the R&I infrastructure through smart specialisation, use indirect motivational tools to promote the business sector, and support better remuneration of work in the field of R&I in Slovakia. Another key infrastructure need is the support of various forms of inter-sectoral partnerships/clustering/technology platforms.
In order to achieve synergies in innovation and economic activities, using the potential of research institutions with positive impacts on the economic growth and on increasing employment, it is necessary to support clusters and cluster organisations, together with activities leading to innovation.

Effects/Impact

No specific effects/impact of RIS3 (the most relevant strategy) in bio-based industry was observed. Only general statements were found, which in our opinion are irrelevant for DanuBioValNet project.

Future challenges for cluster development in bio-based industry

Organization (cluster organization reinforcement, clear membership, enrich services provided to cluster participants)
There are two major and many minor challenges for cluster development in Slovakia:
a) Sustainable cluster policy including relevant programmes/measures to support clusters
b) Unstable cluster management/quality of cluster manager (human resources)

Actors (R&D providers)
It is crucial for the country to interlink world-class research infrastructure and few excellent research teams with the competitive and innovative SMEs and international partners, both researchers and businesses. Clusters are the most suitable actors in this process.

Biomass supply
Slovakia is strong in primary biomass supply since the agriculture, forestry sector, the pulp and paper, the processing of secondary raw materials are very strong in the country.
Clusters should play significant role in the area of biomass supply, first, to coordinate biomass suppliers, and second to develop whole bio-based value chains. The project shall assist in building such value chains in Slovakia and internationally.
Another challenge is not to produce biomass on arable soil, but exploit it from waste.

Funding
Slovak Government offers relatively strong portfolio of programmes/funds (both EU and national) in various areas – the support of innovation, research infrastructure, human resources, co-operation of academic sector with the private companies including bio-based sector. However, majority of the calls has been oriented toward businesses, research institutions or bilateral cooperation rather than support through clusters. In addition, programmes are oriented more on sectoral or individual business innovation rather than cross-sectoral or value chain support. So, the major challenge will be to allow clusters to become eligible for the relevant calls and to enforce support of value chains. Another challenge could be to support international cooperation from structural funds (Slovakia has included such option in its programme).

Policies and measures
The main challenge for the policy makers and bio-based clusters is to develop Bioeconomy Strategy in Slovakia. Development of the Slovak Bioeconomy Strategy will be closely linked creating synergies with the Joint Danube Bio-Based Strategy to be developed within the project. In addition, although there are several strategic/analytical documents in the bio-based sector in Slovakia none of them is based on a value chain. The project will initiate such approach emphasising value chain in bio-based industry.

Key recommendations
The key recommendations for the project are as follows:
- To benefit from excellent (and not adequately used) world-class infrastructure within different research organisations/universities
- To search for existing small but excellent teams of researchers (and thus SMEs) in selected,

project-related areas and link them within the project network/value chain. In particular:

a) The co-operation of National Forest Centre, Bioeconomy Cluster and Agrobiotech centre within the primary biomass and energy related project activities.
b) Involvement of Slovak Plastic Cluster with centre for Applied Research of Environmentally Friendly Polymeric Materials (CEPOMA) in the area of biopolymers
c) The increased focus of National Forest Centre on universal paper machine using new generation of control system, which will allow the establishment of Just In Time system in the paper industry. Given research intention is fully in line with the objectives of the industrial revolution 'INDUSTRY 4.0', which is focused on the optimisation of technology of paper's production.
d) To investigate and search for excellent teams in other bioeconomy areas (biochemistry, phyto-pharmaceuticals, textile, construction)

Annex

Definitions/Glossary

Clusters: Clusters are generally described as groups of specialised enterprises, often SMEs, and other supporting actors in a particular location that cooperate closely together.

Cluster initiatives: A cluster initiative is an organised effort aiming at fostering the development of the cluster either by strengthening the potential of cluster actors or shaping relationships between them. They often have a character like a regional network. Cluster initiatives usually managed by a cluster organisations.

Cluster organisations: Cluster organisations are entities that support the strengthening of collaboration, networking and learning in innovation clusters and act as innovation support providers by providing or channelling specialised and customised business support services to stimulate innovation activities, especially in SMEs. They are usually the actors that facilitate strategic partnering across clusters. Cluster organisations are also called cluster managements.

Cluster participants: Cluster participants are representatives industry, academia or other intermediaries, which are commonly engaged in a cluster initiative. Given the case a cluster initiative has a certain legal form, like associations, cluster participants are often called cluster members.

Cluster policy: Cluster policy is an expression of political commitment, composed of a set of specific government policy interventions that aim to strengthen existing clusters and/or facilitate the emergence of new ones. Cluster policy is to be seen as a framework policy that opens the way for the bottom-up dynamics seen in clusters and cluster initiatives. This differs from the approach taken by traditional industrial policies which try (and most often fail) to create or back winners.

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