ECONSTOR
Make Your Publications Visible.

A Service of
ZBW
Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Pohl, Alina

Research Report

Eco-clusters as driving force for greening regional economic policy

WWWforEurope Policy Paper, No. 27

Provided in Cooperation with:
WWWforEurope - WelfareWealthWork, Wien

Suggested Citation: Pohl, Alina (2015) : Eco-clusters as driving force for greening regional economic policy, WWWforEurope Policy Paper, No. 27, WWWforEurope, Vienna

This Version is available at:
https://hdl.handle.net/10419/125654

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

WWW.ECONSTOR.EU

Mitglied der Leibniz-Gemeinschaft

Eco-Clusters as Driving Force for Greening Regional Economic Policy

Policy Paper no 27

Author: Alina Pohl (WU)

October 2015

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no. 290647.

Author: Alina Pohl (WU)

Eco-Clusters as Driving Force for Greening Regional Economic Policy

Policy Paper no 27

This paper can be downloaded from www.foreurope.eu

The WWWforEurope Policy Paper series is a working paper series that is open to policy makers, NGO representatives and academics that are interested in contributing to the objectives of the project. The aim of the paper series is to further the discussion on the development of a new and sustainable growth path in Europe.

THEME SSH.2011.1.2-1

Socio-economic Sciences and Humanities Europe moving towards a new path of economic growth and social development - Collaborative project

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no. 290647.

Eco-Clusters as Driving Force for Greening Regional Economic Policy

Alina Pohl[1]

Vienna, September 2015

Abstract

This research investigates eco-clusters as driver for greening regional economic policy and examines necessary incentive structures to foster eco-innovation as well as growth and employment in the eco-industry sector. Eco-clusters are seen in context with sustainability and environmental friendly behavior as means for a socio-ecological transition in the long run. The main hypothesis implies that eco-clusters have to be policy driven and established top-down and therefore differ from cluster structures in other industries. Possible reasons are uncertainty on a developing market as well as external effects of eco-innovations; the latter are seen as radical innovations. Based on theoretic findings for the establishment of clusters and general research findings for eco-clusters and eco-innovations, it is differentiated between a spontaneous cluster emergence from private initiatives through self-reinforcing forces of companies in a region (bottom-up), and the formation of a policy-driven network with primarily regional objectives to stimulate the competitive advantage of the regional industrial location (top-down). The hypothesis will be proofed by empirical results gained through personal interviews and complemented by findings in current research literature. Finally, implications for incentive structures to green economic policy are identified. It is shown that eco-clusters are different to other clusters and crucial for a long-term sustainable change and thus need political commitment and public incentives. For empirical observation, eco-clusters in Austria were selected. This research relates to the ongoing debate on green growth and develops policy incentives for establishment of eco-clusters and thus greening of economic policy.

Keywords: Cluster Analysis, Ecological Cluster, Ecological Innovations, Regional Economic Policy, top-down vs. bottom-up

JEL-Codes: C38, I31, O31, O44, Q01, Q55, Q58

[1] Affiliation: Vienna University of Economics and Business, Contact: alina.pohl@gmx.at

Table of Contents

1. Research Question **5**

2. Innovations and Clusters from an Economic Perspective **7**

2.1. Characteristics of Eco-Innovations 7

2.2. Clusters and Innovation Systems 16

2.3. Innovation Policy 25

2.4. Specification of Eco-Clusters 31

3. Research on Eco-Clusters **34**

3.1. Applied Analysis Criteria 34

3.2. Austrian Eco-Cluster Landscape 37

4. Research Findings **39**

4.1. Insights for Incentive Structures of Economic Policy 43

4.2. Further Research Strategy 47

5. Conclusions **48**

Bibliography **51**

Appendix **59**

List of Figures

Figure 1: Regulatory Push/Pull Effects of Ecological Innovations 12

Figure 2: Sustainable development 15

Figure 3: Lifecycle of a Cluster 23

Figure 4: „Diamond Modell“ by Porter 30

Figure 5: Austrian Eco-Cluster Landscape (2015) 38

List of Tables

Table 1: Questionnaire for Cluster Managers 59

Table 2: Questionnaire Policy Maker 61

Introduction

This research defines eco-clusters as driving force for green growth in regions and examines necessary incentive structures to foster eco-innovation as well as growth and employment in the eco-industry sector. The hypothesis is tested that eco-clusters have to be policy driven and established top-down and therefore differ from cluster structures in other industries. This work gives answers on the emergence of eco-clusters and tries to draw conclusions for economic policy to foster regional ecological diversification. The transition to more sustainable behavior on production as well as consumption side is necessary to guarantee well-being of future generations and hence has to be integrated as a strategic goal in today's economic policy strategies. This research investigates necessary incentives in economic policy to reach these goals. One possible instrument are publicly initiated eco-clusters.

The question is whether, and if so, to what extent, policy interventions are needed to reach sustainable production and consumption patterns today and in future, as well as to what extent clusters are necessary motors of eco-innovation. Clusters are an important instrument of industrial development especially for regional prosperity as well as motors of innovation. Innovations and innovative activities are an important topic on the corporate and research levels. They are a supported field of activity in economic policy. Because of increasing environmental impacts as a consequence of climate change and damaging behavior, large parts of society and politics give high priority to sustainable solutions on the production and consumption side to prevent harmful influences on the environment and on humanity in the future. A driving force to address this development is eco-innovations for which eco-clusters offer the best framework conditions, infrastructures and networks for their promotion.

This research work looks at eco-clusters as centers of innovative activity in the field of environmental technology, sustainability and the conservation of resources as well as places for regional economic activity regarding green growth. But which economic pattern and incentive structures are subject to eco-clusters, are they different to others? Therefore, the here formulated hypothesis implies that eco-clusters differ from other clusters, have to be policy-driven and therefore set up top-down. There are specific effects that occur especially in ecological topics, such as external effects, path dependencies or specific spillovers, greater risks or uncertainty that are considered. Or show eco-innovations characteristics of radical innovations because they are directed at long-term changes to sustainable behavior patterns. Evidence is gathered from personal interviews with cluster managers of selected eco-clusters and regional economic policy makers. For empirical observation, eco-clusters in Austria were selected.

At the beginning, chapter 1 states the main hypothesis, further research questions as well as grounds for formulation of these questions. Chapter 2 depicts theoretical aspects of eco-innovations and eco-clusters based in economic literature. The thematic connections underlying the terms innovation and cluster in connection with ecological and sustainable aspects will be set out and specifically addressed. Further work moves from theoretical specifications to an applied level. Chapter 3 gives a detailed explanation of applied analysis criteria and a short introductory description of Austria's eco-cluster landscape. The central research findings of the empirical analysis of eco-clusters as well as implications and key insights for incentive structures in regional

economic policy is presented in chapter 4. The necessary information for empirical insights on eco-clusters was gained through interviews with cluster managers and economic policy makers. On the basis of these answers regarding emergence, financing, structure and cluster visions, a classification according to the emergence structures of bottom-up or top-down is made. A categorization as private, public or private-public initiative helps to outline the underlying emergence structure, but does not necessarily classify one emergence type, although similarities can be observed. With the findings for these indicators it will be elaborated if there is a possible need for government commitment and a publicly initiation of eco-clusters. Several significant criteria for classification of the typology and formation of eco-clusters defined for this research are also applicable to cluster analysis in general. Finally, chapter 5 concludes.

Acknowledgement

I would like to thank all conversation partners from clusters, research units and on the regional policy level who have contributed to this research outcome, for their willingness to provide the requested information, to share their professional knowledge on cluster policy and cluster structures and last but not least for their time. I also would like to thank Prof. Aiginger for his valuable scientific advice and support, constructive criticism as well as supportive motivation during completion of this work.

1. Research Question

This research work looks at eco-clusters as centers of innovative activity in the field of environmental technology, sustainability and the conservation of resources as well as places for regional economic activity regarding green growth. But which economic pattern and incentive structures are subject to eco-clusters, are they different to others? The question is whether there are specific effects that occur especially in ecological topics, such as external effects, path dependencies or specific spillovers, greater risks or uncertainty that must be considered. Or show eco-innovations characteristics of radical innovations because they are directed at long-term changes to sustainable behavior patterns? Certainly, there is already broad social commitment to ecological and environmental-related topics such as sustainability and conservation of resources.

Based on theoretic findings for the establishment of clusters and general research findings for eco-clusters and eco-innovations, following main hypothesis will be investigated:

Eco-Clusters differ from other clusters, have to be policy-driven and therefore set up top-down.

To proof this main hypothesis, personal interviews with cluster managers and policy makers were conducted. This empirical assessment is supplemented by sound literature research considering current research on eco-clusters, eco-innovations as well as clusters and innovations theory in general. These compounded findings result in aggregated implications for economic policy.

One can argue that public support will be necessary to set up cluster structures in general or any public support is necessary at all if clusters emerge primarily bottom-up. Thus, why should eco-clusters differ to other clusters and explicitly need public commitment? Following reasons are the basis for the hypothesis in this work:

1. First, there are high risks, costs and uncertainty about diffusion of new environmental technologies as the market is not yet fully developed. Especially small and young firms (SMEs and start-ups) fear these risks. Hence government commitment and public support have to convey a sense of confidence and the need for sustainable development and future markets for environmentally friendly products (green markets) – thus reduce uncertainty – to consequently encourage public institutions and private companies to invest in eco-innovations and take part in the innovation process. This is why especially eco-clusters – in contrast to clusters in general – need public commitment, because as an emerging market certainty about future eco-friendly technologies has to be strengthened to reach increasing public and particularly private investment as well as to achieve adequate framework conditions.

2. Secondly, governmental policy has to explicitly force cluster establishments in the eco-industry, as decisions of private companies – and thus bottom-up initiated clusters – are subject to short-term market developments. This contrasts arguments suggested in several cluster literature[2], emphasizing the scope of private initiated clusters in reaction to undersupply (e.g. environmental technologies). If there are no market opportunities in fields of environmental technology, private firms may lack for actively initiating cluster structures and cooperation networks, even if public programs would provide financial support. In terms of a long-term strategy

[2] see Ketels (2015:14, 16f), Lindquvist (2013:iv f), Fromhold-Eisebith/Eisebith (2005:1254)

towards sustainable and green future, economic policy thus has to make private company decisions independent from market developments in the field of environmental technologies.

3. Thirdly, eco-innovations show characteristics of radical innovations, because they are designed to reach sustainable goals and development on the long-run; thus they are designed to change individual behavior patterns and influence society's well-being in future. As it is stated in economic literature, innovations in general and eco-innovations in specific show diverse economic external effects (double externalities of spillovers and external benefits) which occur with market failure and undersupply of eco-innovations and environmentally friendly products. Although eco-innovations cause externalities, they show positive external effects which need not strictly be internalized (e.g. good air) as those effects are socially acceptable and not least desirable (as argued in ecological and evolutionary economics). Ecological and sustainable goals, which include eco-innovations, must be considered inevitable in an integrated future growth path and consequently in future economic policy decisions.

4. Fourthly, established eco-clusters already show increasing vertical integration along the value chain and cooperations at interfaces of industries. Synergy effects and spill-overs inherent in clusters and networks push the innovation process and economies of scope create benefits for regions as well as companies, which has been recognized by regional policy makers.

5. Fifthly, to reach the optimal supply and further develop the green market, eco-innovations have to be forced. Because of (1.) uncertainty on this evolving market and a high share of small and young firms, in connection with (2.) lacking market opportunities for private companies, (3.) externalities because of radical innovations and (4.) network effects: governmental commitment, public initiatives and support has to complement the innovation generating process and provide certainty for the evolving market as well as bring different actors together in eco-clusters.

6. Furthermore there is already strong social engagement for environmental and ecological topics which show smaller movements for sustainability and awareness of resources and environment, but also programs on EU-level and national level. Public commitment could complement and force this process.

7. Finally, environmental issues have a public good character. This aspect together with uncertainty on the market and high risks and costs for small and young firms – but nevertheless the necessity and importance of that topic – require state interventions to reach long-term goals to a socio-ecological transition. Instruments may be top-down-initiated eco-clusters and regional networks initiated by regional governments. Because eco-clusters work as means to an end to encourage capacity of eco-innovations in smaller companies and achieve regional prosperity on the one hand and a sustainable and green development on the other hand. If eco-clusters are initiated top-down and governmental support is provided, clusters can be optimal established to bring together actors from private market, research units as well as public units.

2. Innovations and Clusters from an Economic Perspective

This chapter provides introductory information on innovations and clusters as general findings of economic research. Ecological and environmental innovations (eco-innovations) as well as eco-clusters will be explained in more detail as they are of importance for following elaborations of own research in the following chapters.

2.1. Characteristics of Eco-Innovations

Theoretical foundations for innovations are offered in various scientific disciplines; however, there are more innovative theories available for interdisciplinary innovation research. Yet these different approaches cannot be equated in their importance and usefulness. The emphasis is placed on the economic research on innovation and states the scientific approach from the perspective of economic theories. One starting point for research into innovation is offered in the Oslo Manual of the OECD, where following definition can be found: „An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations."[3] Further clear distinctions of innovation types and deferrals are given to similar concepts.

In economics, innovation is understood as something new, as innovative entrepreneurs try to maximize their profit by creating new ideas. The approach of innovation economics can be traced back to Josef Schumpeter (1883 - 1950), who described the innovative spirit of entrepreneurs with the concept of creative destruction, i.e. repeatedly bringing new goods on the market to increase their economic rent[4]. Schumpeter concretizes the concept of economic rent in terms of innovation (Latin innovare - renew, novus - new) as innovation rent and defines it as that "which an entrepreneur gains from his innovative lead"[5]. The term summarizes ideas and innovative processes, which cause changes of the existing economic, social, cultural or political conditions[6]. Initially, mainly technical scientific changes were understood as new features and innovations. According to Schumpeter and different economic theories later, it was related to an empirically ascertainable principle of economic development in economics. Following characteristics of innovations can be distinguished:

Types of Innovation

There are several types of innovation in theory: product and organizational innovations deal with institutional conditions in a system (market) and the corresponding behavior of actors (companies) in terms of industry innovations. Even people within the company are involved, since the management level represents those decision-making actors that influence the strategic planning of innovative processes within companies. Product innovations in particular orient on the demand side and describe the invention and marketing of a product, with which a new market is opened.

[3] OECD Oslo Manual (2005:46)

[4] Economic rent is the amount which a company is willing to pay for a production factor minus the minimum amount which is necessary for its purchase. In general, the term rent defines an additional value (income, benefits) in economic welfare theory without reward of the recipient. (see Pindyck/Rubinfeld, 2005:694)

[5] Grupp (2010:131)

[6] see Grupp (2010:131)

Organizational innovations, however, are innovative changes in the production process. Finally, process innovations include investments to improve processes within companies and in production. [7]

Degree of Innovation

The degree of innovation defines the fundamentally new of an idea or development. The distinction is made between radical and incremental innovations. Radical innovations identify major technological innovations that affect increasing utility and benefits for individuals. They represent innovations that lead to decisive changes in personal lifestyle and behavior pattern in the long-run (e.g. auto mobility). Incremental innovations, on the other hand, represent smaller changes that usually refer to alterations or market adjustments of existing products in order to meet the prevailing market conditions and to remain competitive as a company.

In this research work we assume that eco-innovations show characteristics of radical innovations as they influence individual behavior as well as provoke far-reaching changes for sustainable behavior pattern in the long-run.

Invention – Innovation – Diffusion

Furthermore, various stages of the introduction of new features can be distinguished. Invention is the actual new idea of a product. Innovation describes the launch of an idea on the market. Diffusion finally explains the spread and establishment of a new product on the market or the opening of a new market segment. Imitations, however, are only reproductions of existing products and were distinguished from actual innovations.

The explanation of the OECD[8] stated in the Oslo Manual serves as a definition for innovation in general. This basic definition is also valid for eco-innovations, but will be extended including the idea of sustainable development and environmental protection in terms of technological innovations and environmentally friendly technologies. The definition of innovation in the recent version of the Oslo Manual (2005) targets the definition of eco-innovation as the scope of types of innovation has been enhanced to organizational and service innovations besides product and process innovation. Eco-innovations may be defined as environmentally friendly innovative products, technologies, services or processes which aim at the prevention or reduction of environmental impact and contribute to the optimal use of resources; they include innovations of a technological, organizational, social or institutional nature[9]. A concrete definition for eco-innovation is provided by the European Commission, which defines eco-innovation as "any form of innovation resulting in or aiming at significant and demonstrable progress towards the goal of sustainable development, through reducing impacts on the environment, enhancing resilience to environmental pressures, or achieving a more efficient and responsible use of natural resources"[10]. Specifically, it is "the development and implementation of new products (e.g. environmental technologies), new production processes (integrative environmental protection), new forms of organization (e.g. environmental management systems), new resources (e.g. renewable energy), new markets (e.g. environmental services), systemic changes (e.g. transport of goods) and new

[7] see Grupp (2010:141)

[8] see OECD Oslo Manual (2005:46)

[9] see EC Europe Innova Cluster Cooperation (2011:3); Klemmer (1999:29); Rennings (2000:322)

[10] European Commission, Eco-AP (2011:2)

forms of communication (e.g. stakeholder discourses)"[11]. Eco-innovations are closely related to sustainable development and integrate the idea of a long-term protection of quality of life and prosperity. Yet they are incorporated in the operating area of companies as well as private households and cover substitution of hazardous substances, the use of environmentally friendly products and energy savings or reduction of waste.[12]

There are several reasons for eco-innovations; the most obvious are climate change and the urgently needed reduction of environmental pollution. There needs to be political commitment in improving environmental performance. Various stakeholders (governments, companies, consumers) see growing environmental pollution as threat and hence the need for environmental policy and active political action, but also necessary changes in consumption and behavior. A higher social relevance for environmental protection increases the pressure for political action on state and economy.[13] However, the implementation of ecological process, product and organizational innovations among others depends on environmental and innovation policy incentives and specific market requirements as well as existing market demand. In addition to regulatory measures and incentives for companies, environmental policy also includes changes in consumer behavior and lifestyle[14] which entails the integration of economy and ecology[15]. This states the connection of behavioral patterns of economy and society along environmentally conscious standards and sustainable action.

The technological component of eco-innovations is aimed at easing the burden harmful environmental influences and helps to improve the existing environmental performance. However, innovative environmental improvement measures can only be successful if their use is possible and related benefits arise. The relief potential of eco-innovations thus raises the question of their scope and possible use in relation to the reduction of environmental impacts. This concept is based on the performance improvement of sustainable technologies and the conservation of resources to counteract existing environmental problems[16]. This relief potential is related to the use of so-called precautionary innovative environmental technologies. These are divided into additive or end-of-pipe technologies and integrated technologies. Additive technologies describe improvements in the use of existing technologies, the "core process or the core product [is] unaffected" while "integrated technologies [...] [provide] the potential for environmental improvements on a wider and sustainable basis and may be economically advantageous at the same time"[17]. Integrated environmental technologies describe ecological innovations that address production, organization or processes. Thus they are involved in the development of innovative environmental improvement measures and have long-term existence and great sustainable impact. Additive technologies already are more frequently in use as processes and products both in companies and in people's minds and social behavior patterns (e.g. use of environmentally friendly products, energy reductions, reduced material and resource consumption, use of filters for the reduction of pollutants, etc.). Nevertheless there is a need for eco-innovative products which lead to

[11] Blättl-Mink (2001:144)
[12] see Rennings in Jahrbuch Ökologische Ökonomik (2005:30)
[13] see Blättl-Mink (2001:154f)
[14] see Nill (2009:22)
[15] see Blättl-Mink (2001:141)
[16] see Konrad/Nill (2001:36), Nill (2009:89f)
[17] Nill (2009:90)

long-term change and improvements. The changes they achieve need not only be environmentally friendly but also lasting, and they need to be involved in production and organization processes at an early stage, as well as cause changes in social behavior[18]. The possibility of an actual ecological relief potential is evidenced by a target-directed use of radical and incremental eco-innovations and their strengthening through the development of additive and especially integrated environmental technologies. The division between incremental and radical innovations can be associated with the types of additive and integrated technologies, as for example integrated technologies may be present both as incremental and radical innovations[19]. While regulatory measures of environmental policy support the development of additive technologies, integrated technologies, which can lead to long-term and sustainable environmental improvements, are mainly market-driven[20], but nevertheless more important for a greater socio-ecological transition. Hence political support should especially focus on integrated technologies too.

The point in time when specific action steps are taken or when it is useful to address the development of new integrated technologies and to bring them to market has to be taken into account. Innovation economics describes phases of technology development and diffusion of innovations. Depending on the market situation and other conditions, there are time slots or favorable opportunities to establish eco-innovations. By implementing regulatory measures and incentives, these can be directed towards the development of integrated environmental technology innovations.[21] Since it is still difficult to pinpoint the right moment for incremental or radical innovations of environmental technology, we see an increasing dissemination of additive technologies because they are simpler to market and can be used more easily in business and society. Compared to integrated technologies, they represent a relatively inexpensive form of eco-innovation.[22] Referring to eco-innovations as green niche-innovations (renewable energy, organic food, hybrid-electric vehicles, etc.) these could lead to a possible sustainability transition which may be seen as green industrial revolution in long wave dynamics, as a consequence of economic breaks through financial crises reaching socio-economic crises and thus stressing for long-term solutions[23].

This leads to the here stated assumption that eco-innovations show characteristics of radical innovations, as they influence individual behavior as well as provoke far-reaching changes for sustainable behavior pattern in the long-run. The degree of innovation defines the fundamentally new of an idea or development. As radical innovations identify major technological innovations that affect increasing utility and benefits for individuals, they represent innovations that lead to decisive changes in personal lifestyle and behavior pattern in the long-run (e.g. auto mobility). This fact for changing behavioral pattern in the long term has to be considered in economic and policy actions.

From the point of view of innovation economics, eco-innovations show some specific characteristics. As for innovation in general, externalities occur as a consequence of market failure. The question arises whether there is a general need for regulating eco-innovation and the production of environmental-related products. There is an increasing interest in topics like

[18] see Rennings (2000:320, 323)
[19] see Nill (2009:91)
[20] see Frondel et al. (2007:581)
[21] see Horbach et al (2003:55ff)
[22] see Nill (2009:91)
[23] see Geels (2013)

sustainable products, lifestyle and a changing awareness of environmental issues, but transaction costs for companies in eco-industry are too high and current frameworks and regulations too strict to create the needed market-driven supply to affect changes in behavioral patterns. It is widely recognized that incentives and regulations have to be implemented strategically and integrated into long-term plans to achieve far-reaching effects. In this context eco-innovations are characterized as radical innovations as they effect changes of behavioral patterns in consumption as well as production in the long-run. For this reason, support and commitment must come from superior and governmental authorities, otherwise only incremental changes will be achieved. Regulation of negative external effects of eco-innovations is needed, whereas society and the environment profit from positive externalities (e.g. clean air). Eco-innovations referred to as radical innovations "cannot be generated by competition but only by regulation"[24]. This constitutes the economic need for regulation concerning incentive effects for innovation and investment potential in sustainable and environmental-friendly technologies.

Externalities of eco-innovations as a result of market failure (missing incentives for supply with eco-innovations) are characterized by so-called double externalities. The problem with double externalities is reduced investment incentives in consequence of spillovers and external benefits or reduced external costs. If new innovations reach the market, imitations by other actors may cause the spread of this new feature. This knowledge transfer of an actual invention is called spillover, which can be divided into incoming spillovers – a conscious transfer e.g. through cooperation – and outgoing spillovers – an unwanted transmission and sharing of external knowledge[25]. There is not only a direct purchaser profit from the dissemination of sustainable and environmentally friendly eco-innovations; positive effects in the form of environmental protection also benefit the public. The second externality is external benefits or reduced external costs. According to neoclassical theory, externalities of spillovers due to market failure occur because of unregulated use rights. Internalization is possible by formulating patents, thus regulating the use and application of the actual innovation or thought as simple imitation of know-how is no longer possible. However, there is also an inherent trade-off: in terms of economic innovation theory and neoclassical theory, externalities would be internalized on a perfect market. But in terms of environmental incentives for eco-innovation and sustainable technologies, internalization (for example through patents) may prove to be an obstacle for further ecological innovation and therefore does not always lead to the desired goal of a diffusion of environmentally friendly technologies. Furthermore, additional costs for internalization would arise through implementation lags. Therefore, evolutionary approaches and ecological economics refrain from assuming a perfect market and the internalization of double externalities in eco-innovation, which is why "the incomplete internalization of external costs is considered as permanent normal state"[26]. Through cooperation between actors in a cluster, the sharing of knowledge can be deliberately regulated and controlled; externalities can thus be reduced a priori. Regulation in context with eco-innovations thus refers mainly to integrate sustainable development as necessary long term goal into innovation strategies, set supporting incentive structures and provide encouraging framework conditions. The presence of double externalities further requires co-ordination of environmental and innovation policies at the national level.

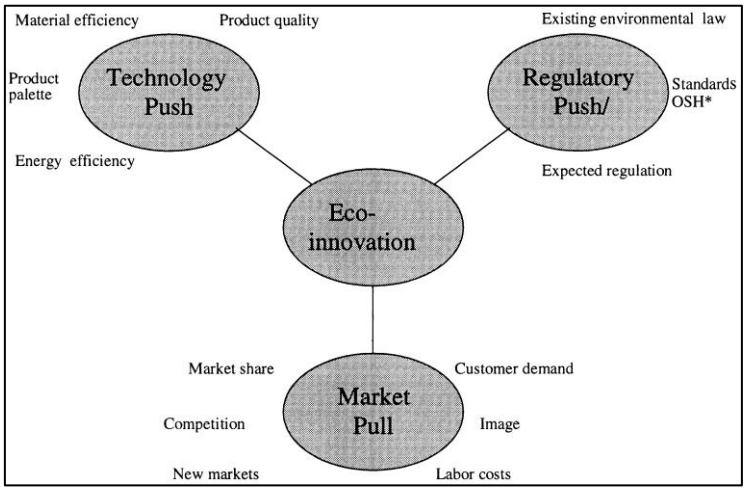
[24] Beise/Rennings (2005:9)

[25] see Karl et al. in Horbach (2003:195)

[26] Rennings (2007:5)

Another feature of ecological innovation is the regulatory push/pull effect. This results from double externalities because the market does not create sufficient ecological and environmental innovations because of reduced investment and innovation incentives. Firstly, sustainable ecological innovations lead to technological innovations and environmentally friendly technologies that cause the so-called technology push effect (see Figure 1). At the same time, there is increased demand and competition for these environmentally-friendly technologies (market pull effect). However, to comply with the legal framework through the development and dissemination of eco-innovations, eventually, state regulation will be necessary (regulatory push). It can be concluded that eco-innovations in particular need regulation to coordinate market-driven demand and innovation-driven environmental technologies. The need for regulation is not least based on coordinated action between environmental and innovation policy-makers and must, if possible, distinguish between product, process and organizational innovations as well as radical and incremental innovations.[27]

Figure 1: Regulatory Push/Pull Effects of Ecological Innovations



Source: Rennings (1999:326), * OSH=Occupational Safety and Health

From an economic point of view, the strength of ecological innovation will be seen in the promotion of competitiveness and growth through sustainable production methods and a careful use of finite resources. In fact, empirical studies in Germany found that environmental innovation in companies achieved limited but positive impacts on competitiveness and employment[28]. From a social or socio-political point of view, sustainable living and behavior patterns are paramount, which develop in interdependence with economic objectives. The goal should be an integrated socio-ecological cultural transition, linking ecological and environmentally friendly technologies in economic production processes with individual and societal behavior.

Ecological Economics

Economic innovation research presents features and concepts for the theoretical presentation of innovations. In this context, eco-innovation and its growing importance in economy and society are emphasized. A consciousness of sustainable lifestyles and behavior characterizes modern and adaptable production processes and calls for new technologies, products and processes. This process of socio-economic and cultural transformation not only affects economic processes and

[27] see Rennings (2000:324ff) and Rennings (2007:5ff)

[28] see Rennings in Jahrbuch Ökologische Ökonomik (2005:30)

requires adaptation to new technologies, but also to new value systems through environmentally conscious and sustainable ideals.

An adequate research approach on eco-innovation, which specifically uses incentives for innovative environmental technologies leading to a corresponding shift towards sustainable behavior, often relates to a dynamic, pluralistic methodological approach. This approach considers various exogenous factors and understands the innovation process as a convertible, non-linear process. In contrast to neoclassical and neoliberal theories, evolutionary innovation economics provides this multidisciplinary approach and uses other disciplines in order to transfer them to economic problems. Learning and change processes as well as socio-economic change are at the center of the analysis of evolutionary theories. The innovation process is seen as a non-linear decision-making process which results in a dynamic moment. Especially in the context of topics like environmental protection, sustainability and resource conservation, new approaches are increasingly used and new methods are explored that unite the complexity of this new consciousness. Eco-innovations require dynamic and multidisciplinary approaches as they combine economic, ecological and social influences with natural science and social sciences. Although they partially conflict, ecological innovation economy integrates neoclassical (e.g. methodological individualism) as well as environmental economic methods (e.g. incentives for environmental policy) to link them in a dynamic evolutionary economic approach of eco-innovation research. The concept of innovation is extended to the idea of sustainable development in terms of technological innovation, which is oriented towards sustainability and environmental protection. Integrated approaches should provide insights on regulation and incentives for innovation out of environmental-economic aspects (aimed at the development and use of environmental policy instruments) and innovation policy contents (explanatory factors for the innovation process).[29]

Social Aspects of Eco-Innovations in the Context of Sustainability

Sustainability represents a keyword which is inevitably related to environmental and ecological change. One reason is finite resources that (among others) limit quantitative economic growth and makes sustainable innovation necessary. Eco-innovation should meet this purpose by achieving independent economic growth or decoupling it from finite resources and the finiteness of nature in general. In this approach, however, we need to differentiate between growth of the economy, resource consumption and quality of life. Qualitative growth[30] and the increase of quality of life through intangibles as well as sustainable living and behavior patterns may well be what is needed. According to neoclassical theory, quality of life and prosperity are dependent on finite resources and unlimitedly substitutable by technological progress. In fact, this is impossible, and alternative solutions must be designed. Eco-innovations are one possibility. They should enable structural change and implement sustainable behavior patterns in the long run. Its aim is to achieve economic growth, without increasing the consumption of natural resources, and force sustainable innovation, which consequently should lead to a socio-cultural transformation of individual behavior patterns.[31] In addition to the integration of ecology and economy in eco-innovations they also allow for necessary integration of economy and nature in sustainable technologies. The sometimes contradictory objectives of quantitative growth and environmental and resource protection require

[29] see Rennings (2000:320ff)

[30] see Lehmann-Waffenschmidt in Pfriem et al. (2006:42)

[31] see Luks in Jahrbuch Ökologische Ökonomik (2005:41ff)

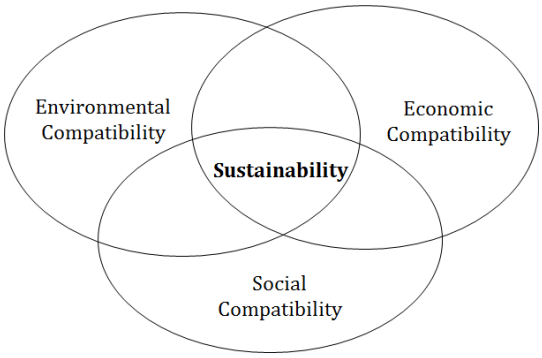
alternative solutions, for instance the promotion of environmental innovation. In order to avoid harming the environment or nature, nor to curb economic processes, integrative approaches attempt to take both interests into account. This combines economic and ecological rationality. Thus, this means efficient and consistent utility increase by technological change as well as economic development on the one hand, and conservation and sustainable use of environmental resources without exploiting them (sufficiency) on the other hand. This will require structural and organizational change on all economic and social levels.[32]

The concept of sustainability is now widely integrated into various topics and serves as a strong argument. It suggests the use of resources in such a way that these will also be available to future generations. It is argued by citing intergenerational sustainability and justice[33]. At the same time it records the fact that current and future needs have to be fulfilled completely, which includes a great responsibility to future generations[34]. A long-term and far-reaching transformation of technology, infrastructure, institutions and ways of life in sustainable structures will be applied to the specific context of eco-innovations[35]. High hopes are placed in the relation of sustainability and sustainable development on innovations in general and eco-innovation in particular, as they allow economic growth in combination to environmental protection. Further qualitative growth can adjust in such a way as to ensure the "qualitative improvement of human living conditions while preserving the natural resource base"[36]. In the same context as sustainable development, the term green growth or environmental-friendly growth[37] is mentioned; this combines actions towards economic growth, ecological compatibility and individual wellbeing.

For this context of eco-innovations, the three-dimensional sustainability model or three-pillar model[38] is of relevance, based on ecological, economic and social values. These three components should result in an integrated form with the objective of sustainable development. In order to achieve this higher goal, substantial innovations in sustainability and ecology are required[39]. For all three dimensions or pillars, sustainable ecological innovations should be consistent, purposeful and increasing utility (Figure 2).

[32] see Blättl-Mink (2001:121ff)
[33] see Blättl-Mink (2001:75)
[34] see Besio in Rückert-John (2013:14f)
[35] see Rennings (2000:319f)
[36] Blättl-Mink (2001:10)
[37] see http://www.greengrowthknowledge.org/ (30.10.2014)
[38] see Konrad/Nill (1999:38), Gerlach in Pfriem et al. (2006:202), Besio in Rückert-John (2013:75)
[39] see Rennings (2007:2)

Figure 2: Sustainable development



Source: Blättl-Mink (2001:12)

A broader vision of sustainable development also includes political and institutional conditions in addition to economic, environmental and social aspects. The aim is a long-term existence of these developments. A broader conception of sustainable development places the value of "intergenerational and global problem perspective"[40] in center, and raises economic growth, environmental protection and socially acceptable and equitable distribution to an international level.

For all these models, the social aspect is relevant. This means inclusion in the sense of the three-pillar model, but also an increased importance of the individual perspective in sustainable processes. Participation in environmentally friendly behavior refers to an increasing awareness combined with the willingness to change and socio-cultural transition. Individual or intrinsic motivation and social control within the scope of environmental awareness have to be taken into consideration, as the latter increases through social pressure towards sustainable behavior.[41] This requires a social and economic transition towards sustainable awareness of consumers and society in general. A change in social behavior with the focus on ecological interests is considered as social innovation. Social innovations describe comprehensive changes of social practices and individual behavior, and thus a general social change in habitual behavior patterns. Due to a changed environmental and sustainable awareness, they are closely related to eco-innovations and sustainability. By means of social innovation, synergy effects between environmental and social policies with regard to a responsibility for future generations can be exploited. Examples for social innovations, which are mainly linked to eco-innovations, include changed consumption patterns towards environmentally friendly products, recycling, waste management, deposit systems, energy use with electricity, heat consumption and environmentally conscious mobility (e.g. cycling).[42] All these examples combine environmentally conscious behavior aspects with sustainable social behavior in the purchase, use and disposal of a product.[43]

In this context of sustainability and social components, the embeddedness of social behavior in economic activity becomes visible in the integration of ecological, economic and social values. "With the approach social embeddedness of economic action the increasing internalization of previously externalized effects in economic calculus, the integration of economy and ecology (environmental

[40] see Brand in Pfriem (2006:61)
[41] see Blättl-Mink (2001:89f)
[42] see Emig in Rückert-John (2013:8f), Besio in Rückert-John (2013:34ff, 77)
[43] see Brand in Pfriem (2006:66)

compatibility) and the integration of economics and living environments (social compatibility) can be explained"[44]. An additional topic that is closely linked to eco-innovations and sustainability addresses issues of ecological and environmental justice, which focus on the distribution of environmental resources in industrialized countries as opposed to developing countries.[45] Beside these positive social facts the exclusion in consumption of environmental friendly products must be regarded. Eco-innovations mainly show positive effects on general environment and for society (e.g. better climate) without exclusions in general. But there are also negative effects especially for socially disadvantaged groups[46]. Higher consumption costs in form of taxes on environmentally unfriendly products result in relatively higher costs for lower-income groups and thus social disadvantages. These higher social burden and costs have to be taken in consideration when designing frameworks for eco-industries and eco-innovations.

Finally, it is useful and helpful to measure and quantify sustainable eco-innovations in order to evaluate the innovation process. These instruments help policy-makers to analyze the ongoing innovation process and set standards for future eco-innovation activities. Driving forces in this process can be identified, which in turn should encourage companies to participate in the innovation process and convince consumers of the importance of sustainable behavior.[47] National statistics offices of European Union member states and the statistics office of the European Union (EUROSTAT) stated indicators for sustainability which reflect diverse aspects of environment and energy[48].

2.2. Clusters and Innovation Systems

Economic research provides explanations to what extent incentives, conditions or specific mechanisms are needed to stimulate innovation. Numerous complex relationships and networks of different actors underlie the result of innovation. To coordinate and direct these innovation-generating connections, so called innovation systems are purposefully applied. Actors as well as innovations and innovation processes are integrated into these systems. Under optimal conditions this interdependence in innovation systems leads – according to economic innovation theory – to increased research activity and subsequently to the development of innovations in appropriate markets. Wave-like cycles of the course are possible. Innovations follow short-term phases of scientific oversupply before new technologies prevail on the market and finally convince the consumers. How and under what conditions innovations arise is explained by the research and establishment of innovation systems. In order to coordinate and ensure innovation policy in a country, coordinated innovation systems are necessary, which control research and development as well as the actions of various institutions and actors from the areas of finance, competition control, education, administration, companies and other.

“Innovative systems are heterogeneous networks which support the generation, modification and diffusion of new technologies.”[49] For innovative systems, the interaction and the functional complementarity of different institutions and stakeholders as well as their relationships with each

[44] Blättl-Mink (2001:26) by Granovetter

[45] see Wehrspaun/Schack in Rückert-John (2013:22)

[46] see Pfriem et al. (2006: 69ff) and Rückert-John (2013)

[47] see Arundel/Kemp (2009:6)

[48] see http://epp.eurostat.ec.europa.eu/portal/page/portal/sdi/indicators (31.10.2014)

[49] Blättel-Mink, Ebner in Blättel-Mink (2009:13)

other is crucial.[50] Central for the emergence of innovations, which happen "in the context of interactive learning processes with systemically interconnected actors"[51], is knowledge, which is considered as a key value of society in the innovation process. "Knowledge and learning are considered to be fundamental structural and behavioral components, whose contents are articulated on the institutional networks of innovation systems"[52]. Learning effects are used and disseminated intentionally or unconsciously by interacting actors in a network. This mechanism plays an important role in the dissemination of knowledge, especially in innovative societies. The phenomenon of learning effects may not be underestimated; they lead to a dissemination of knowledge and an improvement in research.

Innovation Systems and Evolutionary Innovation Economics

Following up innovation systems, which explain the emergence of innovation through the actions of involved actors, evolutionary innovation economics goes one step further. This approach seeks to understand these development processes as non-random and tries to explain them in the context of technological, political and economic complexities, as a series of causalities. The approach of evolutionary innovation economics presents a conscious contrast to conventional neoliberal approaches. "The goal is to explain how economic systems form, stabilize, transform and if necessary degenerate through self-organization with respect to exogenous shocks over time; it mainly deals with factors that accelerate such a process, or hinder, distort or draw it in unwanted directions."[53] In this case, this research approach uses the knowledge of other scientific disciplines such as biology, psychology or the social sciences in order apply them to economic interdependencies. Some moments are considered as dynamic, involving technological change over time as well as heterogeneous actors, and admitting uncertainty. The existence of demand for innovation is considered as an assumption.[54] It investigates the question regarding the time of innovation and of what kind of innovation prevails on the market. It is evident that this theoretical research approach differs from the neoclassical theory in some respects. Rather, interdisciplinary explanations are found. Superficially, these explanations refer to Charles Darwin's evolutionary biology and specific economic conditions that lead to technological change and innovation processes. The approach of evolutionary biology, transferred to economy, could include the "emergence of new technologies, companies or institutions (mutation/variation), their enforcement in competition (selection) and distribution (retention/preservation)"[55]. It should however be noted that only a few biological insights or general statements can be transferred to economic issues.[56]

"Path breaking for many approaches here was the evolutionary theory of economic change by Nelson and Winter (1982), which establishes explicit analogies to biological mechanisms of random variation and systematic selection, whereby company routines were conceived as analogies to genes, and companies as analogous to organisms. [....] The use of an evolutionary biological analogy to explain (selected) Schumpeterian economic development patterns is characterized by Nelson /

[50] see Blättel-Mink (2009:5)
[51] Blättel-Mink, Ebner in Blättel-Mink (2009:13)
[52] Ebner in Blättel-Mink (2009:119)
[53] Wink (2006:210)
[54] see Wink (2006:212)
[55] Nill (2009:57)
[56] see Nill (2009:56ff)

Winter as 'neo-schumpeterian' approach."[57] Even in later considerations, Schumpeter's pioneer entrepreneur plays a central role in economic innovation research, not least as explanatory approaches can be derived from the resulting views of classical economic theory. Evolutionary innovation economics, too, is based on Schumpeter's theory of economic development. Furthermore, it allows the distinction between the three phases of the innovation process, i.e. invention, innovation itself as the first application, and diffusion. As a consequence, so called pioneer profits accrue when innovation spreads throughout the economy by subsequent innovations or learning effects. Cycles are observable, as the competition equilibrium shortly is overridden by new discoveries and the creation of further innovations, which later reverts through diffusion and imitation. For this reason, this field of evolutionary innovation research is called neo-schumpeterian.[58]

The use of various scientific practices on economics should result in meaningful debates and expedient research findings, otherwise interdisciplinary approaches such as that of evolutionary innovation economics would bring little progress. However, there is still potential for further research on evolutionary innovation economics.

In keeping with Schumpeter and returning to innovation systems in general, there are innovations "driving a comprehensive structural and institutional change"[59]; here it is the entrepreneur who creates these innovations. It is the company as a collective, whose actions need to be coordinated in an innovative network. In a historical context, these actions can then be viewed as institutionalized, if they lead to innovation-generating processes. The responsibility of the state is, according to Schumpeter, to provide public goods that foster innovation, such as education, infrastructure, technology structure, etc.[60] Furthermore, guided action should be provided on a higher level in order to promote and coordinate innovative behavior.

2.2.1. Cluster as Regional Innovation Systems

As innovation systems can be referred to as clusters and the focus of this work lies on of eco-clusters, the link is now given to the underlying considerations of clusters, cluster policy and cluster management, which are important for the results of the empirical observation in the final sections of this study.

The term cluster (accumulation, aggregation) refers to the merger of parties or actors. From an economic perspective, it defines a network of interacting actors who are involved in interrelated exchange relations. The exchange refers, in addition to commercial trade relations, especially to knowledge. This includes implicit knowledge according to action habits and behaviors, as well as explicit knowledge, i.e. know-how. A cluster is characterized on the one hand by the value of spatially concentrated knowledge sharing, on the other hand by a spatially specialized division of labor. Depending on the orientation of the cluster actors of one or more sectors may be integrated into this economic cooperative. The central role of a cluster within the value chain is important. Anticipating the basic idea of further explanations, knowledge generation is specifically promoted

[57] Nill (2009:59)
[58] see Nill (2009:61)
[59] Ebner in Blättel-Mink (2009:123)
[60] see Ebner in Blättel-Mink (2009:129)

through inspiring and inspired knowledge exchange within a spatially-concentrated area of innovation designed as a cluster. This will determine and favor innovation.

A cluster can be defined as "a system of interlinked companies of an economic or industrial sector, whose total value is greater than the value of the sum of its parts"[61]. This is Michael E. Porter's definition, whose remarks on clusters were pioneering in economic theory. His explanations on clusters are often used as a central definition for this concept. A widely used definition of Porter says: "clusters are geographic concentrations of interconnected companies and institutions in a particular field"[62]. Specifically in clusters, the contact of individual stakeholders with each other plays an important role through the contact of companies in horizontal and vertical relationship structures. Further, political and institutional units represent the accumulated infrastructure of a cluster. However, Porter sees the concrete surplus value of a cluster in the geographic concentration of these actors. He regards the confrontation between globalization and localization – which, for him, does not represent a contradiction – as an interesting contrast. The paradox lies in the reversal of the phenomenon of globalization, namely in the return to local structures. The competitive advantage of conglomerates no longer only lies in the comparative advantages, in terms of labor and production costs, but in the spatial concentration of knowledge, relationships and motivation, which follows from the dynamic advantage through innovation. Although globalization allows the realization of comparative advantages, for example by shifting production, the true driving force of value creation and efficiency nevertheless lies in close proximity due to a high concentration of knowledge and local networks, which in turn create an innovative environment. This new form of spatial organization stands for an alternative arrangement of the value chain, which manifests itself through competition and cooperation in horizontal and vertical relationship structures. Coordinated and trusting actions promote efficient and strong organizational structures. Although Porter chooses national structures in order to analyze them as a spatial basis for the majority, he states the possibility of clusters as a reasonable agglomeration of actors along a value chain on several spatial levels.[63]

The Region as Observation Unit of Innovation Systems

Current scientific discourse on clusters increasingly points to the importance of the region as a reference unit. In this context, space needs to be a subject of investigation. On the one hand, the subject matter forces us to focus on a clearly definable area, on the other hand the concretization of a spatial level is important insofar as proximity must be given. In determining this space, neither geopolitical boundaries are of relevance nor is it delimited. In the sense used here, local units are rather defined by local factors such as knowledge and network structures, as well as natural resources and specialized labor supply in one place. In economic discussion, clusters are increasingly considered at the regional level, since a high spatial concentration of actors and existing networks is assumed. Close spatial structures provide the basis for a functioning innovation process, the most important feature of which is the short-term and random exchange of knowledge. Studies support that the existence of clusters contributes to increased economic growth in a region. The economic analysis of clusters thus leads to an engagement with space.[64] The

[61] in Cernavin et al. (2005:9) from Porter (1999:225)

[62] Porter (1998:78)

[63] see Porter (1998:78ff); Benner (2012:3)

[64] see Benner (2012:8f)

relevance of the region as an innovator and the increase in the innovation potential of local companies through the influence of regional conditions is also laid down in the Oslo Manual of the OECD[65].

Clusters are aimed at efficient and innovative structures that often emerge on the regional level. For this reason, the discussion of clusters often refers to regional innovation systems. The concept of innovation system relates different actors of a field of activity. This is not restricted to a defined spatial level (international, national, regional) or an organizational level (horizontal, vertical) where these actors meet. These dimensions will only be added on closer examination. In the case of regional innovation systems, it can be assumed that these are in turn integrated into national and European innovation systems and engage in an exchange with other innovation systems. The inclusion of the spatial dimension becomes important when the exchange between actors accrues profits that would not arise on other spatial levels. These profits include gains in utility as well as monetary gains (turnover) and in productivity and competitiveness. The emergence of these benefits will be driven primarily by the promotion of innovative structures.

Innovation in Regional Innovation Systems

Innovation is accorded a high priority in the context of regions and clusters. Within an innovation system there are interdependent relationships between regions and innovation: on the one hand, clustering regions provide an attractive environment for the development of innovation, on the other hand, innovative behavior increases the competitiveness of regions. The reason for the increased innovation potential of regions can be traced back to a geographical concentration and subsequent closer (relational) structures. Spatial agglomeration provides suitable conditions for decisive actions in an innovation process. The exchange of knowledge is facilitated by the presence of a "network of multiple actors"[66] who are (directly or indirectly) involved in the innovation process. It is primarily localized knowledge spillovers and social exchange processes that should be used within the framework of the common objectives. Close social relationships between stakeholders and the transfer of knowledge are best available in a cluster with regional structures and various industrial companies and research institutions. The importance of regional innovation systems is mentioned in the Oslo Manual of the OECD: "The presence, for example, of local public research institutions, large dynamic firms, industry clusters, venture capital and a strong entrepreneurial environment can influence the innovative performance of regions. These create the potential for contacts with suppliers, customers, competitors and public research institutions. Infrastructure therefore plays an important role."[67] In addition to spillovers, synergies within or between horizontal and vertical relationships can emerge, which should be used to avoid external effects. Because of spatial proximity, the moment of coincidence plays an important role for knowledge exchange. This makes the process of innovation an unpredictable non-linear exchange process through which learning effects can be generated. The creation of communication and interaction spaces within a cluster can promote chance encounters, information flows and exchange of knowledge as well as learning and innovation processes.

Innovative structures in regions therefore can be explained – beside other factors – by the proximity of actors, which facilitates cooperation and interaction. The main benefit of clusters

[65] see OECD Oslo Manual (2005:39)

[66] Blättel-Mink (2001:63)

[67] OECD Oslo Manual (2005:39)

especially is seen in the proximity of business partners and colleagues of enterprises and research units, since no large distances have to be covered or meetings arranged in order to share information. The short-term and random interaction of actors makes a regional cluster a dynamic innovation field. "Innovation is no longer understood as a linear process [...] It is rather based on a continuous process of interactive learning"[68]. The importance of clusters for the innovation process is emphasized on different sides: "Collaboration thus fosters knowledge spillovers among actors, contributes to overcoming co-ordination failures (i.e. situations where business success fails because of a lack of co-operation) by facilitating coordination between actors, and encourages a better pooling of financial and human capital resources for innovation that result in economies of scales and can help support higher productivity and to increase in economies' competitiveness."[69].

Social Aspects of Regional Innovation Systems

The role of clusters in the process of knowledge generation and dissemination, which have an important influence on innovation, is not to be underestimated. In a regional innovation system implicit and explicit knowledge transfers on a formal and informal basis and takes place in various reference structures. Furthermore, formal and informal personal contacts meet in a network. At the center of social innovation systems are the social relationships between stakeholders on the level of interaction. Social interactions and decisions trace back to institutionalized norms, rules, cultural values, knowledge, skills and codes that are passed on as implicit knowledge within a group. Regional innovation systems include both these institutionalized norms and resulting synergies and competitive relationships in horizontal and vertical relationship structures. These interpersonal relationship patterns and structures can be used by companies to design their organizational structures. Companies are aware of the advantage of cooperative behavior within a cluster and take advantage of it. "By actively managing up- and downstream relationships to businesses optimization potential can be realized, which can lead to mutual advantage."[70] In addition to the creation and use of competitive advantages, diverse benefits of shared goals and values can be derived in a cooperative environment and from regional knowledge economies. The social dimension in clusters as regional innovation systems focuses primarily on the relationships and connections between stakeholders at the horizontal and vertical levels and the type of communication and knowledge sharing (implicit, explicit). Thus, a cluster is "seen as loosely coupled social system", i.e. "economic action is always embedded in social contexts"[71]. Embeddedness is considered as a specific sector in cluster research. The term includes confidence built on personal contact but also a sense of commitment to business partners and colleagues that results from spatial proximity and short communication distances to each other. Embeddedness shows that the collective consciousness has adjusted within an organization or cluster. This becomes manifest in the transfer of tacit knowledge. Acquired patterns of behavior and interaction are aimed at entrepreneurial and economic performance and serve as a means to achieve these goals. Nevertheless, implicit and explicit rules and norms facilitate social interaction and the achievement of corporate objectives. Beside relationships within a cluster, network structures to other innovation systems or individual companies are included. Openness is required in order to

[68] Benner (2012:35)

[69] https://www.innovationpolicyplatform.org/content/innovation-networks-and-clusters?topic-filters=11389 (31.10.2014)

[70] Raschke (2009:31)

[71] Cernavin et al. (2005:45)

expand the network and to keep the pace of innovation sustainably high. A value system of social norms and etiquette establishes along relationship structures between partners. The social system of a cluster provides the basis for generalized behaviors within the innovation system and network structures to the outside. Beside economic structures at regional level, clusters are also social innovation systems.[72]

Emergence of Clusters

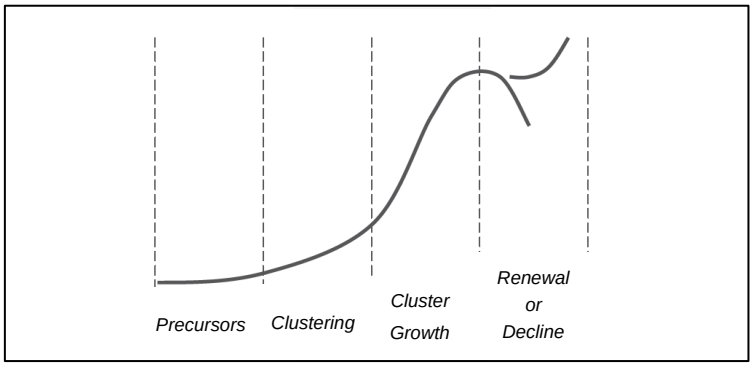
The emergence of clusters at a particular location often cannot be clearly explained, and it is influenced by several interdependent operating states and events. The reason for the establishment of companies in a particular location can be derived from existing structures in regions, but often does not follow events observable ex ante. Explanatory moments are the prevailing geographical, cultural and political preconditions in a place or in a region, but also randomly occurring economic or historical events that are neither foreseeable nor planned. There may be a particular moment which leads to a deviation from the hitherto usual course. This moment can interrupt a habitual process especially in the early stages, for example by introducing a practice different from previous action habits. Schumpeter calls this creative response, by which he means business decisions leading out of previous habits and triggering a creative process. These deviate from path dependencies or deterministic transitions and can have far-reaching consequences on social and economic conditions[73]. For the emergence of a new market or economic entity, such moments are crucial. And for clusters, too, such events can be decisive. However, this is not to suggest that such a process of creative solution is mandatory for the emergence of a cluster. It is merely meant as an indication – in the sense of Schumpeter – that a creative moment can be decisive for the further development and emergence or beginning of a cluster. Another relevant influence may be regional natural resources that lead to a specialized labor market and cause the establishment of companies in one place. The location subsequently becomes attractive for research institutions and other companies operating in the sector. In addition to historical and ecological preconditions of the general economic situation of the region, the regional development of enterprises can be a crucial factor in settling somewhere. Out of these existing path dependencies, a regional focus on a specific sector or product can develop, and subsequently specialized labor and network structures can emerge. Path dependence means that future events can be derived from the past and are to some degree dependent on it. Such preconditions are crucial for the further development – of a company, a region or a cluster. These are potential first conditions for the formation of a business-related network from a cluster. This combination of factors determines the evolutionary process of a cluster, which is difficult to create through planning. Once a certain combination of – often coincidental – events exists, the conditions for the emergence and establishment of a cluster are given. Targeted measures and cluster promotion can now bring benefits to the region and companies. Among others these consist in increasing productivity and competitiveness within the organized and institutionalized structures of a cluster as well as the social and economic relations of a regional environment that can be channeled through coordinated cooperation. The emergence of a cluster or regional innovation system is accompanied by structural and institutional changes, enabling something new through changes. "Successful regional innovation systems therefore do not come from above but from the collaboration between stakeholders [...] It is true that institutional

[72] see Benner (2012:29f, 45ff), Cernavin et al. (2005:35ff), Raschke (2009:82)

[73] see Schumpeter (1947:150)

settings certainly play an important role, [...] but just in terms of promoting and favoring trust and cooperation between businesses, workers, banks and science."[74]. On the one hand clusters therefore offer a special combination of production factors, institutions and knowledge, on the other hand they promote an attractive environment that favors business start-ups and attracts the establishment of research institutions. This creates optimal conditions for the development of innovations. But even here coincidence plays a crucial role as to whether and under which circumstances the settlement of an industry takes place in a region. As can be seen, the formation, establishment and continuation of a cluster constitute a highly dynamic process, which should take ongoing changes into account and adapt to prevailing conditions. Trends and new developments in the market must be recognized in time in order to implement recommendations and remain competitive. Applying these developments over a course in time, a life cycle of clusters can be traced (see Figure 3). It can be divided into 4 phases: precursors, clustering, cluster growth and renewal or decline.

Figure 3: Lifecycle of a Cluster



Source: Raschke (2008:73)

The first phase is defined by factors such as the prevailing preconditions at a particular location, regional conditions and random events and path dependency. According to Schumpeter, these can be natural resources and locally based companies as well as creative changes. In this first phase one cannot yet speak of a cluster. Rather, existing structures and determinants can be detected ex post which worked favorably. In the second phase of the establishment the cluster is in its beginnings, labor supply specializes, infrastructure forms, companies settle, there is a first economic appreciation in the region. In the third phase, economic policy interventions, strategic business decisions, regional developments and the demand side may affect the growth of the cluster. This dynamic process proceeds in the fourth phase, which is decisive for the continued existence or decline of the cluster. For an explanation of the curves and forms of the cycle and determining factors in the individual phases, the "diamond model" by Porter (1990) can be used (see chapter 0). This tries to show reasons for the competitiveness and the existence of clusters and to explain why in some more innovation takes place than in other. In connection with this possible explanation model conclusions can be drawn about a possible life cycle of a cluster.[75]

Another often-considered explanation for the creation of clusters in theoretical designs is Alfred Marshall's[76]. He mentions three crucial factors for the functionality of industrial agglomerations, as

[74] Blättel-Mink (2001:62f)

[75] see Benner (2012:13ff), Floeting (2008:227f), Raschke (2008:71ff)

[76] Marshall (1920)

clusters, as well as explanations for additional benefits and economies of scale: local specialized labor supply, regional supply industries and technological knowledge spillovers. A local specialized workforce reduces search and training costs for companies and generates higher productivity and wages. Regional support industries can optimize supply and production structures, generate economies of scale and minimize transportation costs. Finally, knowledge spillover effects take place at the formal and informal levels and provide localized knowledge exchange. On the one hand, these three factors are necessary for the emergence of clusters, on the other hand innovation and productivity within clusters will be facilitated by these factors' presence and ensure their existence.[77]

Risks of Cluster Structures

With the structure of the cluster, some risks may be associated, to be contrasted with the numerous advantages of this concept in terms of a full consideration. Close proximity can also entail disadvantages the actors in a cluster should be aware of to prevent disease. However, in case of opportunistic behavior, the awareness about it in itself is not sufficient. In addition to the actual benefits of a dynamic innovation process within an innovation system, this process may also turn into its opposite. This can be the case if the proximity within the cluster favors contact between actors to simplify the access to knowledge of similar activities of related companies. Knowledge drawbacks, industrial espionage and the enticement of workers can be consequences of this behavior. Furthermore, openness to national and international stakeholders and competitors is important to preserve contact of actors in a self-contained spatial environment. This applies to the mobility of goods, capital and labor as well as innovation cooperation. On the one hand, the competition needs to be kept in mind in order to react to possible progress and market changes in a timely fashion, on the other hand scientific exchange of new knowledge and technologies has to be promoted. Likewise, contact with upstream and downstream partner companies outside their cluster as well as the observation of competitors in the market are important. A lively exchange of knowledge especially between clusters and other external units enhances a permanent renewal of internal knowledge and a high, sustainable innovation dynamics. The promotion and maintenance of external contacts and networks are essential for the existence and development of a cluster. Otherwise, lock-in effects and rigidities complicate and threaten responses to change in an existing innovation system. Adaptability to new innovations is mitigated, systems are more vulnerable and unable to adequately respond to changes if outdated internal patterns or highly specialized processes exist. The definition of rules for admission of new companies in the cluster can be beneficial. The entry of new labor force and hence of innovative knowledge may be hindered by market-entry barriers and lock-ins. Another risk lies in accustomed behavior patterns of knowledge exchange and relatively weak contacts between actors (weak ties). The contact to external actors may be advantageous in order to create synergies as opposed to rigid internal patterns of interaction. The regional and local companies are threatened by structural crisis if measures by cluster initiative and cluster policies are not taken in time to prevent these developments.[78]

[77] see Marshall (1920) in Blien/Maier (2008:14), Benner (2012:11), Potter/Miranda (2009:30)

[78] see Blien/Maier (2008:35f)

2.3. Innovation Policy

With the approach of innovation systems or clusters, those relationships between actors of the innovation system will be examined which lead to progress and change. Thus, innovation is a decisive factor for competitiveness, which is crucial for the growth of an economy. The interaction between science and economy is particularly important for a country's innovation system. Universities and research units contribute to the theoretical impulse of new technologies. Companies, some with their own research institutions, primarily take part in the implementation and commercialization of new technologies and products. In addition, state institutions that ensure competitiveness and the legal framework are of great importance. But above all, the "network character of institutional interactions, which characterizes the political economy of competitiveness"[79], has a crucial value. The coordination of these processes is summarized in the concept of governance. This includes control and coordination of inter-institutional communication as well as state agencies supporting an innovation-progress-oriented policy of innovation. In the theoretical approach of innovation systems, innovations as well as innovation processes and innovation policy come together in an innovation system.[80]

Since a variety of different factors are decisive to promote the emergence of innovations and to realize their implementation, innovation policy is necessary to define concrete and coordinated objectives and framework conditions. This concept includes both governmental structure elements, such as infrastructure and research units, and non-governmental institutions that directly affect innovation systems. The latter include institutions, which are responsible for economic, financial, environmental, communicative or competition policy concerns. These factors are combined as components of national innovation policy that are coordinated on the national level. [81]

A distinction is made between regional, national and supra-national innovation policy. For purpose of this research, the analysis of clusters in economic theory is broken down to the regional level. Regional innovation policy differs from that on the national level, as spatial clusters can form at intermediate level favoring the relatively rapid exchange of knowledge and technology in an industry. To encourage this phenomenon, the field of regional innovation policy has been established. The advantage of regional assessment lies in the diversity of innovative industries and approaches at the sub-national level. Regional differences within a country can result in benefits for the innovation activities of a state, which can thus pursue innovation activities in various sectors through targeted funding in individual regions. This should lead to a variety of innovations that will benefit the state and society through economic growth, prosperity and quality of life. Such innovative activities do not necessarily include progress in research and development. At the regional level, the potential lies in particular in human capital.[82] Nevertheless, regional innovation policy is coordinated on the national level. National innovation policy therefore should provide regulatory and administrative guidelines on innovation activities at the regional level in order to ensure the flexibility of research activity. Equally, positive growth and welfare effects may be

[79] Ebner in Blättel-Mink (2009:119)
[80] see Ebner in Blättel-Mink (2009:119f)
[81] see Grupp (2010:143)
[82] see OECD (2011:155)

achieved from learning effects and the dissemination of knowledge on similar industries or competitors[83].

On the supra- or multi-national level, one example is the innovation policy of the European Union. Synergy effects can also be found on this level in order to use know-how and learning effects across national boundaries and thereby achieve progress at the European level. At each level, however, companies or public and private institutions are important innovation drivers. For this reason, innovation funding at the corporate level is necessary to support research activities, especially as test procedures and the development of prototypes are very costly. The achievement of innovation push is in the state's interest. Therefore it should pursue innovation funding in order to ensure economic growth and employment as well as the prosperity of society.

„Sound innovation policy is not only about creating innovation; it is about creating the conditions that enable innovation and its benefits to materialise in the form of improved economic, social and environmental outcomes for society as a whole."[84]

2.3.1. Aspects of Cluster Policy and Regional Policy

The task of regional policy and specific cluster policy is long-term planning and control of network cooperatives or clusters. Areas of responsibility include the definition and pursuit of measures targeted to enhance competitiveness, securing and creating jobs in the region, i.e. the design and definition of objectives for regional development. These control measures pertain to economic policy, which provides framework conditions for governance of economic processes. The interdependence between regional and cluster policy as well as the interests of different administrative units are obvious. Regional policy displays a governmental form of regional policy which is derived from higher (governmental) economic policy objectives. However, cluster policy may be designed as a tool funded by the region for implementing regional policy objectives through a cluster or strategic concepts for the development of companies, whose interests are represented in this way. In literature, a clear distinction between regional and cluster policy is not always made due to these difficulties. The concepts behind these concepts intertwine; sometimes the terms are mutually exchangeable. According to the understanding gained so far, cluster policy can be seen as a part of regional policy, but not vice versa. Clusters are based in a region and therefore included in a regional development plan. However, a cluster can define its own goals and develop strategies. Such cluster policies do automatically – intentionally or unintentionally – have an impact on the region. The objectives of region and cluster are not necessarily mutually beneficial. To avoid conflicts, the definition and coordination of regional policy and cluster policy is even more important.

Cluster Policy

Although the theoretical statements on cluster policy in economic research have not yet come to an end, there are sufficient considerations to classify these and define their goals. The task spectrum of cluster policy may include various dimensions, on the one hand government-formulated rules and policy proposals; on the other hand means to achieve these goals formulated by region-based stakeholders and entrepreneurs. For the purposes of economic policy target rules, regulations and specific guidelines or instructions are included. Goals of cluster policy are the strengthening of

83 see Grupp (2010:143)
84 OECD (2011:161)

existing and the creation of new clusters in terms of the promotion of companies, industries and regions. It is focused on the connection of companies and the network character is to be strengthened – the strengths and characteristic of a cluster. Among other components, cluster policy can include growth, industrial, and structural policy issues. Industrial policy can respond to the promotion of regional characteristics as well as to the development of cluster-specific potentials. Regional structural policy is targeted towards trends and long-term plans. With an emphasis on activities, goals and interests of the cluster, these joint considerations can be subsumed under cluster policy. The state coordinates interacting structural and economic policies of different policy areas and provides the necessary information and communication structures, works interactively and promotes economic cooperation[85]. It is a supervisory body, and its primary responsibility is the coordination of higher goals. Nevertheless, the focus lies on the cluster itself. In cluster policy in a broader sense, its actors (regional stakeholders, companies' representatives, research institutions and cluster initiative) are incumbent upon the concrete definition and development of cluster action and their objectives. Cluster policy identifies several partial policy measures targeting long-term changes in economic, geographic and regional structures. Further features include the promotion of a spatial concentration of companies that serve the innovative character of cluster structures, promoting associated industries along the value chain and the cooperation between state and non-state actors in accordance with the objectives. The main focus of cluster policy lies on the influence of sectoral, spatial and economic structures of the region, its purpose being the continued existence and development of clusters. A regional cluster resident values its own dynamics and places economic, innovative and industrial interests at the center of these measures.[86]

Support of Clusters

Related to the concept of cluster policy is the promotion of clusters. Measures of cluster policy can include the support of clusters, since they ensure and develop regional economic activity. This may include monetary grants by governmental or private units, but also the creation of favorable structures for the activity of the cluster. Support of clusters thus means to promote cluster structures with regard to their competitiveness, existence, productivity and innovation activity. It aims to strengthen and develop clusters and to create of new cluster structures to establish cooperations of companies and research units. The promotion is targeted at the actors within the regionally based network cooperative. In a broader sense, cluster policy or cluster-based economic development may be directed at actors at home and abroad along the value chain. By promoting its networking character, an attractive environment for competition should be created, which will further support and promote corporate innovation activity. Due to the presence of multiple actors, these tasks are regarded as a collaborative process. The specialization in specific thematic topics should attract highly qualified personnel to the cluster and the region. Supporting measures for clusters are not sectoral, but directed on the entire value chain. It is assumed that extensive efforts affect the structures of the cluster.[87]

[85] see Blättel-Mink (2001:63)

[86] see Benner (2012:84ff), Blien/Maier (2008:8f), Cernavin et al. (2005:139ff)

[87] see Benner (2012:84), Cernavin et al. (2005:30f)

Cluster Initiatives and Cluster Management

In addition to the activities and the organization of cluster policy and cluster support, cluster initiatives need to be mentioned. These are an institutionalized form of cluster policy for the practical implementation of defined objectives and measures to promote the cluster. The cluster initiative represents an organized unit within the economic conglomerate, whose objectives are the implementation, control and coordination of the defined measures. It is at the heart of the organizational structure of a cluster. In addition to implementing a vision and specific objectives that are coordinated and synchronized between the different actors, the central tasks of the initiative are profile building and strategic positioning in the market. For the members, the knowledge of and possible co-decision in the strategic direction is necessary in order to identify with it and to take appropriate actions. Finally, the individual parts of companies and research units assemble and represent as a whole. Activities in line with the strategic goals of the initiative are therefore on behalf of the various actors. "The vision should give the identity-meaning of the cluster initiative and objectives are intended to provide a common action orientation"[88]. Joint appearance strengthens the cohesion within the cluster and communicates stability to stakeholders. Creating a brand can be an appropriate means to complete these joint lines in order to position the cluster as a productive and trustworthy economic entity in the market. Through location marketing, i.e. measures that increase attractiveness and enhance business settlements or regional infrastructure projects, the location can be promoted. As the activities of the initiative equal the management task of a company in this context, we also speak of cluster management. This is a team of actors who take on management responsibilities within the cluster and coordinate the cluster members. Cluster management can be seen as the "control function of the initiative"[89]. Its focus lies on the competitiveness and economic success of the cluster and its various stakeholders. Since cluster initiatives are actively involved in the process of implementing measures, the activities of cluster initiatives and cluster management can be seen as part of cluster policy.[90]

2.3.2. Competitiveness of Clusters and Regions

Location is not only highly important for individual companies; location and local environment have a great impact on the existence, development and competitiveness of the cluster and all involved actors. And vice versa, as such a regional economic conglomerate characterizes the overall situation of a region. The result is an interplay between the cluster and regional policy and, at best, coordinated policies and common agreements on objectives. With regard to the competitiveness of region and cluster, an intersection of the target bundle should be suspected as competitiveness is considered as the main objective of both policies. Besides productivity, economic growth and job creation and job security, it also includes improved quality of life. Through coordination and concentration of economic policy actions, framework conditions can be better targeted, also to avoid possible conflicts a priori. These include the promotion of innovation and structural change in the region.

Economic performance in terms of innovation, growth and quality of the region in large part depends on the activity of local companies. Companies have to find their position on the market and claim their competitive advantage, but are affected by the surrounding economic situation as labor

[88] Raschke (2009:208)

[89] Raschke (2009:210)

[90] see Benner (2012:86f), Floeting (2008:227), Raschke (2009:206ff)

supply, infrastructure, use of resources and market environment. The already-mentioned close relationships of the various players in a circle of associates have a positive effect on competitiveness factors. Interdependence between business, cluster and regional development can be seen. To this extent, the development of clusters is also a task of regional policy. These findings suggest the following: "Clusters can be regarded as a driving force of regional and even national systems of innovation"[91]. There is interdependence between regional development, innovation processes and local industry. All three indicators influence the development of any other dimension and are mutually dependent. Institutionalized structures in clusters often play a significant role in organized innovation systems. They provide the framework to support and guarantee innovative structures.[92]

Clusters as economic cooperation in vertical and/or horizontal industry conglomerations structure and accentuate the industrial landscape of an economy. Their localized structures, with the inherent geographical component, influence the regional economic and geopolitical landscape. Pro-competitive factors, which strengthen the cohesion of multiple actors, are explained by positive externalities in localized technologies, know-how and skills, knowledge spillovers, diffusion of innovative potential and creativity within the cluster and between various local industries. Their combination promotes innovation, competitiveness and economic strength for the cluster and the region. On the one hand, clusters are defined by these factors; on the other hand, it is due to the great importance of these factors for the economic stability and competitiveness of the cluster and the region that the development of the cluster depends on regional policy and vice versa.[93]

The „Diamond Model“ by Porter

The "Diamond Model" by Michael Porter provides a possible explanation for the competitiveness of nations and key determinants in their interplay for economic success, which, in a simplified manner, also applies to localized units at the regional level.

Previous comments on clusters tried to analyze the emergence, function ability, characteristics and development of clusters. This raises the question of economic factors for the success and competitiveness of a cluster and its impact on the regional economy. To what extent the conditions of a cluster influence the competitiveness of individual companies and the cluster initiative can be explained using Michael E. Porter's[94]diamond model. It is used to analyze microeconomic factors that affect a company or a larger economic system. Porter developed it in the 1990s in order to analyze success factors for companies in international markets. His analysis starts at the national level, as did other analyses on the competitiveness of economic agglomerations. The importance of the region was only considered as decisive in the innovation process in later works, which is why he then increasingly used it as an observation unit. In later works, Porter writes that the competitiveness of clusters and their capacity for innovation is based on the quality of the diamond of a country[95]. Competitive advantages are seen in localized structures through which companies develop their innovation potential and can increase their productivity. He finds reasons and causes for competitive advantages of companies by not least asking the question of innovative strength. He

[91] Blien/Maier (2008:39)

[92] see Benner (2012:87ff), Raschke (2009:43ff), Cernavin (2012:111ff)

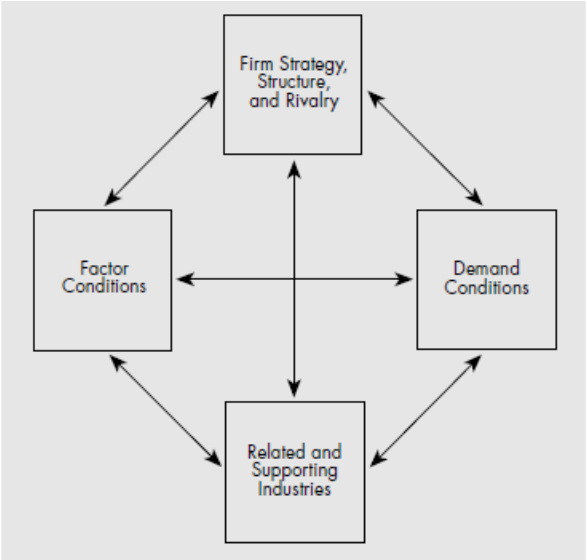
[93] see Porter (2003:569)

[94] Porter (1990)

[95] see Porter/Stern (2001:30)

further examines the impact of circumstances on innovative behavior. In a simplified form, the model is applicable on regional structures, but not to the full extent, as it was designed for the national level. At the regional level, it may help to answer the relative competitiveness and strength of innovation of clusters and regions. The Diamond Model (see Figure 4) summarizes several indicators into four factor bundles. When the model is applied to a cluster, it "describes the quality of the microeconomic business environment of a region and location conditions and determines the competitive advantage"[96]. The Diamond represents the determinants of the competitive advantage of local systems.

Figure 4: „Diamond Modell“ by Porter



Source: Porter (1998:78)

The first dimension of the diamond describes the *Factor Conditions* of a cluster, including professionals, material and financial resources and infrastructure facilities. *Demand Conditions* constitute the second dimension and represent regional, national and international demand trends in terms of output, including the adaptation to changing demand patterns. The third dimension shows the network of *Related and Supporting Industries* as well as related structures to other industries. The fourth dimension in the context of business strategy and competition (*Firm Strategy, Structure and Rivalry*) considers structures of the cluster and related industries, the competition at home and abroad, management and organization. The state has an inferior function, yet it influences the dimensions of the diamond. In the long term, its task is to ensure and promote the existence of the cluster in terms of regional development through economic policy measures. Beside local competition and industry structures that affect the activity of the cluster, factors of proximity and social aspects are discussed. The Diamond Model is to be understood as a system, which acts in the form of a cluster with its members. The characteristics of the diamond are also relevant for the emergence of a cluster. "The more the diamond is developed, the stronger is the random factor in the emergence of a new cluster"[97]. Interdependent influences of the dimensions are expected as well as their impact on the competitive situation of the cluster.[98] "A cluster is the

[96] Raschke (2009:48)

[97] Raschke (2009:73)

[98] see Benner (2012:94f), Cernavin et al. (2005:27), Porter (1998:78f), Potter/Miranda (2009:32), Raschke (2009:48f)

manifestation of the Diamond at work. Proximity – the colocation of companies, customers and suppliers – amplifies all of the pressures to innovate and upgrade."[99].

2.4. Specification of Eco-Clusters

To concretize the analysis of this work, several concepts combine to an understanding of eco-clusters. As explained earlier, clusters are networks of interacting actors within close geographic proximity who are involved in interrelated exchange relations promoting knowledge transfers, network effects and economies of scope. Eco-Innovations refer to "any form of innovation resulting in or aiming at significant and demonstrable progress towards the goal of sustainable development, through reducing impacts on the environment, enhancing resilience to environmental pressures, or achieving a more efficient and responsible use of natural resources"[100]. Finally, eco-industries are "a rapidly growing industrial sector producing goods and services to measure, prevent, limit, minimize or correct environmental damage to water, air, soil and ecosystems, as well as addressing problems related to waste and noise"[101]. Different technologies for environmental issues combine to innovative products and processes. Eco-industries are dealt as an emerging industry and thus attributed to high growth rates and a high future market potential.[102] Over all there is a trend for the "integration of specialized eco-industries-related companies into larger industrial groups"[103], which may later establish as eco-cluster.

The concepts of clusters, eco-innovations and eco-industries can now be converged to an understanding of eco-clusters, which for the purpose of this research work are defined as regional innovative networks with a focus on environmental friendly and sustainable technologies. They mainly or exclusively deal with the issues of environmental protection, resource conservation and sustainability including the aspect of innovations. Members of eco-clusters participate in innovative activities and R&D for products and processes of environmental technologies, creating a market and the division of eco-innovations with the aim to reduce harming influences on the environment and create new products and processes for production and consumption which aim at sustainable behavior pattern in the long run. Eco-clusters enhance regional economic activity and prosperity with respect to green growth and pursue regional long-term objectives in terms of sustainability. There are interdependencies between eco-clusters as economic networks and their interaction with regional prosperity as local companies engage in innovation activity and the market for eco-innovations and environmental friendly products and processes is expanding. Furthermore, regional employment and productivity will be created. Hence, eco-clusters are a driving force for green growth.

As a network with different actors from industry and science, which are in close proximity to each other (within a region), eco-clusters should combine the best conditions to produce environmentally-friendly technologies and eco-innovation. By means of specific regulation and coordinated regional environmental and innovation policy and local know-how, qualitative growth and sustainable development should be within reach. The innovation potential of actors (business and scientific units) is supported by cluster structures. Within the framework of environmental

[99] Porter (1998:90)
[100] European Commission, Eco-AP (2011:2)
[101] European Cluster Observatory (2013:5)
[102] Ketels/Protsiv (2014:1)
[103] European Cluster Observatory (2013:25)

protection and eco-friendly measures, standards of ecological innovation can be designed on the different spatial levels of cluster structures. Thus, a global network of stakeholders with the aim of environmental protection and sustainable development forms a global ecological innovation system[104]. Such structures can also be applied on a regional level. Thus, regional networks which deal with sustainable technologies and enhance eco-innovations can be classified as eco-clusters.

A conglomerate of several partners can obviously realize network effects and economies of scope. This encourages the exchange of know-how and skills in environment-related topics and enhances creativity for eco-innovations. As the motivation of smaller regional firms to go beyond on their own initiative are probably negligible, because they fear potential risks and lack contacts with possible cooperation partners, eco-clusters can function as an instrument to close these strategic gaps. They can link regional firms to possible cooperation partners (companies and research units along the value chain) as well as establish connections between regional policy and local companies. This network character coordinates interdependent information flows and thus enhances regional development and economic prosperity. For that reason, eco-cluster can be seen as a driving force for greening regional industries and economic policies, which strengthen regional eco-industries, generate prosperity and welfare by means of sustainability and environmental-friendly technologies and thus lead to a change toward sustainable behavioral patterns.

Findings for eco-clusters gained through empirical research in the current work will be combined to earlier research insights in economic literature[105] on eco-clusters, eco-innovations and eco-industries. The question is whether the established and observed structures for eco-clusters correspond to findings for cluster structures in general depicted in literature or if eco-clusters show specific characteristics to be addressed.

Economically advanced regions include cluster policy in their concepts of regional policy, and thus provide incentives by public entities that are integrated in government strategies. This goes together with regional and political support through financial funding. Through cluster structures, regions can focus on growth, competitiveness, networking relationships, innovation and R&D as well as export and internationalization. These goals are only attainable by strengthening the location and supporting local companies. Public interest in cluster structures enhances regional innovation and prosperity. Top-down initiatives for eco-clusters can be seen in conjunction with decentralized structures, which is also the case for example in Germany and Denmark, where overall frameworks exist on the national level, which are then translated and adopted on the regional level. Existing industry structures as well as the general predominating economic situation influence the type of emergence. Nevertheless, or because of that, bottom-up approaches are primarily initiated if eco-innovation is seen as a cost-efficient and competitive factor for companies, although they are to a lesser extent set up in that framework for eco-industries. Especially in countries with strong economies, eco-clusters are publicly established and integrated in regional policies as they are seen as regional economic driving forces and used as instrument to meet sustainable and economic objectives for regions, industries and their companies and enhance eco-innovativeness.[106] Despite the fact that some clusters are specifically initiated bottom-up by

[104] see Blättl-Mink (2001:94f)

[105] see for example Barsoumian et al. (2011), Fromhold-Eisebith/Eisebith (2005), Jungwirth/Müller (2011), Ketels (2015), Lindquvist et al. (2013), Meier zu Köcker (2008)

[106] see Barsoumian et al. (2011)

private companies with the aim to cooperate and build a framework for innovation and networking possibilities, many countries are aware of the potential of regional top-down cluster structures to generate regional economic prosperity, welfare and employment[107].

According to new industrial policy, a systemic integration of competitiveness, sustainability and societal as well as ecological goals has to be addressed. Green technologies and eco-innovations have the potential to act as driving forces of an economy. Eco-clusters and the need for sustainable industrial structures can be seen in conjunction with this economic approach and a greening of regional economic and industrial policy.[108] Incentives and actions of decision makers on the governmental as well as the economic policy level must be taken today to achieve a socio-ecological transition and specifically strengthen eco-industries on the national and regional level. Enhancing eco-industries and sustainability by means of eco-clusters and eco-innovations has to be regarded as a long-term goal, which needs strategic orientation, high priority on policy level and integration in a region's funding strategy.

[107] see Lindquvist et al. (2013:1)

[108] see Aiginger (2013) and Aiginger (2014)

3. Research on Eco-Clusters

After assessing the theoretical background of eco-clusters and eco-innovations, the focus is now turned to empirical view on eco-clusters. The main part of this research work is dedicated to the emergence and existence of eco-clusters resulting in consequent implications for greening regional economic policy (chapter 4). The empirical data was collected in personal interviews with responsible individuals in clusters and local government. Questions on the localization, current organizational structures and reasons of emergence for eco-clusters were raised, especially for initiation top-down or bottom-up. First, to get a view as comprehensive as possible and necessary information to determine the emergence and initiation of the eco-clusters, the cluster managers were contacted. Secondly, policy makers of the federal states were invited to give a statement on their cluster policy, support of regional based eco-clusters and the support for innovative activities in eco-clusters. By contacting cluster managers as well as regional policy representatives, insights on the emergence and organization of eco-clusters as well as their interaction with local governments could be gained. Finally, implications for regional economy with regard to supportive measures for eco-innovations to green regional economic policy as well as incentives for increasing growth and employment in the eco-industry sector could be stated. For concrete observation, eco-cluster in Austria were chosen. These findings are results out of own empiric research complemented with actual findings in current literature. The research outcomes are presented in chapter 4.

3.1. Applied Analysis Criteria

To gain the necessary information on cluster structures and the specification of a cluster's emergence and initiation to eventually design an appropriate questionnaire, economic literature was consulted. The methods used to classify the given information are based in selected literature on cluster formation, cluster structures and cluster policies. The framework of the questionnaire for eco-clusters is primarily based on the outline in Jungwirth/Müller/Ruckdäschel (2011). Moreover, aspects of other sources on the specification of cluster types were adopted for the needs of this work and integrated in the questionnaire[109] (see Appendix).

In this research work only clusters with environmental and ecological topics (eco-clusters) are analyzed and referenced to the learned outcomes in the literature. Neither a comparison to eco-cluster structures in other countries, nor relations to clusters from other industries can be made in this work. Nevertheless, defined criteria for classification of typology and formation of eco-clusters are also applicable to cluster analysis in general.

To specify emergence and initiation of a cluster, the nature of different indicators has to be known. Diverse aspects are necessary to relate and assess regional policy activities to a cluster's performance. Hence, the topics covered in the interviews were emergence or initiation of Austria's eco-clusters, objectives and strategic orientation, organizational structures, connection and cooperation with federal state units, etc. Therefore, following main aspects were taken into account in the questionnaire to cluster managers:

[109] see Fromhold-Eisebith/Eisebith (2005), Su/Hung (2009), Meier zu Köcker (2008), Jungwirth/Müller (2014), Ketels (2015)

Emergence

This criterion covers implications for the foundation of a cluster. It was asked about parties involved, which side initiated the first steps, or who showed the greatest interest in structures for eco-clustering. In particular it was asked whether the initiating parties were primary units on federal or federal state level, corporate units or both.

Governance Structure

On basis of the received answers regarding emergence, it was possible to distinguish between public, private or public-private cluster initiatives. The governance of a cluster is closely related to organizational matters, or the structure of the cluster management, and hence its strategic objectives. In a further step this indicates the categorized cluster type.

Cluster Type

The answers received on emergence and governance structure thus led to an important aspect for further research. The cluster type categorizes the initiation according to top-down or bottom-up. The former defines a formation of a policy-driven network with primarily regional objectives to stimulate the competitive advantage of the regional industrial location, while the latter is – to a greater or a lesser extent – a spontaneous emergence out of a private initiative through self-reinforcing forces of companies in a region. This distinction mainly corresponds with all other determinants, for example financing, organizational structure, ownership and legal structure as well as main cluster objectives. It can be assumed that top-down initiated networks have a greater focus on regional economic strength and development, which is mostly reflected in substantial financial support from federal state level. In most cases, the cluster management is organized externally, which means that the cluster manager is formally employed at a public entity but responsible for the cluster. In contrast, internally organized managements would be characterized by a partner or cluster member having the leading position within the cluster.[110] Different strategic objectives result from these constellations.

Organization and Cluster Management

It is distinguished between an externally or internally organized management. An external management structure is characterized by a constellation which originates not basically out of the organizational structure of a cluster, but is appointed by a superordinate unit such as the regional government. For theoretical matters it may be termed network administrative organization (NAO), which allows for an efficient and objective respectively neutral management from a central position[111]. In practical experience, it is mostly a regional business agency that takes this position in the Austrian case. In contrast, an internal management can either be a single partner company or cluster member, who has the leading position, or a self-organized group of individuals who are employed by the cluster itself (as a legal entity), and who work on behalf of the cluster members. Furthermore, this distinction is related to the governance structure. In general, it can be said that in most cases, a public initiative is organized externally, while a private network will have an internal management. Public-private initiatives show both types of management. In terms of cluster types, it is clear that a top-down initiated cluster can show both types whereas a bottom-up cluster will

[110] see Jungwirth/Müller/Ruckdäschel (2011:209)

[111] see Jungwirth/Müller/Ruckdäschel (2011:209)

mostly be internally organized.[112] For further information it was asked how new members are approached and whether there are any selection criteria.

Ownership Structure

The ownership structure will correspond to the above-mentioned indicators, above all the governance structure and type of the cluster management. Therefore it was asked for the legal form of the cluster and specifically the units who hold parts of the cluster. This indication confirms the systematology of other indicators.

Financing

The financing structure is an important indicator to assess a clusters' performance over time and it corresponds to the organizational structure. Therefore it describes one more measure, which goes hand in hand with the above-mentioned criteria. For that reason it is important to know whether and to which extent the financial resources come from member fees, sponsoring, EU funds, national funds, federal state funds, community funds, or others. A distinction was made between the current finance structure and that of the initial period after the cluster's foundation. In case of good cluster performance, the share of EU or national funding (if any existed at all) decreases to a very low share or disappears completely a few years into the cluster's existence, whilst the share of member fees increases.[113] The latter is no indicator of the amount or level of contributions. Comparatively low member fees will be levied in public-private or public clusters (if any at all). As this topic concerns a principal-agent-problem, which would have to be examined with further methodological approaches of utility incentive and cost-benefit structures, this specific aspect of member fees has not been included in the scope of this work. The share of regional funding decreases over time as well, but nevertheless constitutes a relatively large share (up to half of all financial resources) especially for top-down initiated public or private-public clusters.

Objectives

Here a distinction is made between primarily local or corporate objectives. This categorization serves to depict the main objectives of the cluster management, hence the strategic focus and the direction of processes. A cluster's orientation along primarily corporate objectives is explained with a focus on the competitiveness of companies (i.e. cluster members) and the strengthening of the companies' innovation activity and productivity. In contrast, the focus of regional objectives lies on the strengthening of the region in terms of competitiveness, employment, growth and innovativeness, location attractiveness, infrastructure, image, etc. As could be seen, both objectives go hand in hand.

Internationalization

With the criterion of internationalization, aspects of export strategies, the export share on overall turnover as well as cooperations and partnerships abroad and future internationalization plans were inquired into. This shows possible markets for companies and regions and the general standing in the worldwide competition of eco-industries.

Research & Development

This indicator aims at describing innovative activity in environmental and sustainable products and processes. What is especially interesting here is the financial support and effort of regions and

[112] see Jungwirth/Müller/Ruckdäschel (2011:217), Jungwirth/Müller (2014), Meier zu Köcker (2008)

[113] see Lindqvist et al (2013)

companies, as well as the R&D-rate, which is presented as expenditures for R&D efforts as a share of total expenditures. Furthermore, it was asked about patent applications. Interesting further aspects are cooperations between companies and research units as well as the concrete realization of R&D support measures on a regional policy level.

Commitment of Members
The commitment of members is a very subjective category. Nevertheless it should allow insights on forms of cooperation and networking activities in a cluster. An open question left space for individual answers regarding design and measurement of commitment. It emphasizes the form of other indicators.

Region and Cluster
This category is used to describe the focus of the regional policy level on the local eco-industry. It was asked for concrete policy programs fostering innovative activities in the field of environmental technology and corporate sustainable efforts. The aggregation of the answers was to lead to identification of general adjustments in order to strengthen the eco-industry on regional level and possible missing incentives. In a further question, cluster managers were asked for their opinion on necessary policy incentives to reach the corporate and/or regional objectives they described.

These indicators were assessed in conjunction with aspects gained from interviews with regional policy makers. An important aspect from this point of view is the attitude of the region towards eco-clusters, specifically the regional attitude for cluster structures in general, and ecological innovation activity in particular, as well as the importance of regional prosperity through sustainable activity and innovation in the sense of green growth *(main interests and regional priorities)*. It was further asked whether there were concrete funding models to foster cluster structures, ecological innovation activity and regional prosperity through sustainable innovation to reach local policy objectives, and who the recipients of these support measures were *(existing incentive structures)*.

The methods and analytical framework used and questionnaires designed for eco-clusters in Austria can also be applied to other countries and for further economic research and an international comparison of regional and national cluster structures.

3.2. Austrian Eco-Cluster Landscape

For empirical analysis Austria was chosen as object of investigation. At the beginning it was to find out whether there are economic agglomerations of the eco-industry, i.e. eco-clusters, in Austria. To anticipate the answer: there are nine eco-clusters located in six Austrian federal states; all of which were contacted for this analysis. In total Austria locates 61 clusters and networks which operate in different areas of economic and technological strength[114].

Austria shows a well-organized and interconnected cluster landscape with many cross-links for information exchange, cooperation between companies and industries as well as contacts to international clusters and networks on the regional and national level. The main information on eco-clusters in Austria was gained through the national information platform clusterplattform.at[115], which was initiated by the Federal Ministry of Science, Research and Economy (BMWFW) in 2008.

[114] see BMWFW (2014:4)
[115] www.clusterplattform.at

This platform serves as a free association of Austrian clusters and networks and provides insights into the cluster landscape in Austria, and also possibilities for private companies and research units to connect, participate and cooperate in and across different thematic areas and industries on different stages of the value chain. Austria currently presents 61 clusters and networks, categorized in nine thematic industry groups. The group with the largest number of clusters is the category "Renewable energy and environmental technology", to which around ten eco-clusters and technology pools or knowledge centers are assigned. It comprises clusters with a focus on environmental technology, agricultural technology, energy technology, biotechnology as well as resource and energy efficiency. It should be noted that the classification of the mentioned clusters to this thematic group comes from the cluster managers themselves[116]. Often cooperations with local research units promote cluster specific innovation efforts for an innovative and sustainable economic activity. The creative and innovative potential of companies and research units is demonstrated through cooperations for the purposes of better allocation of resources, synergy effects and knowledge spillovers. The growing industry of ecological, environmental and sustainable technologies, products and production processes is reflected in the economic landscape of Austria as well as the European Union and beyond. The focus of industries and companies on eco-innovative products is promoted on the regional and supranational levels through projects, funding and networking and cooperating initiatives, for instance by the European Commission[117].

Figure 5 shows a graphic representation of the regional location of these eco-clusters in Austria. As can be seen, the main regions for eco-clustering are Lower Austria, Upper Austria, Styria, Tyrol, Burgenland and Vienna.[118] Hence, in Carinthia, Salzburg and Vorarlberg, there are no eco-clusters. Besides these clusters mentioned on the platform, another eco-cluster beyond this platform was included in the current work.

Figure 5: Austrian Eco-Cluster Landscape (2015)

Source: www.clusterplattform.at

Although Austria shows many cluster initiatives established out of public interest (see for example "Holzcluster Salzburg" or "LISA Vienna – Life Science Austria Vienna"), the thesis that eco-clusters are different and especially need to be initiated top-down holds for the fact that regulation is needed because of occurring externalities and market failure, which arise from innovation promoting ecology and sustainability, as well as a needed radical change of behavioral patterns towards sustainability.

[116] according to personal information from BMWFW (20.2.2015)

[117] see 'Further Internet Sources' in Bibliography

[118] for more information see BMWFW (2014)

4. Research Findings

The indicators explained in chapter 3.1 help to develop a conjunct overview on existing and missing structures in regional cluster policy. Now summarized insights and aggregated findings from interviews with cluster managers and regional representatives were presented. Concerning the stated hypothesis that eco-clusters differ from other clusters, have to be policy-driven and therefore set up top-down, presented findings refer to and support this thesis. Together with insights from current research literature, it was possible to identify following implications for Austria's regional economic policy concerning eco-clusters and greening economic policy. These findings do not make a claim to be complete as regards ascertained indicators of derived incentive structures, they more or less represent a collection of ideas and conclusions from interviews covering the current organizational structure of eco-clusters and enterprises in the field of environment technology and resource efficiency in Austria.

In general, Austria stands for very advanced and exemplary cluster structures. Conversation partners as well as economic studies on clusters, for instance by the European Cluster Observatory[119], the Eco-Innovation Observatory[120], the OECD[121] or the European Commission[122], who postulate a very good performance of Austria's eco-industry activity in international comparison, confirm that Austria is a pioneer and functions as a role model in terms of clusters and networks ("[Austria] is one of the best eco-innovation performers in the EU"[123]). The presented results were gained from interviews with managers of seven Austrian eco-clusters out of a total of nine that were identified for the purpose of this research work and in consequence contacted. In addition, responses of policymakers or representatives of five provincial governments' (Landesregierungen) business agencies are included in the results. In total, representatives from all six federal states that host the Austrian eco-clusters were contacted.

Austrian cluster systems combine regional as well as corporate objectives. In most cases their publicly communicated maxim is guided by the overall aim of supporting and funding the cluster members, i.e. regional companies, and hence strengthening the innovation activity and competitiveness of the region. In terms of innovation, regional objectives and the support of partner firms aim at an increased innovation activity through cooperation between companies and research units. To express it differently, Austrian eco-cluster structures aim at regional growth through innovation.

Although slight distinctions between regional forms of Austrian eco-clusters can be discerned, i.e. differences in the clusters' structures and cluster initiation, nevertheless they resemble each other in large parts over all federal states. In the studied regions, especially in those which are economically strong, there is a great regional interest in cluster structures. It seemed that clustering and the initiation of networks have been discovered on the one hand to motivate – in

[119] see Barsoumian et al. (2011)

[120] see Giljum/Lieber (2013)

[121] OECD (2013a)

[122] see Regional Innovation Scoreboard 2014

[123] Eco Innovation Observatory (http://www.eco-innovation.eu/index.php?option=com_content&view=article&id=454&Itemid=50, 1.4.2015)

most cases – smaller companies (SMEs) to participate and cooperate, on the other hand to foster regional growth and development and promote each region's own economic goals.

In all federal states in this study, the local business agencies are deeply involved in regional economic development and follow environmental topics to different extents, although not all stated this in their regional economic strategies. Vienna shows an interesting development in cluster policy: a small number of thematic clusters existed for several years, but were later abandoned. The thematic focus has moved toward supporting the interfaces between different industries. Although there is little motivation for small firms to organize themselves and a modest willingness to search for cooperation partners on their own initiative, the organizational structure of clusters was not a success in all industries here. The Viennese eco-industry requires different incentive structures for the support of smaller firms. There are specific project calls or direct financial support for individual projects. Thus the support of the city is more project-focused than industry-focused. It can only be assumed that the differences in Vienna compared to the other regions can be attributed to its role as federal capital and hence a different economic starting point in cluster structures.

The interviews repeatedly revealed that research activities and innovative capacities appear in research units rather than enterprises. To enforce corporate innovative activities, project calls on specific topics were announced. These were increasingly advertised for environmental topics, but mostly depend on the thematic focus and funding priority of the specific region. Some federal states like Tirol, Upper Austria and Styria have already integrated the goal of strengthening the local eco-industry in their regional development strategies.

To give a thematic overview, the following findings resulted from the required criteria:

Emergence, Governance and Cluster Type

It can be summarized that the main focus in Austria lies on public regional initiatives of eco-clusters. According to information of the individual business agencies, a public networking initiative encourages smaller firms to cooperate and enhances their business activity. A superordinate cooperation like the cluster formation builds an institutional structure which decreases their individual risk and offers compact possibilities for business partners and cooperations. It could be confirmed with different conversation partners that a lack of self-organization in cooperations between smaller companies can be observed. Especially for these local firms, a publicly initiated cluster structure helps to strengthen and to expand their business activity. On the public side, the implementation of such measures meets their interest in connecting and supporting local companies, in strengthening networking and cooperations beyond local firms and research units, as well as enhancing local business activity to increase the competitiveness of the region. These facts lead to the conclusion that all seven questioned eco-clusters in Austria have been initiated top-down and are private-public or public initiatives. It can be concluded that in total 70 to 80% of Austrian eco-clusters are publicly or private-publicly governed and initiated top-down.

Organization, Cluster Management

Only two of the seven questioned eco-clusters in Austria have an internal management fulfilled by a company or self-organized by a group of individuals who are employed by the cluster itself. The other five Austrian eco-clusters are organized externally by the local business agency. This means the cluster management is set up in a regional entity or network administrative organization (NAO). When this is the case, the managerial tasks are fulfilled by regional business agencies. In this

case the cluster is one of the business agency's programs and often has no legal form as such. The cluster management is appointed by and works on behalf of this business agency, which is established by the regional government and pursues mainly regional objectives. In this setup, eco-clusters are established to meet regional objectives but with regard to the smallest enterprises as cluster members. Public or private-public governance of a cluster in most cases can be seen as regional support of companies with the main objective of strengthening the regional economy as a whole. Corporate objectives are formulated and elaborated together with the cluster members to reach regional objectives through cooperation and individual support of the enterprises. At the regional policy level, this is seen as a way to foster regional employment and competitiveness and to enhance competence in specific environmental topics on the corporate level. The local business agency provides the necessary administrative and consultancy services. This construction and effort of regional governments can be seen in Austria's economically strongest regions. All externally managed Austrian eco-clusters are initiated top-down.

The ownership structures differ slightly between clusters, although the majority of the eco-clusters in Austria are governed private-public or public, the ownership structure and cluster management is organized in different ways. Five eco-clusters are externally managed by the local business agency, which for its part is founded on behalf of the provincial government. In four of these cases, the cluster has no concrete legal form but is organized as program of the business agency. One of these externally managed eco-clusters has the legal form of an association, and is only managed by the local business agency. The clusters evolved out of a regional institution, which was initiated by the provincial government, is governed private-public, organized as an association but managed externally and initiated top-down. The remaining two clusters are organized as limited companies and hence internally organized, but also initiated top-down by federal government, in one case together with local companies and research institutions. This means that the cluster combines associates of public, private as well as research units. This ownership structure appoints the cluster management, which is responsible for managerial tasks on behalf of the limited company. From the total of nine eco-clusters in Austria, only two eco-clusters may be categorized as privately initiated and assumed to be initiated bottom-up. But as interviews could not be conducted, these assumptions are not proofed. It could be found that one of these two clusters has the legal form of an association. It can only be assumed that the management is organized internally, but unfortunately no definite statement on the organizational and management structures can be given. In summary, the type of the cluster management thus corresponds to the legal structure of the eco-cluster.

Commitment of Members

Generally speaking, the commitment of cluster members is well established, as indicated by the cluster managers. Several activities and events are implemented in the different eco-clusters to strengthen networking activities and cooperation between cluster members as well as to maintain direct and close contact to the companies. These may be large events, round tables, some with political representatives, yearly receptions, workshops and smaller events for cooperation possibilities. They aim for a positive atmosphere through open communication. The fluctuation of cluster members might be used to measure this criterion, which several eco-clusters indicated as very low; high loyalty rates and word-of-mouth-rates are collected through member surveys. Further there are cooperation projects and joint appearance of cluster members abroad.

Accession of new members

Regarding the accession of new members, Austrian eco-clusters only apply thematic selection criteria and firms may join a cluster when they are involved in environmental topics. But cluster managements in many cases also demonstrate an intrinsic motivation to look for new members that fit the cluster's internal thematic focus in the field of ecological and environmental technology. We need to keep in mind that the main interest is on the public side. In some cases, the cluster management looks for companies in the relevant local industry and abroad who might be able to support the cluster program along value chain linkages and act as a driving force for business activity and cooperation structures on behalf of the cluster. Advantages can be seen on both sides: in the view of the cluster management, business activity and cooperation between the regional eco-industry can be strengthened. From the corporate side, in the view of the partner firms, the driving force can be the think tank for current business matters, or support through networking activities in the sense of new business contacts and business opportunities. A general objective is the expansion of the regional market, possibly export opportunities and internationalization efforts, as well as the promotion of innovation opportunities and hence growth and development for firms as well as the region. Selection criteria in general are more thematically orientated. Although member fees exist in many eco-clusters, these are staggered according to the number of employees of the company. Because the main interest underlying the cluster initiative is public, the level of the member fees is kept relatively low, but the actual level differs between eco-clusters.

Financing

In all considered clusters, the information gained was that financial resources mostly received from federal state funding and members' fees. Only a small share of the overall financial resources of Austrian eco-clusters comes from municipal funding, state funding or EU funding. The origin of financial resources at the time of establishing the cluster differs from the one after a few years of existence or at the current stage. At the start of an eco-cluster, financial resources come to a larger extent from regional levels and often amount to half of the total financial resources, whereas member fees only represent a limited percentage (20 - 25 %), if any at all. At this stage, government funding or EU resources (30 - 50 %) are more common, too. In the current stage of the Austrian eco-cluster existence (average existence of Austrian eco-clusters between 7 and 17 years), the share of membership fees increases (30 - 40 %), while that of regional public funds slightly decreases (40 - 60 %), which is nevertheless a good indication of a cluster's positive performance. Six out of seven questioned Austrian eco-clusters charge member fees, which make a share between 10% and 50% of total financial resources. Only one Austrian eco-cluster obtains municipal funding with a share of total financial resources of 10 %, one other eco-cluster receives state funding (less than 1 %) and two eco-clusters EU-funding, which approximately make up half of total financial resources at the current stage. On the whole, the allocation of financial resources depends on the legal constitution or organizational structure of a cluster, this holds true especially for membership fees as well as for national or EU contributions. Regional funding can be observed nearly in all clusters, at the time of foundation as well as later on. This holds especially true regarding clusters established from public initiative. In these cases, the financial resources came to a large extent from the federal states. These findings regarding the financial structures correspond to insights in other research[124].

[124] for example see Lindquvist et al. (2013)

Objectives and Internationalization

Nearly all eco-clusters have ongoing strategic internationalization plans for future developments. The export partners are based in the European Union but also in third countries. Current export markets of Austrian eco-clusters are for example Belgium, the Czech Republic, Germany, Great Britain, Italy, Spain and Sweden and other countries of the European Union as their main export partners, but also Canada, Chile, China, Switzerland and the US. Business cooperations exist with Switzerland. To what extent internationalization plans or exports are forced varies a lot between the eco-clusters. The export share of the observed Austrian eco-clusters ranges between 35 and 90 %. In general, the internationalization support for companies from clusters includes the initiation of international cooperation projects. In one case, internationalization journeys arranged by the cluster management in order to encourage contacts as well as interaction and networking activities were mentioned. The wider objective of one eco-cluster is defined as positioning itself as an international eco-energy region.

Research & Development

It was found that research takes place more in research units than in companies. But the cluster managements push for corporate research activities, especially in small firms, mainly by assigning thematic project calls. In many cases, such projects include cooperations between research units and companies. The concrete research work is not measured in all eco-clusters and could therefore not be specified or compared as such. Few eco-clusters indicate a R&D-rate between 4 and 10 %, which is explained as expenditures for efforts in research and development as a share of total expenditure. In some cases, this key figure is not collected at all. The same holds for patents. It could be found that patenting is more within the scope of universities and research units than the corporate level. When enterprises or small and medium enterprises (SMEs) develop an innovative product or process, they tend not to patent it rather than research units.

Region and Cluster

In general, there are close connections between the regional government and cluster management, which is not least due to the organizational structures underlying most eco-clusters in Austria. Public cluster initiatives see the established cluster structure as a means to an end, with the intention of reaching corporate goals by focusing on regional development objectives. This is also partially reflected in financial support and the pushing of environmental issues in regional funding strategies.

4.1. Insights for Incentive Structures of Economic Policy

The described incentive structures are based on the interviews and information gleaned from them. The findings are summarized and aggregated over all eco-clusters and regions. The cluster managers firstly mentioned the need for more and better incentive structures for promoting cluster activities. Structures on the federal state level do exist, which is reflected in the existing eco-clusters, but national frameworks are generally missing. This coincides with the concern that Austria has "no explicit eco-innovation policy program"[125], mentioned by the Eco-Innovation Observatory. Secondly, incentives are required for a more sustainable economy and economic activity. Finally, further incentives are missing to attract more companies for settling in the regional

[125] see Giljum/Lieber (2013:11)

eco-industries. This fact matches the need for a larger and more qualified regional work force. The following findings for incentive structures can be summarized:

Adequate legal framework for eco-industry

A fundamental concern is the legal framework for cluster structures on a national level and adequate laws to authorize and support the eco-industry. From claims of the cluster managers this could be referenced to the energy efficiency law, which represents a framework that is too weak for a domestic eco-industry. Keeping the future development in mind, these and other laws or the legal framework covering environmental issues have to be adequate for the present and future performance of this industry. By now there is a strong impetus of Austria's eco-industry. It is also a general social and economic goal to further enhance this industry and foster the greening of Austria's economic policy. This adjustment of requirements leads toward a modern economic policy in general and one for eco-industries and environmental technology in particular.

Funded projects in ecological and environmental topics

Environmental and ecological issues are not yet an explicit objective in all Austrian regional funding strategies. The question is whether this should be embedded on the national level or through incentive structures for their implementation on regional level. Only a few regions mentioned eco-tech as a general regional goal which is specifically supported by different activities. This is mainly the case in those regions where the biggest eco-clusters are located and a corresponding infrastructure already exists. One activity to promote business activity in the eco-industry that has been implemented so far is assigned project calls in this field. Their frequency is assumed to be rather low, which is why there are rarely advertisements for environmental issues from the public side. Of course there are several regions where this support is more available than in others, but those are rather exceptional. One way to foster activity in the eco-industry could therefore be more project calls and funding support for innovative small firms on the hand, and support for cooperations between companies and research units on the other hand. These funding possibilities meet the need for more direct financial support for individual project ideas, in particular for smaller firms and start-ups.

Alternative Funding Structures

Although Austria is a country with diverse funding structures, government funding and research premiums decreased or stagnated. As further savings can be expected, recipients stress the need for alternative methods of financial funding and support especially in eco-industry. Since public funding on the governmental level is expected to decline further, a rethinking of funding structures towards participation of private actors is required. Eco-innovations show high risks and costs for small and young firms, but risk pooling – like in bigger firms – is not possible. Thus incentives are needed to encourage private companies to increase their expenditures in research and development either in their own research departments, or with partners, e.g. in clusters. Confidence for the market must be created to motivate companies of the private sector to invest in eco-innovations[126].

Regional Settlement of firms

The potential for the establishment of firms in the field of eco-industry is not yet fully exploited. Cluster managers in the regions are aware of this potential, and it is also a general consensus in this

[126] see also Geels (2013:34)

industry. Therefore more incentives for the regional settlement of firms in the field of eco-industry are necessary. It could be implemented through concentrated local marketing activities to foster business settlements in the regions and the main objective of green growth in general. Embedding ecological goals in public funding strategies on the regional and national levels is one point, and the range of possibilities continues to better funding options for small firms and start-ups in general as well as more and better field-specific qualification offers on the tertiary education level.

Qualification offers in eco-related issues

The increase in more settlements of firms in the field of eco-industry is related to the current qualification offers in this area. Examples of more and better education offers for employees have been implemented by few eco-clusters. Through cooperation of the eco-cluster with the local university, a post gradual university course was established, as well as courses and seminars in current study curriculums. A higher education level in this field leads to well-qualified employees on the one hand, but also to a potential increase in start-ups in the eco-industry on the other hand, as well as diverse potential contacts of businesses with research units for cooperations. As a further consequence, this will lead to a reduction of the regional unemployment rate, which was expressed as a concrete concern by cluster managers who outlined the need for a better education structure in the eco-industry. The needs of the eco-industry have to be addressed by providing incentives and actions for specific know-how in environmental topics.

Energy self-sufficiency

The overarching goal is to limit the use of resources in terms of sustainability as well as financial resources for competitiveness. A possibility to reach both objectives is implementing structures which enable municipalities to be energy self-sufficient. Local resources are used and converted into energy to be used by the local population and industry. Eco-technology is already able to implement self-sufficient power production with photovoltaic systems and heat energy by converting locally available biomass cost-efficiently. Hence regions and communities can produce the necessary energy on their own, save resources and implement sustainable energy use on their own. Models of climatic regions (Klimamodellregionen) are already implemented in Austria, but currently are at an early stage and not yet common practice. Promotion of local eco-industries can thus also be implemented by focusing on energy self-sufficiency and by enabling local companies to specialize on this feature.

According to Porter's Diamond, the following specifications for eco-clusters in Austria can be summarized. The first dimension (*Factor Conditions*) includes financial resources and infrastructure facilities. Nearly all Austrian eco-clusters receive financial support from the federal state, and some from municipalities, the state or the EU. Nearly all eco-clusters charge membership fees, although they amount to only a small part of their overall financial resources. Regional and local infrastructure exists and will be addressed continually as the cluster structures function as a means to an end for regional development. But full factor conditions are not yet fully developed as qualification training and education of professionals needs to be upgraded. Specialization in eco-related industries is necessary which should manifest in educational plans, apprenticeships and university programs to create specialized factor pools for eco-industry. The *Demand Conditions* as a second dimension includes important export and internationalization plans in all eco-clusters in Austria. To increase domestic demand, the support of consumption of eco-friendly and sustainable products (e.g. building) could boost domestic sales and consequently be an additional benefit of regional eco-industries. Related and supportive industries have to be motivated to engage in the

ongoing eco-innovation process as well as to create home demand for inputs of eco-friendly products along the value chain. The network of *Related and Supporting Industries* as a third dimension is demonstrated very well in Austrian eco-clusters. The majority of eco-clusters prioritize cooperations along the value chain, hence support vertical as well as horizontal mergers between companies and research units and thus build networks. Sometimes the focus is on thematic intersections, for example technology and sustainability (e.g. e-mobility) or sustainable building. Incentives have to be set through project calls and other funding options to create possibilities especially for SMEs and start-ups to take part in the eco-innovation process. The fourth dimension in the context of business strategy and competition (*Firm Strategy, Structure and Rivalry*) considers structures of the cluster and related industries, the competition at home and abroad, management and organization. In the sense of eco-clusters as a regional policy instrument, the cluster often is established as an umbrella brand over partner companies and cluster members to present in a unified appearance externally and hence provide a solid foundation for member companies' daily business. However, member companies are still working autonomously and are responsible for themselves, but can use the service and advantages of the cluster structures. One main goal of top-down-initiated eco-clusters is the strengthening of small and region-based business. A further advantage is economies of scope and network effects which underlie cluster structures and influence the members' actions. To further motivate local companies and enhance regional in conjunction with sustainable development, publicly initiated eco-clusters could function as institutional instrument to connect diverse actors of the economic process.

A report on Austria's eco-industry states that "Although there is no explicit eco-innovation policy, the country implements a number of relevant measures and strategies, including a dedicated policy addressing resource efficiency"[127]. The findings of this research confirm this statement. Nevertheless, far more support is needed to establish firms in the eco-industry sector. This means that a more thematic specialization of firms is needed that puts no special regional constraint on settlement. In general this goes with the need for a larger number and better educated employees on the regional level. Once more, this corresponds to the expressed need for more education offers for the existing and possible work force. This means more courses and programs at universities and in corporate cooperation with regional research units. In a further step, these measures lead to a more attractive economic framework and therefore create incentives for the establishment of firms and start-ups in the eco-industry. Incentives are also needed on the national level, concerning overarching goals and superior respectively national support strategies for eco-industries.

All these findings confirm government commitment for greening regional economic policy, which means the consideration of a sustainable growth path with concrete actions of politics and economic policy. Measures on consumption side include distribution of environmentally friendly products to social acceptable prices (preventing social exclusion) and creation of a consciousness for sustainable behavior patterns which have to be publicly communicated and distributed. On supply side adequate frameworks and incentives to enable the diffusion of eco-innovations as well as encouragement of cooperations between companies and research units is necessary. Over all, to reach a greening of economic policy, the integration of social, ecological and sustainable goals together with regional development and competitiveness is important. This can be achieved by including these as long-term goals in regional and national innovation and development strategies.

[127] Eco Innovation Observatory – Austria (http://www.eco-innovation.eu/index.php?option=com_content&view=article&id=454&Itemid=50, 1.4.2015)

Publicly initiated eco-clusters can function as means to an end and work interdependently with green economic policy. All these processes focus on a path towards sustainable development and the creation of a consciousness about our behavior patterns today and necessary changes for the future.

4.2. Further Research Strategy

The questionnaire designed for the purpose of this research work may be applicable on other clusters too. A comparison between emergence and structures of eco-clusters in contrast to clusters of other industries or other main thematic focuses may gain further insights on cluster structures in general. Hence, a first interesting further research approach may be regional data surveys for Austria's cluster landscape in general. The fact of emergence and mainly public or private initiation of clusters and the level of public support could be contrasted to the findings for eco-clusters presented in this work. Both steps of analysis (for eco-clusters and other clusters) could be done for any other country. A further step could compare national cluster landscapes. This could focus on clusters of one industry, i.e. a national comparison of eco-cluster-structures, or national cluster landscapes in general. In both approaches statistical significant differences for individual countries but also for instance within the Europe Union could be worked out as well as distinctions between eco-clusters and other clusters. For a deeper insight on economic development regional data for economic indicators could widen the analysis and provide deeper insights in regional developments, also over time.

5. Conclusions

This research work verifies the hypothesis that e*co-clusters differ from other clusters, have to be policy-driven and therefore set up top-down* through initiatives of public entities. Following reasons led to this main hypothesis:

1. High risks, costs and uncertainty on a developing market for environmental technologies and diffusion of eco-innovations.

2. Decisions of private companies are subject to short-term market developments, private cluster initiatives are dependent on market opportunities in the eco-industry sector and thus volatile.

3. Eco-innovations show characteristics of radical innovations and thus external effects which have to be addressed by economic policy.

4. Eco-clusters show strong network effects and economies of scope for regional firms as well as for competitiveness of the region.

5. Governmental commitment and public initiatives have to force the eco-innovation process to create certainty on an evolving market for eco-innovations (green market) und thus raise supply for eco-friendly and sustainable products to eventually reach a change in behavioral consumption pattern in the long run.

6. Environmental issues have a public good character and thus need governmental commitment and possibly state interventions, which may be realized through top-down-initiated eco-clusters and regional networks initiated by regional governments.

The presented research work gives evidence on eco-clusters by analyzing eco-clusters in Austria regarding emergence, organization, financing structures as well as their interconnectedness with regional policy. Interviews with cluster managers and regional policy makers gained insights for incentive structures in economic policy to green regional economic policies and foster eco-innovations and regional development. The methods used and questionnaires designed for the analysis of eco-clusters in Austria can also be applied in other countries for further economic research, for example an international comparison of regional and national cluster structures.

Empirical research on Austrian eco-clusters was complemented by a sound research on current literature. The findings are consistent with current research literature. Moreover, they show new implications for implementation and incentive structures for public initiation of eco-clusters. Empirical results from interviews with cluster managers from Austrian eco-clusters and regional policy makers show:

- Government commitment is necessary to provide certainty on a developing market about new environmental technologies and arouse interest for private investment and sustainable development in the long run.

- Research and development of eco-innovations especially in small and young firms is missing. Reasons are greater risk, costs and uncertainty together with externalities and market failure which occur because of a lack of adequate supporting framework conditions and missing incentives. Regional companies should be encouraged to concentrate on environmental topics and take part in

eco-industry by providing cooperation possibilities through clustering and through public funding of eco-innovations.

- Funding strategies for innovation and research, especially in the field of eco-innovation are necessary incentives to be included in a long-term context. Impetus can be direct financial innovation support of smaller firms and start-ups in eco-technology as well as calls for innovation projects and possibilities for cooperations between companies and research units.

- Support for smaller firms and the possibility for networking and cooperations, especially with research units, can be a driving force for eco-innovation and the local economy. Therefore measures and support of economic policy and regional government are necessary. Especially smaller firms, which are the main driving force of a region's economy, in many cases do not have sufficient resources to establish innovative structures and fully exploit their innovation capacity. The motivation of smaller regional firms to go beyond on their own initiative is probably negligible, because they fear potential risks and contacts to possible cooperation partners are limited. For this reason, eco-clusters can function as an instrument to close these strategic gaps. They can link regional businesses to possible cooperation partners (companies and research units along the value chain) as well as establish connections between regional policy and local companies. This network character coordinates interdependent information flows and thus enhances regional development and economic prosperity, as possibilities in eco-industry are introduced on a higher level.

- These missing incentives und public support results in a lack of supply with environmental friendly products and processes, which can also be seen as a consequence of market failure, externalities, possible lock-in effects and path dependencies in eco-industries. To implement effective economic structures and use regional resources and know-how in the most efficient way, incentive structures in regional policy are necessary to explore the highest potentials of a region and enhance its economic development. Especially to make supply with environmental technologies and eco-innovations independent from short-term market decisions of private companies and missing market opportunities in the eco-industry sector.

- Eco-clusters build stable networks, provide regional infrastructure, ensure financial support and funding structures and create prosperous surroundings for innovations, to overcome lock-in effects and path dependencies. They are networks for cooperations between companies, research units and public entities. Bringing these three actors together should be an objective of regional economic policy together with supporting incentive structures. This is a reason why especially smaller and young firms profit from regional eco-clusters.

- Environmental objectives and the strengthening of eco-industries should be implemented as strategic long-term goals in regional research and innovation strategies, thus aligned to higher national goals. Therefore eco-clusters are a driving force of regional development and welfare, they establish networks, enhance know-how and innovative creativeness as well as improve economic strength and support of local enterprises on a regional level. They function as instrument and driving force for green growth in regions and beyond and force the greening of regional economic policy. A far-reaching economic strategy on the national and regional level can lead to an integrated and coordinated plan for different actions. In the long run this should lead to changes towards sustainable behavior patterns and a socially optimal supply of sustainable products and secure environmental-friendly processes.

Through governmental commitment externalities as consequences of market failure in eco-industry can be internalized, risks for companies in eco-industry reduced, certainty about an evolving market on eco-innovations created and possible private investors attracted. This development defines active participation in the ongoing green-growth-process towards a socio-ecological transition to achieve sustainable and socially acceptable behavior patterns for a better well-being today and a safe world for future generations. For this reason publicly top-down initiated eco-clusters on the regional level and their innovation capacity are necessary driver for the development of sustainable behavior patterns and long-term green growth.

Bibliography

Aiginger, Karl (2013): The "greening" of industrial policy, headwinds and a possible symbiosis; wwwforEurope policy paper no 3, WIFO, Vienna.

Aiginger, Karl (2014): Industrial policy for a sustainable growth path; wwwforEurope policy paper no 13, WIFO, Vienna.

Amt der Tiroler Landesregierung (2013): Tiroler Forschungs- und Innovationsstrategie.

Arundel, Anthony; Kemp, René (2009): Measuring Eco-innovation; United Nations University UNU-MERIT Working Paper Series #2009-017.

Barsoumian, Sarine; Severin, Astrid; van der Spek, Titus (2011): Eco-innovation and National Cluster Policies in Europe - a Qualitative Review; Greenovate! Europe EEIG, im Auftrag des European Cluster Observatory.

Beise, Marian; Rennings, Klaus (2005): Lead Markets and Regulation: A Framework for Analyzing the International Diffusion of Environmental Innovations; Ecological Economics 52, p. 5-17.

Benner, Maximilian (2012): Clusterpolitik - Wege zur Verknüpfung von Theorie und politischer Umsetzung; Dissertation Universität Heidelberg; LIT Verlag, Berlin.

Blättel-Mink, Birgit (Hg.) (2001): Wirtschaft und Umweltschutz - Grenzen der Integration von Ökonomie und Ökologie; Campus-Verlag, Frankfurt/New York.

Blättel-Mink, Birgit (Hg.) (2003): Ökologische Innovationssysteme im Vergleich - nationale und regionale Fallstudien; Nomos-Verlag-Gesellschaft.

Blättl-Mink, Birgit (2006): Kompendium der Innovationsforschung; Verlag für Sozialwissenschaften, Wiesbaden.

Blättl-Mink, Birgit; Ebner Alexander (Hg.) (2009): Innovationssysteme - Technologie, Institutionen und die Dynamik der Wettbewerbsfähigkeit; Verlag für Sozialwissenschaften, Wiesbaden.

Blien, Uwe; Maier, Gunther (2008): The Economics of Regional Clusters - Networks, Technology and Policy; Edward Elgar Publishing Limited, Cheltenham (UK).

Bollmann, Petra (1990): Technischer Fortschritt und wirtschaftlicher Wandel - eine Gegenüberstellung neoklassischer und evolutorischer Innovationsforschung; Physica-Verlag.

Boons, Frank; Wagner, Marcus (2009): Assessing the relationship between economic and ecological performance: Distinguishing system levels and the role of innovation; Ecological Economics 68, p. 1908-1914.

Bundesministerium für Wissenschaft, Forschung und Wirtschaft (BMWFW) (2014); Cluster in Österreich – Leistungsstarke Innovationsnetzwerke in den wirtschaftlichen und technologischen Stärkefeldern Österreichs; Wien.

Cainelli, Giulio; Mazzanti, Massimiliano; Montresor, Sandro (2012): Environmental Innovations, Local Networks and Internationalization; Industry and Innovation, Vol. 19, No. 8, p. 697-734.

Cernavin, Oleg; Führ, Martin; Kaltenbach, Martin; Thießen, Friedrich (2005): Cluster und Wettbewerbsfähigkeit von Regionen, Erfolgsfaktoren regionaler Wirtschaftsentwicklung, Volkswirtschaftliche Schriften - Heft 543; Duncker & Humboldt, Berlin.

Christensen, Thomas A.; Lämmer-Gamp, Thomas; Meier zu Köcker, Gerd (2012): Perfect Cluster Policy and Cluster Program - The Cluster League - Some food for Thought; Discussion Paper, Berlin/Copenhagen: Danish Ministry of Science, Technology and Innovation/Competence Networks.

Clement, Werner (2010): Beiträge zu: Leitlinien für eine österreichische Clusterstrategie; 4C foresee - Management Consulting GmbH Wien, im Auftrag von www.clusterplattform.at.

Clement, Werner; Pamminger, Werner (2009): Cluster in Österreich: Bestandsaufnahme und Perspektiven; 4C foresee - Management Consulting GmbH Wien, im Auftrag des Bundesministerium für Wirtschaft, Familie und Jugend (BMWFJ), www.clusterplattform.at.

Clusters Cord, Central Europe Programme (2011): Joint Research and Analyses of Regional Clusters and Related Policies - Benchmarking Study; Mit-Pannon Regional Development Company, Hungary.

Costantini, Valeria; Mazzanti, Massimiliano; Montini, Anna (2013): Environmental performance, innovation and spillovers. Evidence from a Regional NAMEA; Ecological Economics 89, p. 101-114.

Daly, Hermann E. (2002): Ökologische Ökonomie: Konzepte, Analysen, Politik; Discussion Paper FS-II 02-410. Berlin: Wissenschaftszentrum, Berlin.

Delgado, Mercedes; Ketels, Christian; Porter, Michael E.; Stern, Scott (2012): The Determinants of National Competitiveness; NBER Working Paper No. 18249, NBER: Cambridge, MA.

Deutz, Pauline; Gibbs, David (2008): Industrial Ecology and Regional Development: Eco-Industrial Development as Cluster Policy; Regional Studies, Vol. 42.10, pp. 1313-1328.

Doloreux, David; Parto, Saeed (2005): Regional Innovation Systems: Current Discourse and Unresolved Issues; Technology in Society 27, p. 133-153.

Enerdata (2014): Costs and Benefits to EU Member States of 2030 - Climate and Energy Targets.

European Cluster Observatory (2012): Emerging Industries - Report on the methodology for their classification and on the most active, significant and relevant new emerging industrial sectors; Pricewaterhouse Coopers on behalf of DG Enterprise and Industry Directorate-General, European Commission.

European Cluster Observatory (2013): Eco industries - Analysis of industry-specific framework conditions relevant for the development of world-class clusters; Pricewaterhouse Coopers on behalf of DG Enterprise and Industry Directorate-General, European Commission.

European Commission (2006): Eco-industry, its size, employment, perspectives and barriers to growth in an enlarged EU; Ernst & Young on behalf of European Commission – DG Environment.

European Commission (2010): Europe 2020 Flagship Initiative Innovation Union; Brussels.

European Commission (2011): Innovation for a sustainable Future - The Eco-innovation Action Plan (Eco-AP); Brussels.

European Commission (2013): Measuring Innovation Output in Europe: Towards a New Indicator; Brussels.

European Commission (2013): Innovation Clusters in Europe: A statistical analysis and overview of current policy support; European Commission - DG Enterprise and Industry Report.

European Commission (2013): Öko-Innovation: EU-Regionen übernehmen Führung auf dem Weg zu einer umweltfreundlichen Wirtschaft; Panorama-Inforegio, European Commission - DG Regional Policy.

European Commission (2014): Regional Innovation Scoreboard 2014; European Commission - DG Enterprise and Industry.

European Commission (2014): Innovation Union Scoreboard 2014; European Commission - DG Enterprise and Industry.

European Commission (2014): Das 7. UAP - ein allgemeines Umweltaktionsprogramm der Union für die Zeit bis 2020 "Gut leben innerhalb der Belastbarkeitsgrenzen unsere Planeten"; European Commission - DG Environment.

European Commission Europe Innova Cluster Cooperation (2011): Eco Innovative Cluster Partnership for Growth & Internationalisation (EcoCluP, 2009-2012), Präsentation, http://www.esv.or.at/fileadmin/redakteure/OEC/Veranstaltungen/2012/Eco-Clusters/Jones.pdf

Faucheux, S.; Nicolai, I. (2011): IT for green and green IT: A proposed typology of eco-innovation; Ecological Economics 70, p. 2020-2027.

Feldmann, Maryann; Francis, Johanna; Bercovitz, Janet (2005): Creating a Cluster While Building a Firm: Entrepreneurs and the Formation of Industrial Clusters; Regional Studies; Vol. 39.1, 129-141.

Fischer-Kowalski, Marina; Wiedenhofer, Dominik (2014): An optimal policy mix for resource use; wwwforEurope European Policy Brief no. 5, September 2014.

Floeting, Holger (2008): Darf's ein bisschen mehr sein? Clusterstrategien und kommunale Wirtschaftsförderung; in: Schrenk, Manfred; Popovich, Vasily V.; Engelke, Dirk; Elisei, Pietro (2008): REAL CORP 008 Proceedings / Tagungsband "Verkehrsknoten als Wissensdrehscheiben - Beiträge zur 13. internationalen Konferenz zu Stadtplanung, Regionalentwicklung und Informationsgesellschaft", Vienna (www.corp.at).

Friesenbichler, Klaus (2013): Innovation in the energy sector; wwwforEurope, Wifo, European Commission.

Fromhold-Eisebith, Martina; Eisebith Günter (2005): How to institutionalize innovative clusters? Comparing explicit top-down and implicit bottom-up approaches; Research Policy 34 (2005), 1250-1268.

Frondel, Manuel; Horbach Jens; Rennings, Klaus (2007): End-of-Pipe or Cleaner Production? An Empirical Comparison of Environmental Innovation Decisions Across OECD Countries; Business Strategy and the Environment 16, p. 571-584.

Geels, Frank W. (2013): The impact of the financial-economic crisis on sustainability transitions: Financial investment, governance and public discourse; wwwforEurope Working Paper no. 39.

Gibbs, David (2006): Prospects for an Environmental Economic Geography: Linking Ecological Modernization and Regulationist Approaches; Economic Geography 82(2), p. 193-215.

Gibbs, David; Deutz, Pauline (2005): Implementing Industrial Ecology? Planning for Eco-Industrial Parks in the USA; Geoforum 36, p. 452-464.

Giljum, Stefan; Lieber, Mirko (2013): Country Profile 2013: Austria; Eco-Innovation Observatory.

Grupp, Hariolf; Fornahl, Dirk (2010): Ökonomische Innovationsforschung, in: Simon Dagmar, Handbuch Wissenschaftspolitik; Verlag für Sozialwissenschaften, Wiesbaden.

von Hauff, Michael; Schmid, Uwe (Hg.) (1992): Ökonomie und Ökologie - Ansätze zu einer ökologisch verpflichteten Marktwirtschaft; Schäffer-Poeschel Verlag, Stuttgart.

Healy, Adrian; Morgan, Kevin (2012): Spaces of innovation: Learning, Proxmity and the Ecological Turn; Regional Studies, Vol. 46.8, pp. 1041-1053.

Hof, Hagen; Wengenroth, Urlich (Hg.) (2007): Innovationsforschung, Ansätze, Methoden, Grenzen und Perspektiven; Lit-Verlag.

Horbach Jens, Huber Joseph, Schulz Thomas (Hg.) (2003): Nachhaltigkeit und Innovation - Rahmenbedingungen für Umweltinnovationen; ökom Verlag.

Howaldt, Jürgen; Jacobsen, Heike (Hg.) (2010): Soziale Innovation - auf dem Weg zu einem postindustriellen Innovationsparadigma; Verlag für Sozialwissenschaften, Wiesbaden.

Howaldt, Jürgen; Kopp, Ralf; Schwarz, Michael (2008): Innovationen (forschend) gestalten, Zur neuen Rolle der Sozialwissenschaften, WSI Mitteilungen 2/2008; WSI/Hans-Böckler-Stiftung, Düsseldorf.

Huber, Joseph (2008): Pioneer Countries and the Global Diffusion of Environmental Innovations: Theses from the Viewpoint of Ecological Modernisation Theory; Global Environmental Change 18, p. 360-376.

Inclusive Green Growth - The Pathway to Sustainable Development (2012); The World Bank, Washington D.C.

Jahrbuch ökologische Ökonomik, Innovationen und Nachhaltigkeit (Band 4) (2005); Metropolis Verlag, Marburg.

Jänicke, Martin (2001): Ökologische Modernisierung als Innovation und diffusion in Politik und Technik: Möglichkeiten und Grenzen eines Konzepts; Freie Universität Berlin, Fachbereich Politik- und Sozialwissenschaften, Otto-Suhr-Institut für Politikwissenschaften, Forschungsstelle für Umweltpolitik.

Jänicke, Martin (2008): Ecological Modernisation: New Perspectives; Journal of Cleaner Production 16, p. 557-565.

Jappe-Heinze, Arlette; Baier, Elisabeth; Kroll, Henning (2008):Clusterpolitik: Kriterien für die Evaluation von regionalen Clusterinitiativen; Arbeitspapiere Unternehmen und Region Nr. 3/2008, Fraunhofer Institut - Institut System- und Innovationsforschung (ISI).

Jones, E.; Harrison D.; McLaren J. (2001): Managing Creative Eco-innovation - Structuring Outputs from Eco-innovation Projects; The Journal of Sustainable Product Design 1, p. 27-39.

Jungwirth, Carola; Müller, Elisabeth F.; Ruckdäschel, S. (2011): Clustertypen - Eine Typologisierung und Charakterisierung regionaler Netzwerke; Zeitschrift für Wirtschaftsgeographie, Jg. 55 (2011), Heft 3, S. 207-225.

Jungwirth, Carola; Müller, Elisabeth F. (2014): Comparing Top-Down and Bottom-Up Cluster Initiatives from a Principa-Agent Perspective: What We Can Learn for Designing Governance Regimes; Schmalenbach Business Review (sbr). 01/2014; 66:357-381.

Kallis, Giorgos; Norgaard, Richard B. (2010): Coevolutionary Ecological Economics; Ecological Economics 69, p. 690-699.

Ketels, Christian (2013): Recent Research on Competitiveness and Clusters: What are the Implications for Regional Policy?; Cambridge Journal of Regions, Economy and Society, Vol. 6, Iss. 2, pp 269–284.

Ketels, Christian; Protsiv Sergiy (2013): Clusters and the New Growth Path for Europe; wwwforEurope Working Paper No. 14.

Ketels, Christian; Protsiv Sergiy (2014): European Cluster Panorama 2014; European Cluster Observatory Report; Center for Strategy and Competitiveness Stockholm School of Economics.

Ketels, Christian (2015): Competitiveness and Clusters: Implications for a New European Growth Strategy; wwwforEurope Working Paper no 84.

Klemmer, Paul; Lehr, Ulrike; Löbbe, Klaus (1999): Umweltinnovationen - Anreize und Hemmnisse; Analytika, Berlin.

Konrad, Wilfried; Nill, Jan (2001): Innovationen für Nachhaltigkeit - Ein interdisziplinärer Beitrag zur konzeptionellen Klärung aus wirtschafts- und sozialwissenschaftlicher Perspektive; Schriftenreihe des Instituts für ökologische Wirtschaftsforschung (IOW) 157/01, Berlin, http://www.ioew.de/uploads/tx_ukioewdb/IOEW_SR_157_Innovationen_fuer_nachhaltigkeit.pdf

Köppl, Angela; Kletzan-Slamanig, Daniela; Köberl, Katharina (2013): Österreichische Umwelttechnikindustrie - Export und Wettbewerbsfähigkeit; Österreichisches Institut für Wirtschaftsforschung (Wifo).

Leitner, Karl-Heinz; Weber, Matthias; Fröhlich, Josef (Hg.) (2009): Innovationsforschung und Technologiepolitik in Österreich - neue Perspektiven und Gestaltungsmöglichkeiten; Studienverlag, Innsbruck/Wien/Bozen.

Lindqvist, Göran; Ketels, Christian; Sölvell, Örjan (2013): The Cluster Initiative Greenbook 2.0; Ivory Tower Publishers, Stockholm.

Lucas, Marilyn T. (2010): Understanding Environmental Management Practices: Integrating Views from Strategic Management and Ecological Economics; Business Strategy and the Environment 19, p. 543-556.

Maier, Gunther; Sedlacek, Sabine (Hg.) (2005): Spillovers and Innovations - Space, Environment and the Economy; Springer, Wien/New York.

Meier zu Köcker, Gerd (2008): Clusters in Germany - An Empirical Based Insight View on Emergence, Financing, Management and Competitiveness of the Most Innovative Clusters in Germany; Institute for Innovation and Technology, Berlin.

Meier zu Köcker, Gerd; Kind, Sonja (2013): Evaluation of Clusters, Networks and Cluster Policies - Challenges and Implementation; Working Paper of the Institute for Innovation and Technology (iit) Berlin, Nr. 14 (October 2013), Berlin.

Malecki, Edward J. (2012): Regional Social Capital: Why it Matters; Regional Studies, Vol. 46.8 pp. 1023-1039.

Marshall, Alfred (1920): Principles of Economics; 8th edition; Macmillan, London.

Massard, G.; Jacquat, O.; Zürcher, D. (2014): International Survey on Eco-innovation Parks. Learning from Experiences on the Spatial Dimension of Eco-Innovation; Federal Office for the Environment and the ERANET ECO-INNOVERA, Bern. Environmental studies no. 1402: 310 pp.

Nill, Jan (2009): Ökologische Innovationspolitik - eine evolutorische Perspektive; Metropolis-Verlag, Marburg.

OECD (2002): Frascati Manual - Proposed Standard Practice for Surveys on Research and Experimental Development.

OECD (2005): Oslo Manual - Guidelines for Collecting and interpreting Innovation Data.

OECD (2010): Cluster Policies; OECD Innovation Policy Plattform www.oecd.org/innovation/policyplatform.

OECD (2010a): Ministerial report on the OECD Innovation Strategy - Key findings; OECD Innovation Strategy.

OECD (2011): Towards Green Growth: Monitoring Progress, OECD Indicators.

OECD (2013): Moving towards a Common Approach on Green Growth Indicators; Green Growth Knowledge Platform Scoping Paper.

OECD (2013a): OECD Environmental Performance Reviews: Austria 2013; OECD Publishing.

OECD (2014): Green Growth Indicators; OECD Green Growth Studies, OECD Publishing.

Österreichischer Forschungs- und Technologiebericht (2013); Joanneum Research (JR), Austrian Institute of Technology (AIT), Zentrum für Europäische Wirtschaftsforschung (ZEW) im Auftrag des Bundesministeriums für Wissenschaft und Forschung (BMWF); Verkehr, Innovation und Technologie (BMVIT) und Wirtschaft, Familie und Jugend (BMWFJ).

Parto, Saeed (2000): Industrial Ecology and Regionalization of Economic Governance: An Opportunity to 'localize' Sustainability?; Business Strategy and the Environment 9, p. 339-350.

Pfriem, Reinhard; Antes, Ralf; Fichter, Klaus (2006): Innovationen für eine nachhaltige Entwicklung; Deutscher Universitäts-Verlag / GWV Fachverlage GmbH.

Pindyck, Robert; Rubinfeld, Daniel (2005): Mikroökonomie, 6. Auflage; Pearson Studium, München.

Pirgmaier, Elke; Schreiber, Johanna; (2011): Eco-Innovations in Austria - EIO Country Profile 2011: Austria; Eco-Innovation Observatory.

Porter, Michael E. (1990): The Competitive Advantage of Nations; Harvard Business Review, Vol. 68 Issue 2, p. 73-93.

Porter, Michael E. (1998): Clusters and the New Economics of Competition; Harvard Business Review, Vol. 76, Issue 6, p. 77-90.

Porter, Michael E. (1998a): Cluster und Wettbewerb - Neue Aufgaben für Unternehmen, Politik und Institutionen; in: Wettbewerb und Strategie. Econ, München.

Porter, Michael E.; Stern, Scott (2001): Innovation: Location matters; MIT Sloan Management Review; 42, 4; ABI/INFORM Global p. 28.

Porter, Michael E. (2001a): Clusters of Innovation: Regional Foundations of U.S. Competitiveness; Monitor Group, on the FRONTIER, Council on Competitiveness, Clusters of Innovation Initiative.

Porter, Michael E. (2003): The Economic Performance of Regions; Regional Studies, Vol. 37.6&7, pp. 549–578.

Potter, Jonathan; Miranda, Gabriela (2009): Cluster, Innovation and Entrepreneurship; OECD - Local Economic and Employment Development (LEED).

Potts, Travis (2010): The Natural Advantage of Regions: Linking Sustainability, Innovation and Regional Development in Australia; Journal of Cleaner Production 18, p. 713-725.

Raschke, Falk Werner (2009): Regionale Wettbewerbsvorteile - Identifikation, Analyse und Management von Clustern am Beispiel der Logistik im Rhein-Main-Gebiet ; Gabler Verlag/GWV Fachverlage Gmbh, Wiesbaden.

Rennings, Klaus (1998): Towards a Theory and Policy of Eco-Innovation - Neoclassical and (Co-) Evolutionary Perspectives; Center for European Economic Research (ZEW) Discussion Paper 98 - 24.

Rennings, Klaus (2000): Redefining Innovation - Eco-Innovation Research and the Contribution from Ecological Economics; Ecological Economics 32, p. 319-332.

Rennings, Klaus (2007): Messung Analyse nachhaltiger Innovation; DESTATIS, Neue Wege Statistischer Berichterstattung.

Rennings, Klaus; Rammer, Christian (2009): Increasing Energy and Resource Efficiency through Innovation - An Explorative Analysis Using Innovation Survey Data; Czech Journal of Economics and Finance, 59, no. 5.

Rennings, Klaus; Rammer, Christian (2011): The Impact of Regulation-Driven Environmental Innovation on Innovation Success and Firm Performance; Industry and Innovation, Vol. 18, No. 3, p. 255-283.

Rennings, Klaus; Wiggering, Hubert (1997): Steps Towards Indicators of Sustainable Development: Linking Economic and Ecological Concepts; Ecological Economics 20, p. 25-36.

Rückert-John, Jana (Hg.) (2013): Soziale Innovation und Nachhaltigkeit - Perspektiven sozialen Wandels; Springer VS, Wiesbaden.

Rutten, Roel; Boekema, Frans (2007): Regional Social Capital: Embeddedness, Innovation Networks and Regional Economic Development; Technological Forecasting & Social Change 74, 1834-1846.

Scheer, Dirk; Bark, Kerstin (2007): Umweltinnovationen: Europäische Erfahrungen - maghrebinische Herausforderungen; Institut für ökologische Wirtschaftsforschung, Schriftenreihe des IÖW 185/07, Berlin.

Schumpeter, Josef (1947): The Creative Response in Economic History; The Journal of Economic History, Vol. 7, No. 2, p. 149-159.

Sell, Axel (2000): Innovationen und weltwirtschaftliche Dynamik – der Beitrag der Innovationsforschung nach Schumpeter; Bericht aus dem Weltwirtschaftlichen Colloquium der Universität Bremen (Band 67); Bremen.

Smith, Mark T. (2001): Eco-innovation and market transformation; The Journal of Sustainable Product Design 1,p. 19-26.

Sölvell, Örjan; Lindqvist, Göran; Ketels, Christian (2003): The Cluster Initiative Greenbook; Ivory Tower Publishers, Stockholm.

Su, Yu-Shan; Hung, Ling-Chun (2009): Spontaneous vs. policy-driven: The origin and evolution of the biotechnology cluster; Technological Forecasting & Social Change 76/5, 608-619.

Venkatachalam, L. (2007): Environmental Economics and Ecological Economics: Where they can converge?; Ecological Economics 61,p. 550-558.

Wagner, Marcus; Llerena, Patrick (2011): Eco-Innovation Through Integration, Regulation and Cooperation: Comparative insights from Case Studies in Three Manufacturing Sectors; Industry and Innovation, Vol. 18, No. 8, p. 747-764.

Wink, Rüdiger (2006): Die Rolle der Nachfrage im Innovationsprozess. Eine evolutorisch-institutionen-ökonomische Perspektive; in: Parthey Heinrich, Spur Günther (Hrsg.), Wissenschaft und Technik in theoretischer Reflexion, Wissenschaftsforschung Jahrbuch 2006, Peter Lang GmbH, Frankfurt/Main.

Wink, Rüdiger (2007): Innovationsförderung durch die EU-Strukturpolitik nach 2007: neue Ansätze, alte Probleme?; Raumforschung und Raumordnung, Volume 65 (4),p. 315-326.

Wirtschaftsbericht Österreich 2013; Bundesministerium für Wirtschaft, Familie und Jugend (BMWFJ).

Wise, Emily; Langkilde, Lotte; Berelsen, Marie Degn (2009): The Use of Data and Analysis as a Tool for Cluster Policy - An Overview of International Good Practices and Perspectives Prepared for the European Commission; European Cluster Alliance.

Zimmermann, Klaus; Hartje, Volkmar J.; Ryll, Andreas (1990): Ökologische Modernisierung der Produktion - Strukturen und Trends; Ed. Sigma, Berlin.

Internet Sources:

Bau.Energie.Umwelt.Cluster Niederösterreich, http://www.ecoplus.at/de/ecoplus/cluster-niederoesterreich/bau-energie-umwelt

Bundesministerium für Wissenschaft, Forschung und Wirtschaft (BMWFW), http://www.bmwfw.gv.at/

Cluster Erneuerbare Energien Tirol http://www.standort-tirol.at/page.cfm?vpath=cluster/erneuerbare_energien_tirol

Clusterplattform Österreich, http://www.clusterplattform.at/

Eco-Innovation Observatory (Europäischen Kommission, DG Environment), http://www.eco-innovation.eu/

Eco Plus – Die Wirtschaftsagentur des Landes Niederösterreich, http://www.ecoplus.at/

Eco World Styria, http://www.eco.at/

European Cluster Observatory, http://www.clusterobservatory.eu/index.html

Europäisches Zentrum für Erneuerbare Energien Güssing, http://www.eee-info.net/cms/

Fraunhofer Institut, http://www.fraunhofer.de/

Netzwerk Ressourcen- und Energieeffizienz, http://www.nree.at/

Ökoenergiecluster Oberösterreich, http://www.oec.at/

Statistik Austria, http://www.statistik.at/

Umwelttechnik Cluster (OÖ), www.umwelttechnik-cluster.at

Further Information, Sources and Links:

Central Europe 2014-2020, http://www.central2013.eu/

Cleantech Incubation Europe, http://cleantechincubation.eu/

EcoPol, http://www.ecopol-project.eu/en/media/highlights/?itemid=127&a=viewItem

EcoWeb, http://www.ecoweb.info/

European Cluster Alliance – Pro Inno Europe (European Commission, DG Enterprise and Industry), http://www.eca-tactics.eu/eca/news-and-events

European Environment Agency (EEA), http://www.eea.europa.eu/

European Commission – DG Regional and Urban Policy – Inforegio, http://ec.europa.eu/dgs/regional_policy/index_de.htm

European Commission – DG Enterprise and Industry, http://ec.europa.eu/enterprise/index_en.htm

European Commission – DG Environment, Eco-Innovation, http://ec.europa.eu/environment/eco-innovation/

Green Growth Knowlegde Platform (GGKP), http://www.greengrowthknowledge.org/

Greenovate Europe!, http://www.greenovate-europe.eu/

Institut für ökologische Wirtschaftsforschung, http://www.ioew.de/

Klima- und Energiefonds, http://www.klimafonds.gv.at/

Mother Nature Network (mnn), http://www.mnn.com/

OECD, http://www.oecd.org/

OECD Green Growth Strategy, http://www.oecd.org/greengrowth/towardsgreengrowth.htm

OECD Innovation Strategy, http://www.oecd.org/site/innovationstrategy/

OECD and World Bank, Innovation policy platform(IPP), https://www.innovationpolicyplatform.org/

Regional Innovation Monitor Plus (RIM Plus), Europäische Kommission – DG Enterprise and Industry, http://ec.europa.eu/enterprise/policies/innovation/policy/regional-innovation/monitor/

Smart Cities Austria, http://www.smartcities.at/

Sustainable Europe Research Institute, (SERI) http://seri.at/

Umweltcluster Bayern, http://www.umweltcluster.net/de/

Appendix

Table 1: Questionnaire for Cluster Managers

Emergence and actors
1.1) How did the cluster emerge, who were the actors involved? a) cooperation of private companies and/or research units (private), actors involved: b) interest of public entities (federal/regional level), actors involved: c) both (public-private, cooperation of public entities/private companies/research units), actors involved:
1.2) Did the cluster emerge…? a) top-down (primarily public interest) b) bottom-up (primarily private interest)
Organization
2.1) Who manages the cluster? a) a company, which is member of the cluster (lead company) b) internal (self-organized) cluster management c) external management by:
2.2) How does the accession of new cluster members take place? a) there are no selection criteria, everyone can join b) the following selection criteria are applied:
2.3) What is the legal form of the cluster?
Ownership Structure
3) Who are the owners of the cluster? a) public entities: b) private companies, research units:
Financing
4.1) Where are the financial resources obtained from today and in which percentages? (share in total financial resources, %) a) membership fees (%): b) sponsoring (%): c) share EU-funds (%): d) share federal funds (%): e) share regional funds (%): f) share municipal funds (%): g) other (%):
4.2) What was the distribution of financial resources at the start of the cluster? a) membership fees (%): b) sponsoring (%): c) share EU-funds (%): d) share federal funds (%):

e) share regional funds (%): f) share municipal funds (%): g) other (%):
Objectives
5) What are the main objectives of the cluster? a) corporate objectives: (e.g. profitability of the company, innovation, productivity, support by the cluster management, etc.) b) local objectives: (e.g. competitiveness of the region, attractiveness of the region, innovation, employment, infrastructure, image, etc.) c) both:
Internationalization
6.1) Are there business contacts abroad? (international cooperations/partner) a) yes, with following countries: b) no
6.2) What is the export share on total turnover of the cluster? (%)
6.3) Which internationalization plans do exist?
Research and Development
7.1) How is R&D supported in the cluster? (instruments, mechanism)
7.2) What is the research quota of the cluster? (expenditures for R&D on total expenditures, %)
7.3) Are there patent applications in the cluster? a) no b.1) yes, since foundation of the cluster (number): b.2) yes, approximately per year (number):
Commitment of Members
8) How strong is the social cohesion, willingness for cooperation and sense of belonging of the cluster members and how does it manifest itself?
Region and Cluster
9.1) What is the political interest of the federal state/the region in the cluster and how does this manifest itself? a) strong interest, following interactions: c) little interest, following interactions:
9.2) Which interest is attributed to ecological and sustainable products, processes and innovations by the federal state and how does this manifest itself?
Incentives for Economic Policy
10) Which economic policy incentives would be necessary to… a) …enhance the cluster activity? (e.g. increase in sales, patent applications, etc.) b) …enhance sustainable management (production, consulting, consumption, etc.) in the region? c) …settle more companies in the eco-industry? d) other:

Table 2: Questionnaire Policy Maker

1) What is the priority or interest of the federal state government to… a) …foster the emergence of ecological clusters and cluster structures? b) …foster ecological innovations (products, processes, etc.)? c) …generate local employment and value added through sustainable innovation ("green growth")?
2) Which incentives were provided or which funding models exist to… a) …foster the emergence of ecological clusters and cluster structures? b) …foster ecological innovations (products, processes, etc.)? c) …generate local employment and value added through sustainable innovation ("green growth")?
3) Who is funded?
4) Are there funding strategies on the regional level?

Project Information

Welfare, Wealth and Work for Europe

A European research consortium is working on the analytical foundations for a socio-ecological transition

Abstract

Europe needs change. The financial crisis has exposed long-neglected deficiencies in the present growth path, most visibly in the areas of unemployment and public debt. At the same time, Europe has to cope with new challenges, ranging from globalisation and demographic shifts to new technologies and ecological challenges. Under the title of Welfare, Wealth and Work for Europe – WWWforEurope – a European research consortium is laying the analytical foundation for a new development strategy that will enable a socio-ecological transition to high levels of employment, social inclusion, gender equity and environmental sustainability. The four-year research project within the 7th Framework Programme funded by the European Commission was launched in April 2012. The consortium brings together researchers from 34 scientific institutions in 12 European countries and is coordinated by the Austrian Institute of Economic Research (WIFO). The project coordinator is Karl Aiginger, director of WIFO.

For details on WWWforEurope see: www.foreurope.eu

Contact for information

Kristin Smeral

WWWforEurope – Project Management Office

WIFO – Austrian Institute of Economic Research

Arsenal, Objekt 20

1030 Vienna

wwwforeurope-office@wifo.ac.at

T: +43 1 7982601 332

Domenico Rossetti di Valdalbero

DG Research and Innovation

European Commission

Domenico.Rossetti-di-Valdalbero@ec.europa.eu

WWWFOR EUROPE
WELFAREWEALTHWORK

Partners

	Austrian Institute of Economic Research	WIFO	Austria
	Budapest Institute	Budapest Institute	Hungary
	Nice Sophia Antipolis University	UNS	France
	Ecologic Institute	Ecologic	Germany
	University of Applied Sciences Jena	FH Jena	Germany
	Free University of Bozen/Bolzano	FUB	Italy
	Institute for Financial and Regional Analyses	GEFRA	Germany
	Goethe University Frankfurt	GUF	Germany
	ICLEI - Local Governments for Sustainability	ICLEI	Germany
	Institute of Economic Research Slovak Academy of Sciences	IER SAVBA	Slovakia
	Kiel Institute for the World Economy	IfW	Germany
	Institute of World Economics, RCERS, HAS	KRTK MTA	Hungary
	KU Leuven	KUL	Belgium
	Mendel University in Brno	MUAF	Czech Republic
	Austrian Institute for Regional Studies and Spatial Planning	OIRG	Austria
	Policy Network	policy network	United Kingdom
	Ratio	Ratio	Sweden
	University of Surrey	SURREY	United Kingdom
	Vienna University of Technology	TU WIEN	Austria
	Universitat Autònoma de Barcelona	UAB	Spain
	Humboldt-Universität zu Berlin	UBER	Germany
	University of Economics in Bratislava	UEB	Slovakia
	Hasselt University	UHASSELT	Belgium
	Alpen-Adria-Universität Klagenfurt	UNI-KLU	Austria
	University of Dundee	UNIVDUN	United Kingdom
	Università Politecnica delle Marche	UNIVPM	Italy
	University of Birmingham	UOB	United Kingdom
	University of Pannonia	UP	Hungary
	Utrecht University	UU	Netherlands
	Vienna University of Economics and Business	WU	Austria
	Centre for European Economic Research	ZEW	Germany
	Coventry University	COVUNI	United Kingdom
	Ivory Tower	IVO	Sweden
	Aston University	ASTON	United Kingdom