

Discussion Papers

DIW Berlin

German Institute
for Economic Research

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**Lydia Illge
Reimund Schwarze**

**A Matter of Opinion: How Ecological and
Neoclassical Environmental Economists
Think about Sustainability and Economics**

Berlin, September 2006

Opinions expressed in this paper are those of the author and do not necessarily reflect views of the institute.

IMPRESSUM
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ISSN print edition 1433-0210
ISSN electronic edition 1619-4535

Available for free downloading from the DIW Berlin website.



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Neoclassical Environmental Economists
think about Sustainability and Economics**

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Abstract

The differing paradigms of ecological and neoclassical environmental economics have been described in various articles and books and are also embedded in different institutional settings. However, we cannot take for granted that the paradigm debates described in the literature are actually mirrored in exactly the same way in the perceptions and opinions of researchers looking at sustainability from an economic perspective. This paper presents empirical results from a German case study on how economists and others involved in economic sustainability research from different schools of thought think about the issues of sustainability and economics, how they group around these issues, how they feel about the current scientific divide, and what they expect to be future topics of sustainability research. Knowing that sustainability research is highly and still increasingly internationally intertwined, and assuming that the opinions of German economic sustainability researchers do not dramatically differ from those in other countries, we think that these results will be of interest to the international scientific community.

We analyze the data using cluster analysis. Based on a literature survey, we generated forty sustainability-related statements and asked 196 economic sustainability researchers about their degree of agreement or disagreement with these statements. In evaluating our survey results, we discuss to what extent the clusters that we identified do - or do not - represent the two schools of thought of ecological and neoclassical environmental economics. We also propose some research concepts that can help to bridge the gaps amongst economic sustainability researchers as well as others more suitable for a scientific 'competition of ideas'. Key results of the study are: We identify two primary scientific clusters, one clearly confirming the existence of the ecological economics schools of thought, and the other largely capturing the neoclassical environmental view. Yet, there are some surprising exceptions: Both schools of thought share a conceptual definition of sustainability that is integrative in considering ecological, societal and economic dimensions ('three pillar concept') and is based on preserving the development potentials of society. We also find a shared critique of 'pure economic growth' strategies in our sample. These agreed opinions may provide bridging concepts between the schools of thought. Also both clusters agree with respect to a wide range of future fields of sustainability research. Yet, the research agenda of the ecological economics cluster contains a large number of additional topics, primarily related to social, distributional and evolutionary aspects of sustainable development as well as a strong microeconomic focus.

Strong divides between the clusters that seem to be more suitable for a kind of scientific competition of ideas are primarily related to the question of how to achieve sustainability, including suitable environmental policy measures.

Acknowledgement

The authors would like to thank Matthias Deutsch for his extensive literature evaluation, providing an important basis for generating the statements that are the ‘heart’ of our survey.

1 Introduction

In an international workshop on future topics for economic sustainability research held in Berlin in 2003, the participants got involved in a heated discussion about whether economic growth is a desirable goal for the sustainable development of nations. From their pro and con arguments, the sustainability researchers could be easily assigned to the two competing sustainability paradigms of ecological economics and neoclassical environmental economics. It turned out that both groups of researchers did not realize that they were talking about two different things when they mentioned the term ‘economic growth’. Whereas some referred to a rather physical concept of economic growth associated with an increasing use of material resources and the increasing generation of emissions and waste, others had a monetary concept of growth in mind that could be measured through GDP (or GNP) and would not necessarily bring about increasingly negative environmental effects. In the end, everyone agreed that a kind of decoupling of economic activities from harmful environmental effects is a desirable goal. However, opinions differed strongly on how to achieve such a development.

The differing paradigms of ecological and neoclassical environmental economics that more or less clashed at our Berlin workshop have been previously described in various articles and books (e.g., Costanza 1991, Klaassen and Opschoor 1991, Söderbaum 1992, Munda 1997, Beckenbach et al. 1999, van den Bergh 2000). They are also embedded in different institutional settings. In a European context, neoclassical environmental and resource economists have joined together in the European Association for Environmental and Resource Economists (EAERE), whereas ecological economists are organized in the European Society for Ecological Economics (ESEE). A similarly divided structure can be found in Germany. On the neoclassical side there is the group of environmental and resource economists within the German Economic Association (VfS), while on the ecological-economic side are the Association for Ecological Economics (VÖÖ) and the Association for Ecological Economic Research (VÖW). As a consequence of such institutional segregation, each paradigm has its own publication media (typically environmental-economic mainstream and ecological-economic side stream¹ journals) as well as parallel institutional structures at universities (e.g., chairs for

¹ The metaphor of ‘side stream’ may not satisfy all readers since side streams typically flow into the mainstream. Yet, we think that it is a useful picture for describing the current situation, assuming that ecological economics has a potential influence on future research in traditional environmental economics.

environmental and resource economics and others for sustainable development). This divide is an ambivalent phenomenon from a science policy perspective. On the one hand, it may help (the still young) scientific discipline of ecological economics to develop. On the other hand, valuable scientific synergies within economics may remain untapped.

The literature mentions a large variety of watershed topics that divide neoclassical and ecological economists, which can be summarized under the following categories: *concept of human behavior* (homo economicus/homo politicus/homo sustinens; e.g., Costanza et al. 1993, Norton et al. 1998, Ropke 1999, van den Bergh et al. 2000, Siebenhühner 2000), the *bio-physical vs. monetary valuation of nature* (e.g., Pearce and Turner 1990, Solow 1992, Pearce and Atkinson 1993, Functowicz and Ravetz 1994, Munda et al. 1994, Faucheux and O'Connor 1997, Martinez-Alier et al. 1998), judgments about the *relationship between sustainable development and growth* (e.g., Daly 1991, Norgaard 1994, Munda 1997, van den Bergh 2000), as well as varying emphases on issues of *distribution and justice* (e.g., Daly 1992, Ekins and Max-Neef 1992, Howarth 1992, Pezzey 1992, Martinez-Alier and O'Connor 1999, Weimann 1999). We also find differences related to the *scientific concept of economics* (e.g., Pearce 1987, Functowicz und Ravetz 1990, Klaasen und Opschoor 1991, Söderbaum 1992, Costanza 1993, van den Bergh 2000) and different *recommendations for sustainability policy* (e.g., Norton et al. 1998, van den Bergh et al. 2000).

Yet, are all of these topics equally strongly divisive or can we distinguish between key divides on the one hand and somewhat less differentiating issues on the other? And, besides from the divisions and disagreements, are there also bridging concepts related to sustainability, shared by both schools of thought? Thus, we cannot take for granted that the paradigm debates described in the literature and the institutional divides are actually mirrored in exactly the same way in the perceptions and opinions of sustainability researchers.

This paper presents empirical results of a German study, based on a survey concerning how economists (and others involved in economic sustainability research) from different schools of thought think about the issues of sustainability and economics, how they group around these issues, how they feel about the current scientific divide, and what they expect to be future topics of sustainability research.² Knowing that sustainability research is highly and still increasingly internationally intertwined, and assuming that the opinions of German eco-

² For more information on the survey, see www.sustainabilityeconomics.de.

conomic sustainability researchers do not dramatically differ from those in other countries, we think that these results are of interest to the international scientific community. Based on the survey results, we discuss to what extent the scientific clusters that we identified do - or do not - represent the two schools of thought of ecological and neoclassical environmental economics. We also propose some research concepts that can help to bridge the gaps amongst economic sustainability researchers as well as others more suitable for a scientific ‘competition of ideas’.

The paper is organized as follows: In section 2, we describe our sampling and survey methodologies. Section 3 describes the ‘opinion sets’ (clusters) about sustainability that are held by the identified groups of researchers, section 4 shows how the scientific divide is perceived within the clusters, and section 5 presents the perspectives on sustainability research as seen by the study participants. Finally, we summarize our findings and draw conclusions on the science policy implications of the divide with respect to the future of sustainability research.

2 Sampling and Survey methods

The target groups of the study were not only economists in Germany who deal with issues of sustainability, but also other sustainability researchers who look into economic research questions without being economists themselves. Such a broad definition of the target group appeared to be reasonable, as sustainability research is typically interdisciplinary. Since we could not include all researchers in Germany dealing with economic sustainability research due to resource constraints - and since there is no such thing as ‘the representative sustainability economist’ - we selected those ecological-economic and neoclassical-economic associations that we consider to be the ‘focal points’ of the scientific divide described in the literature. On the one side are the German Economic Association (VfS) and its section for Environmental and Resource Economics (AURÖ), labeled ‘Group A’.³ On the other side are the Association for Ecological Economics (VÖÖ), the Association for Ecological Economic Research (VÖW), and German members of the International Society for Ecological Economics (ISEE), labeled ‘Group B’.⁴ All members of both AURÖ and VÖÖ were invited to participate

³ VfS stands for ‘Verein für Socialpolitik’ (and AURÖ for its ‘Ausschuss für Umwelt- und Ressourcenökonomie’ (see: www.socialpolitik.org). VÖÖ – mentioned in the following - stands for ‘Vereinigung für ökologische Ökonomie’ (www.voee.de), whereas VÖW is the acronym of the ‘Vereinigung für ökologische Wirtschaftsforschung’ (www.voew.de).

⁴ We only included those German member of ISEE that were not at the same time members of VÖÖ or VÖW.

in the survey. Because of their large size we took random samples of VfS and VÖW, each of a size that resulted in a roughly equal distribution of both expected schools of thought within the total survey sample.

All participants were asked to fill out a questionnaire about various issues related to sustainability and economics (described later in this section). Of the 396 questionnaires given out, we received 196 completed questionnaires back. The return rate of 49.5 percent can be considered high. Based on information provided by the participants, we assigned them to groups A (71 persons) and B (79 persons), which we assume to reflect the two schools of thought. Another group contains 24 persons with multiple memberships, whereas 22 participants did not provide any information on their memberships. Considering this distribution, we had a roughly equal share of members from the various associations in our study sample (see table 1).

Table 2–1
Membership of survey participants in scientific associations

Scientific association	Number of people contacted by questionnaire	Responses	
		Number	Percentage of total (%)
<i>Group A</i> Research Committee for Environmental and Resource Economics of German Economists' Association "Verein für Socialpolitik" (complete); German Economists' Association "Verein für Socialpolitik" (VfS, random sample of all members, excluding above-mentioned research committee)	150	71	36,2
<i>Group B</i> Association for Ecological Economics (VÖÖ, complete); Association for Ecological Economic Research (VÖW, random sample); International Society for Ecological Economics (ISEE) (includes multiple memberships among these)	194	79	40,3
Multiple memberships <u>between</u> groups A and B	23	24 ⁵	12,2
No information on membership	-	22	11,2
Total	396	196	100,0

An important implication of our sampling procedure is that the results we present are not representative for all those who do economic research on sustainability. Instead, our results mirror the views of members of selected scientific associations in our study that to our opinion reflect the scientific divide described in the literature. Thus, the question that we follow in this paper is whether and how this institutional divide is reflected in the thinking of the members of these institutions. While the first part of this question seems to have an obvious answer - because membership in an association is a willful decision of individuals to join a group of people who share aims and values -, we can not simply conclude from 'membership' on 'beliefs'. Although this is in many respects a far stretch, we use the analogy of the catholic church here to support our point: Even though it is the official 'policy' of that church to not allow women to become priests, there may still be (many) church member who believe that

⁵ The higher number in the response group, compared to the selected sample, is most likely due to not fully up-to-date membership databases.

women should be allowed so. Thus, we cannot conclude from the institution's beliefs on the beliefs of (all) its members. Indeed, we find some evidence in our study for opinions of economic sustainability researchers that differ from the theoretical paradigms.

In the questionnaire, the participants were asked for their personal perception and opinion about the scientific divide within economic sustainability research and the perspectives of sustainability economics. These results were evaluated by using standard statistical procedures for frequency-counting, based on groupings of study participants representing different clusters. These clusters provide the 'heart' of our analysis and were identified as follows: In the questionnaire, the study participants expressed the degree of their personal agreement with 40 statements on sustainability on a scale ranging from +2 (strongly agree) to -2 (strongly disagree). The statements on sustainability were generated based on a literature survey⁶ and a number of pre-tests. In the pre-tests, we used the questionnaire with small groups of persons and carried out statistical analysis in order to filter out those statements that cause a high variance, that is, particularly contrary opinions within the test groups.

We evaluated the participants' statement rankings by means of cluster analysis (Centroid analysis, combined with Varimax rotation). In doing so, the ranking results of each participant were correlated with those of all others, identifying those ranking patterns (clusters) that are typical for one group of participants but significantly different from ranking patterns of other groups. We ran the cluster analysis for the versions of two, three, four and five possible clusters. While all versions turned out to be acceptable from a statistical perspective, the lowest value of highest cluster correlation (0.358) was achieved by a simple two group clustering (see table 2). This result is in favor of version 'two clusters' since high correlations indicate relatively large overlap between the clusters. We also carried out a 'scree test', evaluating the eigenvalues of all clusters. In the test, we looked for the place where the slope of the eigenvalue function changes from being steep to being flat (cp. Cattell 1966). This test also suggested extracting two clusters.

⁶ See literature mentioned in the introduction.

Table 2–2
Key data of cluster analysis

Alternative →	2 clusters	3 clusters	4 clusters	5 clusters
Share of defining variables (total for all clusters)	88 %	84 %	81 %	74 %
Average reliability coefficient	0.800	0.800	0.800	0.800
Lowest value of composite reliability	0.996	0.978	0.981	0.970
Highest value of standard error of cluster loads	0.062	0.149	0.137	0.174
Highest value of standard error of differences in normalized cluster loadings	0.088	0.211	0.177	0.246
Highest value of correlation between cluster loadings	0.358	0.523	0.553	0.544

Finally, we carried out a verbal interpretation of the clusters for all versions. For doing so, we focused on the statements and their ranking scores. In this step of the analysis, the version with two clusters led to the most plausible results, while all other versions (three, four and five clusters) did not create coherent pictures. In particular, our verbal interpretations revealed that the two clusters identified in the first version would continue to exist in all other versions, with only slight variations. All additional clusters tended to be contradictory rather than creating sound understandings of sustainability and economics. Thus, based on all quantitative and text-based results, we decided to select two clusters.

3 Clusters in sustainability economics

The two clusters that we identified can be described by sets of characteristic statements related to sustainability and economics. We derived these distinct ‘opinion sets’ using those statements of the questionnaire that the representatives of a cluster either agreed or disagreed with the most, i.e. statements with a cluster score of more than +1 or less than –1. Since we found not only differing opinions but also a number of statements that both clusters share, we will present the common ground first.

Common ground of the clusters

As common ground we consider those statements with rankings being not indifferent (that is, ranked equal to/higher than +1 or equal to/lower than -1) and showing in the same ,direction' for both clusters (e.g., -1.4 for cluster 1 and - 1 for cluster 2). We find that clusters 1 and 2 agree largely in their understanding of sustainability as a multidimensional concept (ecological, social, economic) and agree about a sustainability concept based on maintaining 'development potentials' for future generations. They also do not see economic growth as being the ultimate answer to distributional conflicts within and between generations.

Broad consensus amongst sustainability researchers exists also in seeing sustainability as an important field of research in economics that needs to be approached with interdisciplinary methods. Furthermore, both clusters have a positive attitude towards applied economic research with a clear political outreach. Finally, both clusters are skeptical about the possibility to figure out what resources are indispensable for humankind for an indefinite time span.

All common ground statements with are summarized in box 1.

Box 1

Common ground of the clusters of 'ecological economics' and 'neoclassical economics'

Concept of sustainability: Sustainability means preserving development opportunities for future generations. To extend the sustainability concept to also include social and economic dimensions does not dilute the normative power of the sustainability concept.

Substitution and valuation of nature: It is not possible to determine for an unlimited time horizon which resources will be indispensable for humans.

Sustainability policy: The basic conflict between efficiency and equitable distribution can ultimately be solved not only through economic growth.

Scientific concept: Sustainability is an important field of economic research in the future. Sustainability research must overcome the disciplinary boundaries. Political debates of economic questions do not hinder theory generation.

Cluster 1 'Ecological Economics'

Corresponding with the common ground, representatives of cluster 1 strongly support an integrated concept of welfare, including not only economic but also ecological and social

aspects. Further, the economy is seen as being dependent for its existence on the ecosystem. Nature appears to be substitutable by human-made capital only to a very limited extent and its services cannot to be valued through monetarization. Creating private property rights over the environment is seen as being little suited towards achieving sustainable solutions. A concept of human behavior based on individual utility maximization appears to representatives of cluster 1 as not being suitable for studying issues of sustainability. Accordingly, they support the idea of changing individual values as part of a strategy towards sustainability. Cluster 1 consequently disagrees with the idea of a ‘value-free’ economics. Rather, ethical dimensions should be part of economic thinking about sustainability.

Based on our literature survey, the ‘opinion set’ described so far (consisting of both common ground and distinct statements for cluster 1) can be assigned to the ecological economics school of thought. With 105 persons, about half of all participants (54 percent) are characteristic for this cluster. The original statements that are particularly typical for the ‘ecological economics’ cluster are summarized in box 2.

Box 2

Distinct statements of cluster 1 ‘Ecological Economics’

Conceptions of justice and sustainability: An essential element of the sustainability concept is an integrated understanding of societal welfare (economic, ecological, social).

Substitution and valuation of nature: Natural capital can be substituted by human-made capital only in a very limited way. The economy is dependent for its existence on the interrelations in nature. The value of an intact environment cannot be expressed by approximation in monetary terms.

Conception of human behavior: Questions of sustainability cannot be answered on the basis of a self-interest-oriented image of human nature.

Sustainability policy: Changing societal value systems is an important element for a strategy of sustainability. Economic growth as a goal can be questioned. Creating private property rights over the environment cannot largely solve the problem of overusing the environment.

Conception of science: Sustainability economics must deal with the question of how to make decisions in an intergenerational context. Economic science should not be value-free.

Cluster 2 ‘Neoclassical Environmental Economics’

Persons representing cluster 2 reject seeing intra-generational justice as being a prerequisite of intergenerational justice. They also disagree with the ‘sustainability concept’ of non-declining

individual utility over time. Strong commonalities within this group are related to sustainability policy. Here, both fundamental changes of the economic system and restrictions of material consumption are rejected. Instead, representatives of this cluster support setting the ‘right’ prices for environmental goods (as a key element of sustainability policy), and they support international specialization as a means towards achieving the goal of sustainable welfare worldwide. Representatives of cluster 2 also support the idea of an objective economic science. Interestingly, we find no strong opinions, but rather indifference concerning the explicitly valuation-related statements in this cluster (related to nature, sustainability policy and the scientific conception of economics) that we found for the first cluster (see box 2).

Opinion set 2 largely corresponds with neoclassical economics as described in the literature. Yet, considering both common ground and distinct statements for cluster 2, we find four important exceptions, most of them being conceptual. The cluster rejects a sustainability concept based on non-declining utility, accepts a multidimensional sustainability concept (ecological, social, economic), and agrees with a sustainability concept based on maintaining development potentials. Treating intergenerational distribution as non-declining individual welfare over infinite periods and refusing a multidimensional concept of sustainability is often seen as being typically neoclassical (Pezzey 1992, Weimann 1999), but is not shared by our second cluster.

The cluster also rejects growth as the ultimate answer to distributive conflicts. Neoclassical growth theory is generally based on the assumption that economic growth increases social welfare and, thus, treats growth as a desirable macroeconomic goal. The underlying assumption is that if the whole economic is growing, in the end, the whole society is better off, and distributive conflicts will emerge to a much lesser extent. Thus, we could conclude that growth is a primary solution for reducing distributional conflicts. Yet, our neoclassical cluster does not share this view.

Altogether, 63 persons are characteristic for cluster 2, which equals with about one third (32 percent) of all participants. Statements that are particularly typical for cluster 2 are summarized in box 3.

Box 3

Distinct statements of cluster 2 ‘Neoclassical environmental economics’

Conceptions of justice and sustainability: Sustainability cannot be defined as non-declining benefit for a representative individual over unlimited time. Intergenerational justice does not presuppose intragenerational justice.

Sustainability policy: Sustainability does not require material consumption restrictions. Sustainability is achievable not only through fundamental changes of our economic system. The utilization of the environment can be brought to a level that is sustainable in the long run by setting the ‘right’ prices. International specialization leads to more long-lasting wealth worldwide.

Conception of science: Economic science should be objective.

Key divides between the clusters of ‘ecological economics’ and ‘neoclassical economics’

In order to identify the strongest differences, we selected those statements that received rankings going in opposite ‘directions’ (+, -) from both clusters, and of which at least one ranking is not indifferent.⁷ Further, we set a minimum ranking ‘distance’ between the clusters of 1.5 (e.g., +1 for cluster 1 and -0.6 for cluster 2).

Based on these definitions, strongly opposed opinions between the clusters appear to be those regarding intra-generational justice, which is very strongly rejected as being the precondition for intergenerational justice by the neoclassical cluster, but is supported by the ecological-economic cluster. A strong conceptual dissent also exists regarding the utilitarian conception of human behavior (*homo economicus*), which is rejected by the ecological-economics cluster and supported by the neoclassical cluster. Finally, clear differences in opinion exist with respect to many aspects of sustainability policy. Here, the neoclassical cluster strongly denies that fundamental changes of our economic system and material consumption restrictions are necessary for achieving sustainable development. On the contrary, the ecological-economics cluster favors exactly these approaches. Furthermore, the neoclassical cluster supports international specialization as a way towards more, durable welfare worldwide – an assumption questioned by the ecological-economic cluster. There is also a clear difference between the clusters regarding their conceptions of science. While the neoclassical cluster strongly demands an objective science, the position of the ecological-economics cluster about is inclined

⁷ We define ‘not indifferent’ as rankings equal to/ higher than +1 or equal to/lower than -1.

towards a subjectivist methodology of science. The statements with the strongest differences in opinion are summarized in box 4.

Box 4

Key divides between the clusters of ‘ecological economics’ and ‘neoclassical economics’

Conceptions of justice and sustainability: Intergenerational justice presupposes intragenerational justice.

Conception of human behavior: Questions of sustainability can be answered on the basis of a self-interest-oriented image of human nature.

Sustainability policy: Sustainability requires material consumption restrictions. Sustainability is achievable only through fundamental changes of our economic system. International specialization leads to more long-lasting wealth worldwide.

Scientific conception: Economic science should be objective.

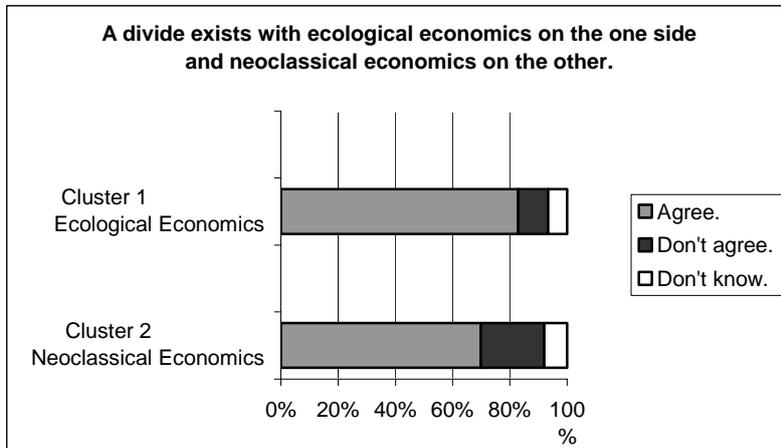
Besides the typical representatives of clusters 1 and 2, there remains a relatively small group of 28 people (14 percent of the participants) whose opinion sets cannot be clearly assigned to any cluster. They do not share common views on sustainability and economics and will hence not be analyzed further in this paper.

4 Opinions about the scientific divide and perspectives of sustainability research

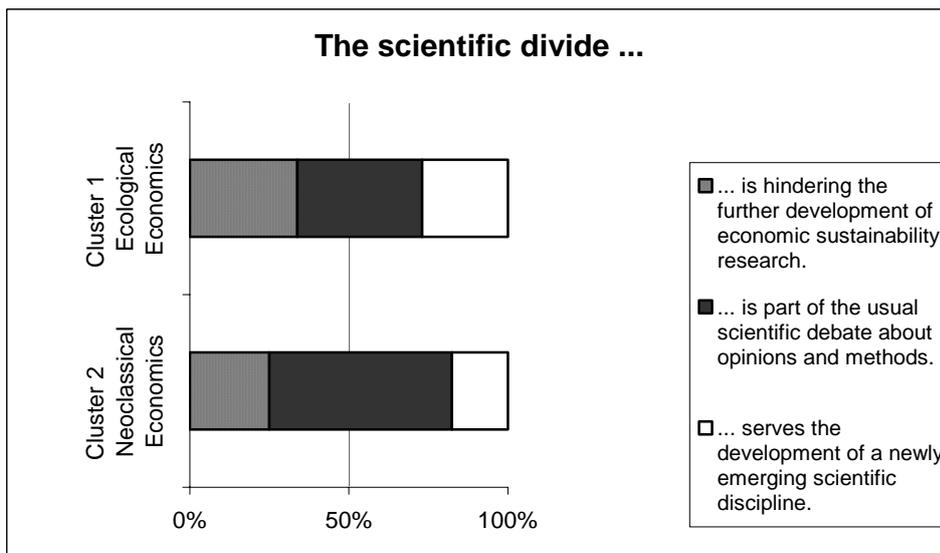
The study participants were also asked about their perceptions of and opinions on the scientific divide as well as perspectives of sustainability research. A clear majority of representatives of both clusters acknowledge the existence of a scientific divide in economic sustainability research. Yet, the majority is somewhat larger for the ‘ecological economics’ cluster, with 83 percent, than for the ‘neoclassical economics’ cluster, with 70 percent. There are also differences between the clusters related to the perceived effects of the scientific divide. Overall, the ‘neoclassical economics’ cluster sees the scientific divide rather as a normal phenomenon, putting less emphasis on its positive and negative consequences than the ‘ecological economics’ cluster does (see figure 1).

Figure 4–1
Perceived existence and effects of a divide in economic sustainability research

a)

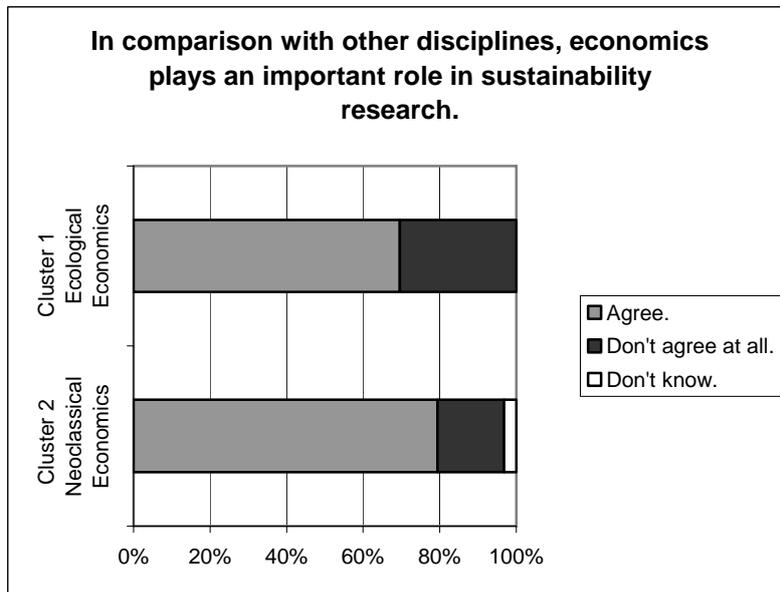


b)



Whereas both scientific clusters largely agree that *sustainability* is an important field of future economic research, still about 70 percent of those representing the ‘ecological economics’ cluster and about 80 percent representing the ‘neoclassical economics’ cluster share the opinion that *economics* has an important role in sustainability research (see figure 2).

Figure 4–2
Perceived importance of economics in sustainability research

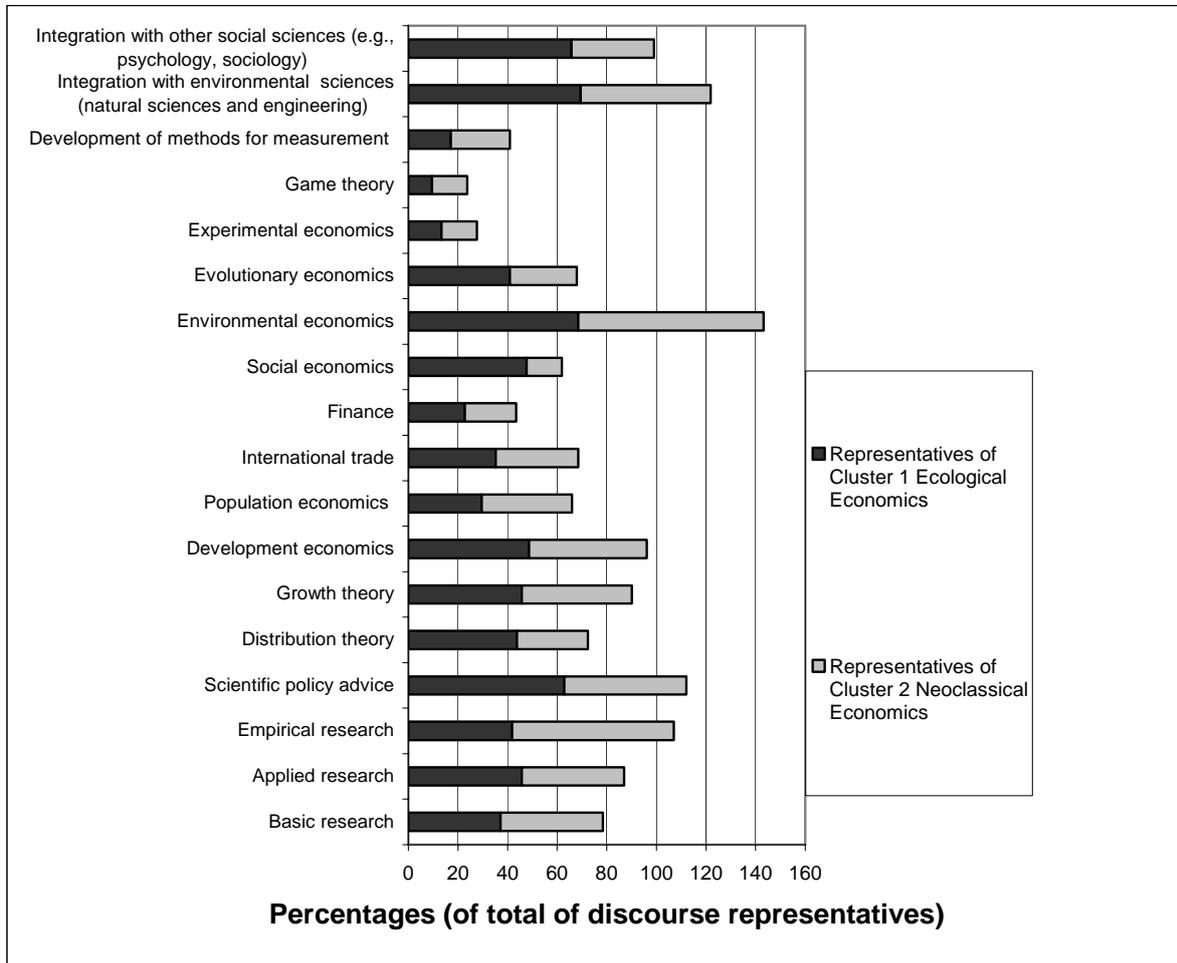


Asked about future fields⁸ of sustainability economics out of a predefined set of alternatives, representatives of both clusters considered environmental economics, development economics, growth theory, and integration with environmental sciences (natural sciences and engineering) to be most important. They also emphasize the need for empirical and applied sustainability research that is oriented towards policy advice. In addition, representatives of the ‘ecological economics’ cluster see social economics, distribution theory, evolutionary economics, and integration with other social sciences (e.g., psychology, sociology) as being important as well, while representatives of the ‘neoclassical economics’ cluster emphasize basic theoretical research (see figure 3).

⁸ We use *future fields* as a general term for topics, sub- or mixed disciplines, methods, and further aspects of sustainability research, which should be emphasized more strongly in future economic sustainability research.

Figure 4–3

Future fields of sustainability research in economics, based on a given selection (multiple choices possible)



Since the results presented above are based on a given selection of future fields, the participants had the opportunity to add an unlimited number of further future fields. In an open question, representatives of both clusters were in agreement in mentioning institutional and innovation economics, ecological economics, political economy, public choice theory, and economic ethics. Representatives of the ‘ecological economics’ cluster, making up the majority of those answering this open question, added further disciplines, methods and topics. Categorizing these very diverse future fields reveals the following overriding issues:

- Methodological and analytical approaches for operationalizing sustainability;
- Global and regional economic perspectives;
- Theories of collective learning, cooperation and, networking;

- Gender studies, social and labor economic aspects;
- Integration with (political) philosophy, philosophy of science, cultural sciences, communication science, critical theory, social psychology;
- Theory of complex systems, plural economics, economic variety; and
- Approaches for sustainability activities on the business level.

5 Summary and conclusions

Our study shows that there is a clear divide within German sustainability research, largely along the lines that are described in the literature. We do not find any additional clusters either within or across the established schools of thought. Thus, we have shown that there is in fact a foundation in the perceptions of researchers for the paradigmatic and institutional divide of ecological economics and neoclassical environmental economics. However, the study participants perceive the scientific divide in different ways: Neoclassical environmental economists see the divide primarily as a normal phenomenon of scientific cluster; ecological economists tend to focus on its negative, but also its positive, effects.

Both the neoclassical and ecological-economic cluster shows a relative maturity of paradigm evolution: There is a broad spectrum of common opinions *within* them about their concepts of sustainability and justice, their sustainability policy recommendations, and their conceptions of science. Whereas this result may be expected for neoclassical economics (a school of thought with a history of about almost a century, taking Alfred Marshall's "Principles of Economics" as a starting point), it is a remarkable sign of maturation of a school of thought that started out only in the 1970s as a merger movement of those concerned about environmental degradation.

Ecological economists in our sample group themselves around the principle of strong sustainability. They share the opinion that natural capital can ultimately not be substituted by human-made capital, but that it is essential for the long-term existence of the economy. The ecological-economics cluster rejects mainstream policy solutions such as the goal of growth and the policy instrument of property rights over the environment. Instead, it appears to be strongly (almost exclusively) oriented towards value-related issues (bio-physical approaches to valuation of nature, changing societal values as political strategy, rejection of the self-interested

image of human behavior, rejection of value-free economics) and intergenerational justice. The fact that our neoclassical cluster is indifferent about these explicitly value-related issues indicates to us that both schools of thought seem to continue to go in different directions with respect to the inclusion of values. It seems to also signify a gap in the mainstream that ecological economists can (continue to) fill with much success.

In our sample, neoclassical economics appears to be ‘open-minded’. Unlike some participants of the international workshop described in the introduction, it generally disagrees with the idea that growth is the primary answer to the challenges of sustainability, which was still an accepted view by a large number of environmental economists in the 1970s. Also, treating intergenerational problems as non-declining utility of a representative individual is rejected in favor of a rather more evolutionary concept (‘preserving future development potentials’). Both views are shared with the ecological-economics cluster - a surprising finding to us.

Besides the orientation at development potentials, there is an unexpectedly broad conceptual basis shared by both schools of thought with respect to including economic, social and ecological dimensions. Yet, how these dimensions are to be valued against each other (especially weighting the ecological dimension) remains an issue of dispute. Some common ground exists also with respect to what is empirically un-doable in sustainability research, namely the identification of indispensable resources. However, this commonality does not necessarily mean that the clusters also draw the same conclusion from it. Rather, it is most likely that the ecological-economic cluster tends to conclude that, because of this uncertainty, a large variety of natural resources should be preserved (precautionary principle). Yet, the statement also implies that the – typically ecological-economic – normative setting that all people must be allowed to satisfy their basic needs (Ekins and Max-Neef 1992) does not lead to a certain set of indispensable resources that must be protected in the long run. In opposition to the ecological-economic view, the neoclassical-economic cluster may tend to conclude that resource use today does not have to be limited because once the resources are scarce this will lead to technological innovations finding other ways of satisfying human needs (technological optimism).

Further common ground and, thus, possible ‘bridges’ between the clusters are that they both consider economic sustainability research to be important, stressing the need for interdisciplinary, empirical and applied research that is oriented towards policy advice. The representatives also largely agree about promising fields for joint future research by emphasizing environmental economics, development economics, growth theory, and the integration with envi-

ronmental sciences (natural sciences and engineering). Yet, the research agenda of the ecological economics cluster contains a large number of additional topics related to social, distributional and evolutionary aspects of sustainable development, a strong microeconomic focus, but also to spatial aspects, systemic approaches and methods for operationalizing sustainability. It also suggests being more open towards the social sciences.

Yet, despite all these commonalities, strong dividing lines between the groups remain. The consideration of intergenerational questions does not imply for our neoclassical economics group the inclusion of intragenerational questions of distribution in economic analysis; and to be open to a sustainability concept of preserving development potentials for future generations does not mean a general orientation away from methodological individualism. Critique of the 'system' by our 'neoclassical economics' cluster is relatively modest compared to that of the 'ecological economics' cluster. Fundamental changes of the economic system, material restrictions of consumption, and a general move away from the international division of labor are not acceptable for the neoclassical group. Thus, for future developments of economic sustainability research, we can expect a lasting controversy between ecological and neoclassical economists about the question of how to achieve sustainable development. Another dividing line that seems to be hard to overcome is the difference in conceptions of science: Economics has to be objective and (possibly) value-free in the opinion of our neoclassical economist sample, whereas our ecological economists share the conception of postmodern science. All of these issues seem to be potential obstacles for establishing dialogue aimed at harmonization between the groups. Yet, the topics may at the same time provide ground for a kind of 'scientific competition' concerned with finding explanations and solutions to societal problems of sustainable development.

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Annex

List of all statements used in the questionnaire

- (1) Sustainability is an important future field of economic research.
- (2) In relation to other disciplines, economics occupies an important role in sustainability research.
- (3) There is a scientific divide, with ecological economics on one side and neoclassical economics on the other.
- (4) Sustainability can be defined as non-declining benefit for a representative individual over unlimited time.
- (5) Sustainability means preserving development opportunities for future generations.
- (6) The stock and structure of non-substitutable natural capital has to be maintained for coming generations.
- (7) Natural capital can be substituted by human-made capital only in a very limited way.
- (8) The acceptability of accident-related risks should be gauged with regard to the maximum possible damages that they may incur on humans and nature.
- (9) Changing societal value systems is an important element for a strategy of sustainability.
- (10) Sustainability requires material consumption restrictions.
- (11) Intergenerational justice presupposes intragenerational justice.
- (12) Sustainability economics must deal with the question of how to make decisions in an intergenerational context.
- (13) Economists can carry out valuation of intergenerational and intragenerational distribution.
- (14) Efficiency and distribution in a macroeconomic context should be analyzed separately.
- (15) The basic conflict between efficiency and equitable distribution can ultimately be solved only through economic growth.
- (16) Extending the sustainability concept to also include social and economic dimensions does not dilute the concept's normative power.
- (17) It is a realistic scenario that humankind is going to destroy its own basis for existence.
- (18) A core problem of sustainability is population growth.
- (19) The economy is dependent for its existence on the interrelations in nature.
- (20) The maintenance of nature has a value in itself, independently of its value for humans.
- (21) Efficiency leads to more sustainability.
- (22) Technical innovations are the decisive condition for sustainable development.

- (23) Sustainability is achievable only through fundamental changes of our economic system.
- (24) Economic growth as a goal cannot be questioned, only how it happens.
- (25) To reduce governmental debt is an important goal for economic sustainability.
- (26) International specialization leads to more long-lasting wealth worldwide.
- (27) The utilization of the environment can be brought to a level that is sustainable in the long run by setting the 'right' prices.
- (28) Creating private property rights over the environment can largely solve the problem of overusing the environment.
- (29) Sustainability is a problem of long-term planning (e.g., resource utilization).
- (30) Uncertainties about the long-term effects of economic activities can be incorporated into economic analyses in the form of probability estimations.
- (31) It is possible to determine for an unlimited time-horizon which resources will be indispensable for humans.
- (32) The value of an intact environment can be expressed by approximation in monetary terms.
- (33) Needs of individuals have to be taken as given in economic analyses.
- (34) Questions of sustainability can be answered on the basis of a self-interest-oriented image of human nature.
- (35) Political debates on economic questions hinder theory generation.
- (36) Economic science should be value-free.
- (37) Economic science should be objective.
- (38) An essential element of the sustainability concept is an integrated understanding of societal welfare (economic, ecological, social).
- (39) Sustainability research must overcome disciplinary boundaries.
- (40) Economic models should offer theoretically consistent, partial views that have to be brought together with other scientific findings.