



Socio-economic aspects in the
assessment of GMOs

Options for action



SOCIO-ECONOMIC ASPECTS IN THE ASSESSMENT OF GMOS – OPTIONS FOR ACTION

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SUMMARY

At international level, as well as the level of the European Union, socio-economic aspects of genetically modified organisms are discussed more and more. Although the consideration of these aspects is possible according to European legislation and socio-economic aspects can be taken into account by the European Commission as “other legitimate factors” (Reg. (EC) No. 1829/2003), a clear definition of socio-economic aspects is not available, nor is there any guidance on respective criteria. No Member State has referred to these factors in the course of the authorisation procedure so far. A proposal of the European Commission currently under discussion, regarding the freedom of Member States to decide on the cultivation of GMOs on their territory, is also referring to socio-economic aspects. This report gives an overview of the legal documents where socio-economic aspects of GMO cultivation are reflected and discusses recent political developments.

This report also provides an overview of the scientific background for socio-economic assessment, as well as experiences with such assessments and important scientific issues which have been identified. It shows that there are different approaches and opinions regarding the scope of a socio-economic assessment (e. g. regarding consideration of ethical issues or impacts on third countries). In addition, although data are a crucial basis for an assessment, data availability is scarce, as shown by the experiences of Norway, where a socio-economic assessment of GMOs is already required. Studies are mainly available for economic and less for social issues. Most of these studies deal with effects on the micro-economic level and as the results cannot be transferred there is a lack of data on the macro-economic scale. Other open questions are the definition of a baseline for such an assessment, the quality and quantity of the data needed and the selection of methods to be applied.

These issues were also identified in the report of the European Commission on the socio-economic implications of GMOs published in June 2011. This report was analysed from an Austrian perspective by focusing on the views of Member States on aspects of coexistence, cost development, possible conflicts and sustainable agriculture. As a result of the report, the European Commission concluded that the topic of socio-economic aspects with regard to GMO cultivation needs further attention. In order to discuss the open questions identified in the report a process will be launched starting with a workshop in autumn 2011. This initiative is very important in order to discuss some basic issues like e. g. the scope of socio-economics and the role of ethical issues on a European level. Work on criteria and indicators is important as a precondition to substantiate socio-economic data and thus provide a basis for a meaningful assessment in the future.

The catalogue of socio-economic criteria presented in the report at hand will provide an input to these discussions. It is focusing mainly on aspects which are of major relevance for Austria, as well as on the risks and potential negative effects of GMO cultivation. The catalogue of criteria is based on the three pillars of sustainability, thus providing economic, social and ecological aspects. For each aspect criteria and respective key issues have been defined and described accordingly. In the light of ongoing discussions, ethical issues and issues important for third countries are also reflected.

The catalogue comprises the following criteria of relevance for Austria:

- Economic criteria
 - profit
 - prosperity
 - preservation of the environmental basis
 - costs during the whole production chain
 - indirect costs
 - tourists` expectations
 - possibility to implement regional policy

- social criteria
 - quality of life
 - food availability
 - labelling regime
 - accessibility of alternatives and dependency
 - freedom of research
 - preservation of cultural heritage
 - social changes

- ecological criteria
 - preservation of resources
 - preservation of environmental quality
 - preservation of biodiversity in cultivated areas
 - preservation of biodiversity in uncultivated areas

The information presented here provides a basis for an input to ongoing discussions in the European Union regarding the possible implementation of socio-economic aspects in the GMO authorisation procedure.

ZUSAMMENFASSUNG

Sowohl auf internationaler als auch auf Ebene der Europäischen Union nimmt die Diskussion sozioökonomischer Effekte von gentechnisch veränderten Organismen zu. Obwohl die Berücksichtigung dieser Aspekte im Zulassungsprozess nach europäischem Recht als „andere legitime Faktoren“ nach der Verordnung (EG) Nr. 1829/2003 möglich ist, gibt es derzeit weder eine klare Definition von sozioökonomischen Aspekten noch Leitlinien für entsprechende Kriterien. Bisher wurden diese Faktoren im Zuge des Zulassungsverfahrens aber von keinem Mitgliedsstaat verwendet. Ein Verordnungsvorschlag der Europäischen Kommission zur Freiheit der Mitgliedsstaaten GVO-Anbau auf ihrem Territorium zu beschränken oder zu verbieten bezieht sich auch auf sozioökonomische Aspekte. Der vorliegende Bericht gibt einen Überblick über jene Rechtsdokumente die auch sozioökonomische Auswirkungen eines GVO-Anbaus beinhalten und diskutiert die jüngsten politischen Entwicklungen.

Der vorliegende Bericht gibt auch einen Überblick über den wissenschaftlichen Hintergrund einer sozioökonomischen Bewertung, die bisherigen Erfahrungen mit solchen Bewertungen und über relevante wissenschaftliche Bereiche. Verschiedene Ansätze und Meinungen bezüglich der Abgrenzung einer sozioökonomischen Bewertung, z. B. in Bezug auf die Berücksichtigung von ethischen Aspekten und Auswirkungen auf Drittländer, werden aufgezeigt. Die Wichtigkeit der Datenverfügbarkeit, die in den meisten Fällen aber nicht gegeben ist, wird am Beispiel der Erfahrungen in Norwegen gezeigt, wo eine sozioökonomische Bewertung von GVOs bereits verlangt wird. Die meisten Studien behandeln ökonomische Themen, wobei soziale Aspekte oft nicht berücksichtigt werden. Außerdem beschränkten sich viele dieser Studien auf mikroökonomische Effekte und da die Ergebnisse nicht auf die makroökonomische Ebene übertragbar sind, ergibt sich hier eine Datenlücke. Andere offene Fragen, die identifiziert wurden, sind die Definitionen der Vergleichsdaten für die Bewertung, die Qualität und Quantität der benötigten Daten sowie die Auswahl der zu verwendenden Methoden.

Diese offenen Fragen wurden auch in dem Bericht der Europäischen Kommission zu sozioökonomischen Auswirkungen von GVOs identifiziert, der im Juni 2011 veröffentlicht wurde. Dieser Bericht wurde aus österreichischer Sicht analysiert, wobei der Fokus auf die Ansichten der Mitgliedsstaaten zu Koexistenz, Kostenentwicklung, mögliche Konflikte und nachhaltige Landwirtschaft gelegt wurde. Die Europäische Kommission kommt in ihrem Bericht zu dem Schluss, dass dem Thema der sozioökonomischen Aspekte eines GVO Anbaus weiter Aufmerksamkeit geschenkt werden sollte. Um identifizierte offene Fragen weiter zu diskutieren, wurde deshalb ein Prozess gestartet, der mit einem Workshop im Herbst 2011 beginnen wird. Diese Initiative ist sehr wichtig, da sie die Möglichkeit bietet grundlegende Fragen auf europäischer Ebene zu diskutieren, wie z. B. die Abgrenzung von sozioökonomischen Themen und die Rolle von ethischen Fragestellungen. Auch die Arbeit an Kriterien und Indikatoren ist wichtig als Voraussetzung für eine Verbesserung der Datengrundlage und für eine aussagekräftige Abschätzung möglicher Auswirkungen.

Der Katalog sozioökonomischer Kriterien, der in diesem Bericht präsentiert wird, stellt einen Beitrag zu diesen Diskussionen dar und behandelt hauptsächlich jene Aspekten, die für Österreich besonders wichtig sind, sowie die Risiken

und die potentiell negativen Effekte eines GVO-Anbaus. Der Kriterienkatalog basiert auf den drei Säulen der Nachhaltigkeit und beinhaltet so wirtschaftliche, soziale und ökologische Aspekte. Für jeden Aspekt wurden Kriterien und entsprechende Schlüsselthemen definiert und beschrieben. Im Lichte der laufenden Diskussionen wurden auch ethische Aspekte und Themen, die für Drittländer von Bedeutung sind, behandelt.

Der österreich-spezifische Katalog umfasst die folgenden Kriterien:

- Wirtschaftliche Kriterien:
 - Gewinn,
 - Wohlstand,
 - Erhaltung der Umwelt,
 - Kosten während der gesamten Produktionskette,
 - Indirekte Kosten,
 - Touristische Erwartungshaltung,
 - Möglichkeit zur Implementierung von regionaler politischer Linien;

- Soziale Kriterien:
 - Lebensqualität,
 - Nahrungsmittelverfügbarkeit,
 - Kennzeichnungsregelung,
 - Zugang zu Alternativen und Abhängigkeit,
 - Forschungsfreiheit,
 - Erhalt des kulturellen Erbes,
 - Soziale Veränderungen;

- Ökologische Kriterien:
 - Ressourcenerhaltung,
 - Erhalt der Umweltqualität,
 - Erhalt der Biodiversität in kultivierten Bereichen,
 - Erhalt der Biodiversität in nicht-kultivierten Bereichen.

Die präsentierten Ergebnisse bieten eine Basis für Beiträge zu den laufenden Diskussionen in der Europäischen Union bezüglich der möglichen Implementierung von sozioökonomischen Aspekten in der GVO Zulassung.

1 INTRODUCTION

Socio-economic aspects of genetically modified organisms (GMO) are getting increased attention in discussions at the European level (COUNCIL OF THE EUROPEAN UNION 2008). According to articles 7(1) and 19(1) of Regulation (EC) No. 1829/2003 these aspects can be taken into account as “other legitimate factors” in the decision-making process on applications for deliberate release or placing on the market of GMOs (REG. (EC) No. 1829/2003). However, so far there has been no clear definition of socio-economic aspects. No criteria for a socio-economic assessment have been defined either and the availability of a sufficient data basis for the development of assessment indicators remains unclear. The heterogeneity of socio-economic and environmental conditions in European Member States poses a challenge for the development of such criteria and indicators.

Besides the regulatory option laid down in Regulation (EC) No. 1829/2003 to take socio-economic considerations into account, discussions are underway regarding a proposal put forward by the European Commission for a Regulation amending Directive 2001/18/EC to give Member States the freedom to decide on the cultivation of GMOs on their territory (EUROPEAN COMMISSION 2010). In the course of these discussions, the European Commission put forward a working document in February 2011, including an indicative list of possible grounds on which such restrictions and prohibitions might be based (EUROPEAN COMMISSION 2011a). Some of these grounds are associated with socio-economic considerations. However, there is still no agreement between Member States on the adoption of the proposal despite positive comments from the legal services of both the European Commission and the Council. The Environment Committee of the European Parliament also dealt with the proposal of the European Commission and after several rounds of negotiations proposed a number of amendments to the text. A resolution on the European Commission’s proposal was adopted with 28 amendments at the first reading in July 2011 (EUROPEAN PARLIAMENT 2011). These amendments of the European Parliament will now be discussed at the Council level.

At the international level socio-economic aspects in relation to GMO cultivation also receive growing attention. According to Article 26 of the Cartagena Protocol on Biosafety, socio-economic considerations arising from the impact of living modified organisms may be taken into account in the decision-making procedure (SECRETARIAT OF THE CONVENTION ON BIOLOGICAL DIVERSITY 2000). Currently this issue is being discussed in different fora and working groups.

Against this background, the aim of this study is the identification of socio-economic aspects particularly relevant for Austria. The objective is the development of a list of concrete criteria to capture economic and social consequences of the use of GMOs as well as related ecological consequences. This report may thus help to meet possible future demands when addressing socio-economic impacts in authorisation procedures.

This specific analysis for Austria is based on a literature review taking especially into account a study of the Commission on Genetic Modification prepared on behalf of the Dutch Ministry of Environment (COGEM 2009) and the experiences of Norway, where the assessment of socio-economic consequences of GMOs has been mandatory since 1993 (GOVERNMENT OF NORWAY 1993, GOVERNMENT

OF NORWAY 2005). In addition, the recently published report of the European Commission on the socio-economic implications of GMO cultivation (EUROPEAN COMMISSION 2011b) has been analysed.

The approach to developing the list of criteria mentioned above is based on a broad understanding of socio-economic aspects and primarily guided by a view on agriculture in the broader sense. In doing so, aspects relating to public morals and public order have been excluded. However, a separate chapter of this report is dedicated to the discussion of ethical aspects and concerning GMOs and GMO products imported from third countries.

Moreover, the assumption was made that it is very unlikely that the EU regulatory framework for GMOs will be changed fundamentally in the near future to establish a socio-economic impact assessment framework (SOEIA). This was for instance conceptualised by Spök et al. in 2010 who envisaged robust scientific advice, mainly from social sciences, to be implemented in parallel to the currently established risk assessment (SPÖK 2010). Taking into account the general political focus and the public opinion on GMOs in Austria, this report focuses on possible negative socio-economic effects which may arise from the use of GMOs and does not discuss potential benefits.

With this approach the Austrian position towards GMOs should be supported, in particular concerning the ongoing discussion process at the European level regarding the potential freedom for Member States to decide on the cultivation of GMOs on their own territory. Moreover, it may also be of use in the authorisation procedure where “other legitimate factors” may be put forward.

2 BACKGROUND

The concept of a socio-economic assessment regarding the use of GMOs is quite new and poses challenges to scientists as well as authorities. However, socio-economic aspects are reflected in a number of legal documents and the development of an assessment of these aspects for GMOs is discussed in the EU, based on existing legislation and recent political developments. In addition, scientific issues are more and more debated. An overview about such scientific aspects as well as the legal basis and related developments is provided in the following.

2.1 Legal and political background

2.1.1 Potential options for socio-economic considerations in the current legal framework

The authorisation of GMOs in the EU is regulated by Directive 2001/18/EC and Regulation (EC) No. 1829/2003 (DIR 2001/18/EC, REG. (EC) No. 1829/2003). In the following, potential links to socio-economic aspects are discussed separately for both pieces of legislation.

2.1.1.1 Directive 2001/18/EC

Preamble 62 of the Directive reads as follows:

“A report to be issued every three years by the Commission, taking into account the information provided by Member States, should contain a separate chapter regarding the socioeconomic advantages and disadvantages of each category of GMOs authorised for placing on the market, which will take due account of the interest of farmers and consumers.”

Similarly, the Directive required the European Commission to submit an assessment of the socio-economic implications of deliberate releases and placing on the market of GMOs (Article 31, 7d) together with a first report on the implementation of the Directive in 2003. After the report had been postponed (due to the lack of experience) it was finally published in 2011 and is analysed in chapter 4 of this study.

Besides this requirement for general observation and reporting, Directive 2001/18/EC does not contain any provisions relating to the socio-economic implications of GMOs. The preamble refers to the “category of GMOs” without a further definition and thus clearly does not require case-specific assessment of socio-economic impacts.

2.1.1.2 Regulation (EC) 1829/2003

Preamble 32 of the Regulation reads as follows:

“It is recognised that, in some cases, scientific risk assessment alone cannot provide all the information on which a risk management decision should be based, and that other legitimate factors relevant to the matter under consideration may be taken into account.”

Furthermore, as referred to in paragraph 1, Art. 7 and 19 defining the authorisation procedure for GM food and GM feed determine that the Commission shall submit a draft decision “...taking into account the opinion of the Authority (i.e. EFSA), any relevant provisions of Community law and other legitimate factors relevant to the matter under consideration.”

There has been no concrete definition so far for the term “other legitimate factors” and it therefore remains unclear which aspects could or should be dealt with in this framework. However, it is clear that any consideration referring to this term must be different from those covered in the risk assessment according to Directive 2001/18/EC and Regulation (EC) No. 1829/2003. In accordance with the precautionary principle the objective of this legal framework is to protect human health and the environment when carrying out deliberate releases of GMOs or placing GMOs on the market. Any risk consideration which does not directly refer to human health or environmental aspects could theoretically be related to the term “other legitimate factors” and could thus, theoretically, be taken into account by the European Commission in the decision-making process. So far this possibility has never been made use of by the European Commission, but the issue of appraising socio-economic risk and benefits has been addressed by the European Council in its Conclusions in 2008 (COUNCIL OF THE EUROPEAN UNION 2008). The Council refers to Regulation (EC) No. 1829/2003 and requests the Member States to discuss which aspects could be considered under “other legitimate factors” and, possibly, to put them forward in the course of an authorisation process for a specific GMO.

However, the legislative framework does not set any conditions, i. e. for instance specific methodology, or information or data requirements, as a prerequisite for such risk consideration. In addition, it does not provide for an EU-wide scientific, socio-economic assessment parallel to (or following) an environmental risk assessment (ERA) as e. g. required for the authorisation system for chemicals in the EU (REG. (EC) NO. 1907/2006) or as conceptualised by Spök for SOEIA (SPÖK 2010).

Following the discussion leading up to the Council Conclusions in 2008 and the legal requirements of Regulation (EC) No. 1829/2003 it can be summarised:

- Other legitimate factors would have to be put forward by Member States on a case by case basis in the course of an authorisation procedure. At the moment this would also constitute a precedent as so far no Member State has referred to “other legitimate factors” in the course of an authorisation procedure.
- In such a case, an evaluation of the evidence and arguments brought forward by the Member States, as well as possibly laying down regional restrictions on the use of GMOs in a respective decision would be at the discretion of the Commission.
- The arguments used for the justification of demands for restrictions and the evidence provided must not be supported by aspects relevant for risk assessment.

2.1.1.3 Cartagena Protocol

According to the Cartagena Protocol on Biosafety (CPB), each signatory may take socio-economic considerations into account in decisions regarding the authorisation of a GMO (Article 26). As the European Union and all its Member States are Parties to this international treaty (REG. (EC) No. 1946/2003), the approach to addressing socio-economic issues in the course of the GMO decision-making process is also relevant for the EU in an international context. At international level this issue is discussed with much emphasis, and at the COP/MOP 5 in October 2010 held in Nagoya, Japan, the Parties decided to cooperate on *“identification of capacity-building needs for research and information exchange on socio-economic considerations”* (SECRETARIAT OF THE CONVENTION ON BIOLOGICAL DIVERSITY 2011), resulting in ongoing activities aiming at the global exchange of information and experiences on socio-economic considerations, e. g. online discussion fora, online conferences and workshops.

2.1.2 Potential changes to the legal framework regarding socio-economic considerations

In July 2010 the European Commission tabled a proposal for a regulation which should allow Member States to restrict or prohibit GMO cultivation on their territory, but requiring justification which needs to be in line with the relevant Treaties and international agreements (EUROPEAN COMMISSION 2010).

Pursuant to this proposal, Member States may impose restrictions or bans on the cultivation of all GMOs authorised according to Directive 2001/18/EC or Regulation (EC) No. 1829/2003, but should not restrict the free circulation and import of GM seeds. With respect to possible justifications, the original proposal explicitly states that these would need to be based on grounds other than those related to the assessment of adverse effects on human health and the environment (Article 26 b (a)). This means that any justification associated with human health and the environment, including arguments which are based on specific environmental conditions (e. g. protected areas or endangered species), would not be accepted.

According to the Opinion of the Council's Legal Service on the Commission proposal regarding the freedom of Member States to decide on GMO cultivation on their territory (EUROPEAN COUNCIL 2010), any measures taken by Member States on the basis of this proposal, especially if a ban on cultivation in the whole territory were to be imposed, might be interpreted as a restriction of trade and thus be in conflict with WTO rules. This is a matter which is heavily discussed among Member States and European institutions.

In order to identify possible justifications that could be used by Member States and which are in line with the Treaties and the WTO the European Commission tabled a Staff Working Document with an indicative list of grounds on which Member States may restrict or prohibit cultivation of GMOs (EUROPEAN COMMISSION 2011a):

- Public morals
- Public order
- Avoiding GM presence in other products
- Social policy objectives
- Town and country planning/land use
- Cultural policy and
- General environmental policy objectives, other than the assessment of adverse effects of GMOs on the environment

In this document the prior exclusion of any justification linked to environmental concerns is weakened, but all aspects which are dealt with in the risk assessment are still excluded. The list also defines other issues which might be used and thus gives some indication of the definition of “other legitimate factors” as referred to in Regulation (EC) No. 1829/2003, and of socio-economic aspects which can be taken into account in the authorisation procedure for GMOs.

2.2 Scientific background

There is no clear definition as to which aspects can clearly be defined as falling within the scope of socio-economics. Basically every possible effect that does not clearly constitute a direct environmental or health effect (covered by current EU legislation and the risk assessment required therein) could be considered a socio-economic issue (e. g. any direct or indirect effect linked to GMOs finally becoming manifest in society). Consequently, the meaning and use of the term varies in the literature. Often the focus is on economic and/or social factors, but sometimes ethical issues are also included (GOVERNMENT OF NORWAY 1993). The concept of sustainability can be used as a suitable background since it comprises economic and social questions as well as environmental aspects (especially regarding large scale effects and time periods of several generations). In addition, sustainability comprises ethical questions such as for instance the responsibility for future generations.

Since the scope for socio-economic assessment seems to be extremely broad, the question of the boundaries of a socio-economic assessment is highly pertinent. Open questions are e. g. how to define a society that may be influenced (region, country, EU), whether or not socio-economic impacts which affect third countries should be taken into account or if an analysis should be restricted to the EU, or whether ethical issues should be considered and how ethical and cultural values can be defined and quantified.

As in environmental risk assessment, baselines also need to be defined for socio-economic assessment. It needs to be discussed which socio-economic impacts are considered acceptable, desirable or avoidable.

2.2.1 Experiences with socio-economic assessments

Although socio-economic considerations are included in the biosafety frameworks of a number of countries worldwide, regulatory experience seems to be limited (FALCK-ZEPEDA 2009, SPÖK 2010). In Europe, only Norway requires the assessment of socio-economic impacts in the course of GMO market approvals. However, authorities have difficulties with the assessment of societal utility and the contribution of the respective GMO to sustainable development as required under the Norwegian Gene Technology Act, as applications for approval contain hardly any relevant information (DIREKTORATET FOR NATURFORVALTNING 2009).

Whereas experiences regarding the assessment of the socio-economic impacts of GMOs are limited, dealing with socio-economic issues has a longer tradition in other fields, e. g. chemicals, where such an analysis is conducted according to European legislation (REG. (EC) No. 1907/2006).

Two examples of socio-economic assessment depending on the goal pursued are: assessments which are guided primarily by economic considerations such as for instance classic risk/benefit assessments. The socio-economic analysis (SEA) carried out in parallel to the risk assessment of chemicals under REACH (REG. (EC) NO. 1907/2006) is such an example. On the other hand, there are assessments which focus on the societal impacts of certain development schemes and projects. Social impact assessment (SIA) which is often carried out as part of an impact assessment or in addition to an environmental impact assessment (EIA) goes beyond predicting social impacts, in that it strives for their analysis, monitoring and management (VANCLAY 2003). Consequently, an assessment of other alternatives/options, as well as participatory processes and stakeholder involvement all play a major role in this context.

2.2.2 Important issues for a socio-economic assessment

The evaluation of the socio-economic impacts of GMOs, when compared to environmental risk assessment (ERA), poses new challenges to people performing risk assessments and decision-makers. Important basic differences and overlaps between ERA and socio-economic assessments were analysed by SPÖK (2010).

As currently no systematic socioeconomic assessment of GMOs takes place in the EU, related discussions focus very much on the availability of data and are based on the results of a limited number of scientific studies. However, in order to know which data are needed, some decisions need to be made regarding a few basic issues like the scope of the assessment, the spatial and temporal scale of the assessment, or appropriate criteria and indicators. Before discussing the status of the data which might be of relevance for a socio-economic assessment, some general issues which need to be considered are presented below.

While in an ERA conducted for the authorisation of GMOs every single event is considered a case and subject to separate assessment, socio-economic effects may rather depend on a specific GM crop species (e. g. soya bean) than on a specific event (e. g. MON89788). For instance, for an organic farmer there is no difference whether his products are contaminated with Bt or HR maize. Other socio-economic effects are very much linked to a certain type of GMO applica-

tion. For South America e. g. it has been shown that the excessive cultivation of HR soya bean, accompanied by an increased use of herbicides, has far-reaching socio-economic consequences (e. g. decrease of domestic food security, displacement of farming populations (ANTONIOU et al. 2010)). In addition, the outcome of an assessment may differ, depending on the level at which socio-economic effects are studied - either at the microeconomic (e. g. farm level) or at the macroeconomic level (e. g. national level). Therefore, socio-economic impacts and the generation of respective data on a specific crop or trait (e. g. herbicide tolerance) or a combination of these may be important.

The level at which socio-economic effects are studied is of utmost importance for the collection and evaluation of socio-economic data in general, and for the identification of adequate indicators in particular. Today most studies in developing countries are conducted at the farm or the household level, i. e. the basis to which all collected data refer to. However, economic analysis can and should also be conducted for whole economic sectors, e. g. the seed sector, food trade sector, the food processing industry, commodity trade, or it should be conducted at the level of political units (e. g. communities, regions, countries or federations). In addition, economic models may differ in their underlying assumptions of market situations, e. g. by including or excluding trade.

When assessing socio-economic impacts on a certain level, the given environmental, economic and socio-cultural conditions in a country or region need to be considered (similar to an ERA of GMOs where the different environmental conditions in European Member States need to be taken into account). For instance, in some parts of the EU agriculture is predominantly small structured and extensively managed (e. g. in Austria) and thus resulting in completely different socio-economic conditions compared to those in industrialised agricultural systems like e. g. in some parts of the Netherlands, France or Spain.

Conclusions derived from socio-economic assessments cannot easily be transferred to other countries or regions. The fact that socio-economic studies will lead to different results and conclusions, depending on the context chosen and the conditions prevailing at the time of collecting the data, was e. g. demonstrated by (KAPHENGST et al. 2011). Socio-economic impacts are also determined by societal circumstances, as shown by the differences in the establishment of GMO-free production schemes across European countries.

Given the limited information available for the European context, there is a need for clarification as to who will collect socio-economic data and conduct relevant studies. As the example of Norway shows, it is crucial that the responsibilities of authorities and applicants for collecting data and information are clearly defined (DIREKTORATET FOR NATURFORVALTNING 2009). For the EU it is also important to define which data could be assessed on the European level and which data are specific to certain regions and countries and thus require national assessments.

Equally important are the issues of defining the data that need to be generated and the selection of the scientific methods that are to be applied. Whereas in the case of an ERA for GMOs it is to some extent possible to generate experimental data before market approval, this is more difficult for socio-economic assessments. The importance of the further advancement of methods has also been shown by the European Commission (EUROPEAN COMMISSION 2011b). To estimate future developments and impacts *ex-ante* studies would be needed. By their nature these studies are of a modelling and predictive character and

their outcome depends on the quality of the data basis used and on the methodology and parameters chosen. However, socio-economic data on European circumstances are rare and their collection could to a certain degree not start until after the market approval and use of a particular GMO.

2.2.3 Limitations and data availability

In addition to the limited experience with socio-economic assessments there are also other limitations, e. g. regarding available data. Although opinions differ with regard to the quality of data included in GMO applications and their relevance for the ERA, a substantial amount of information has undoubtedly been collected on the environmental impacts of GMOs in general. This, however, is not yet the case for data on the socio-economic effects. Apart from availability of data in principle, the quality of the data and limitations of the study results are also important issues, as discussed in the following.

The lack of suitable data for socio-economic assessment has been pointed out e. g. by Norway, a country where socio-economic aspects are already assessed in the course of GMO authorisation. There are also scientific studies showing the limitations of data availability (e. g. GOMEZ-BARBERO et al. 2008, SMALE et al. 2009, FRIENDS OF THE EARTH 2010). This has been confirmed by the European Commission, which concludes its assessment by stating that data on economic aspects are limited and that even less is available on social aspects (EUROPEAN COMMISSION 2011b).

The economic consequences of the use of a certain GM crop by farmers in developing and developed countries have, up to now, mainly been of interest for industry so far. Most studies have dealt with farm level impacts of GM crops, but fewer have covered social impacts on a broader scale. Furthermore, studies on wider micro-economic effects (e. g. impacts on non-adopters, household income) are rare in particular for developing countries. Some studies are available on the macro-economic level. However, as they are based on models, they show wide variations in their results (EUROPEAN COMMISSION 2011b). For Europe, a lot of relevant information has been gained in the course of discussions on co-existence and respective EU-funded research programmes like COEXTRA, SIGMEA and CONSUMER CHOICE. However, macro-economic studies looking at the economic impacts on various sectors (e. g. seed companies, feed industry, food producers, consumers etc.) are less abundant (EUROPEAN COMMISSION 2011b). Furthermore, most of the reports and reviews are published by industry (EUROPABIO 2010, JAMES 2010), or by authors and institutions more or less affiliated to industry or NGOs (e.g. (BENBROOK 2009, GREENPEACE 2009, THEN & LORCH 2009). In conclusion it can be said that “*comprehensive studies from public authorities or independent organisation are scarce*” (SPÖK 2010).

The International Food Policy Research Institute (IFPRI) has conducted a food policy review of studies measuring the impacts of transgenic crops in developing countries and has classified these studies into impacts on farmers, the industry and on international trade as well as consumer attitudes. The results reveal that little evidence is actually available on which to base generalisations. The few crops studied and the few in-depth country studies are not suitable as a basis for generalisation. Therefore it is suggested that more information should be generated with a more comprehensive research design (SMALE et al. 2009).

SMALE et al. (2009) assessed studies conducted in developing countries and revealed some important limitations. Farm impact studies e. g. are focused on limited crop-trait combinations (mainly Bt-cotton) and have been carried out only in a few countries. Consumer studies have mostly been conducted in China. Aside from the fact that the number of scientists publishing work on the socio-economic issues of GMO cultivation is rather limited, these publications also show a wide range of quality.

As the findings of SMALE et al (2009) show, data need to be carefully assessed for their suitability and quality. Attention needs to be paid to the fact that sample sizes are often rather small or that comparisons between GM and non-GM lines need to be discussed cautiously since farmers do not usually grow isogenic lines for comparison. In addition, data derived from measurements are more objective than farmer's interviews - the latter, however, being the source most commonly used for data on insecticide and herbicide use.

An example of how difficult it is to assess socio-economic impacts on the basis of available data is how profits are gained from the production of GMOs. In order to determine whether a farmer earns more or less when cultivating GMOs, one also needs data on the costs of GMO cultivation, e. g. the costs for seeds, pesticides or coexistence measures. However, the costs for coexistence measures are hardly ever included in the studies, although this would be needed (GOMEZ-BARBERO et al. 2008, FRIENDS OF THE EARTH EUROPE 2010). In this respect not only the costs for coexistence measures incurred by the GMO farmer but also for non-GMO farmers need to be taken into account. Increases of the latter may be the reason for the observed decline in organic maize cultivation in the major maize growing areas in Spain (BINIMELIS 2008). The correct interpretation of data on profits and GM yields requires a direct comparison with the respective non-GM crop. However, although data are available on the cultivated area for GM (and the respective non-GM) crops in a country, detailed data on yields are not usually reported, apart from the summarised production levels of a country (JAMES 2010). Adding to the complexity of the issue, it is also important to take changes in pest management into account. If the pest management system in place before the introduction of the GMO was very bad or if there was no pest management at all, any yield increases achieved may not have been caused by the GMO itself, but by a more efficient management of the crop. An example is the increase in soya bean yields as reported in Romania after the introduction of GM soya bean. However, conventional weed control had been very inefficient before (EUROPEAN COMMISSION 2011b)

Apart from data availability, the data interpretation is also of utmost importance. This aspect is also discussed in the studies mentioned above.

- The data quality needs to be reviewed, as e. g. Smale et al. (2009) state that the data quality is in some cases questionable.
- It is often not possible to extrapolate the results from one country to another. It is e. g. rather doubtful that one can apply conclusions from studies on consumer acceptance carried out in China, as described in SMALE et al. (2009), to consumer acceptance in the EU, since the political and cultural systems are rather different. Also, data on agronomic parameters like pest damage, insecticide use or yields are highly variable between crop, geographic regions or years, farming systems and environmental conditions (GOMEZ-BARBERO et al. 2008, SMALE et al. 2009, HEINEMANN 2009, KAPHENGST et al. 2011).

- Results from studies based on economic models must be reviewed with caution, since the parameters used are most important, as well as the underlying data that determine the validity of the findings. SMALE et al. (2009) come to the conclusion that models are often based on uncertain assumptions and use sometimes problematic aggregations such as non-homogenous countries, sectors or crops. Most models also assume perfectly compatible markets.
- Selected methods have an influence on data quality and affect the results, since e. g. information provided by farmers tends to be rather subjective (SMALE et al. 2009, KAPHENGST et al. 2011). People conducting the studies influence performance estimates and crop yields depend on appropriate varieties suitable for specific environmental conditions.
- Data can only be assessed if comparable data are available. But such data are lacking (KAPHENGST et al. 2011). This is a most important issue when assessing yields and pesticide use.

3 CATALOGUE OF CRITERIA

The catalogue of socio-economic criteria presented and described in the following focuses mainly on criteria which are of major relevance for Austria. In the light of current discussions, some criteria are also presented that are primarily of relevance for third countries. These could be included in a socio-economic assessment of GMOs to be authorised for imports. However, this aspect needs to be further discussed.

The development of the criteria is based on the three pillars of sustainability, thus focusing on economic, social and ecological issues, and it also includes ethical aspects. However, the decision on whether or not these aspects could or should be included in a socio-economic assessment remains open for in-depth discussions.

3.1 Introduction

For the development of the Austrian-specific catalogue of criteria, especially a report on this subject published by COGEM and the requirements of the Norwegian law based on a report by the Norwegian Biotechnology Advisory Board (THE NORWEGIAN BIOTECHNOLOGY ADVISORY BOARD 2003, GOVERNMENT OF NORWAY 2005, COGEM 2009) have been taken into account. The information provided in both reports and the criteria defined have been analysed for their relevance to Austria. Many different aspects are discussed and a different classification is used in these reports. Both concepts have been analysed for their suitability and a catalogue of criteria for Austria has been developed. The catalogue has been cross-checked with the issues discussed in a report by the European Commission (EUROPEAN COMMISSION 2011b).

The report of COGEM comprises a broad assessment of the socio-economic aspects of GMOs as independent scientific advice and information for the Dutch government (COGEM 2009). Nine building blocks or themes with associated criteria are defined allowing an assessment of the contribution of GM crops towards more sustainable agriculture. Many socio-economic aspects which need to be accounted for in GMO cultivation are summarised. The closely related building blocks are as follows:

- Benefit to society
- Economics and prosperity
- Health and welfare
- Local and general food supply
- Cultural heritage
- Freedom of choice
- Safety
- Biodiversity
- Environmental quality

The topics most relevant for Europe are considered to be the “benefits for society”, “cultural heritage” and “economics and prosperity” since these are not included in the European assessment framework or regulated in any other way. It is mentioned that “health and welfare” as well as “local food supply” are no longer discussion topics in Europe. Ethical aspects are not included as they are not considered to fall within the scope of socio-economics since ethical concerns cannot be removed by establishing socio-economic criteria.

However, the report focuses on an assessment of the benefits, e. g. the criteria are formulated in a rather positive way (“The production of GMOs causes more yield”) and not as questions to be answered. Since the main focus of the Austrian-specific catalogue of criteria is an assessment of potential risks a different approach than in the COGEM report has been used.

According to Norwegian legislation, the assessment of a GMO also has to consider whether a specific GMO is ethically justifiable, promotes sustainable development and is socially acceptable – in short, benefits society (GOVERNMENT OF NORWAY 1993). To conduct an assessment, a checklist approach was developed by THE NORWEGIAN BIOTECHNOLOGY ADVISORY BOARD (2003) and implemented in the respective regulations (GOVERNMENT OF NORWAY 2005). The main topics are the following:

- Sustainable development
 - Global impacts
 - Ecological limits
 - Basic human needs
 - Distribution between generations
 - Distribution between rich and poor countries
 - Economic growth
- Favourable or unfavourable social consequences
 - Characteristics of the product
 - Production and use of the product
- Ethical considerations
 - Ethical norms and values relating to people
 - Eco-ethical considerations

It is stated that the checklists were developed to be used on a case-by-case basis. Therefore not all questions may be applicable for every GMO notification.

Included in the Norwegian assessment is the consideration of alternatives as well as respective advantages and disadvantages for various parts of society. It may be that an advantage can be demonstrated only for a specific part of society whereas the majority has either no advantage or is at risk. In this respect it is necessary to find out whether there is a demand or need for the product and whether or not it can help to solve a social problem (this may be more relevant for developing countries), or whether or not the GMO is significantly better than similar products already on the market or whether other or better alternatives are being developed.

3.2 Relevant criteria for Austria

This chapter provides information on those criteria which were identified to be of possible relevance to GMO cultivation in Austria. The focus was to identify possible risks of GMO cultivation, not only regarding economic issues but also regarding potential societal influences as well as related ecological issues. Since there have been only limited experiences with GMO cultivation in Europe so far, as also recognised by the European Commission (EUROPEAN COMMISSION 2011b), many of the discussed issues are based on assumptions. Taking into account the general negative perception regarding GMO cultivation in Austria, possible risks for farmers not cultivating GMOs are especially relevant.

3.2.1 Overview

Relevant criteria identified for Austria have been assigned to categories and to economic, social or ecological aspects. Table 1 provides an overview of the specific categories. In addition, the specific sectors to be taken into account in an assessment have been identified for each criterion.

Table 1: Categories of socio-economic aspects to be dealt with in GMO assessment

Aspect	Category
Economic	Productivity
	Costs
	Tourism
Social	Health and welfare
	Choice
	Cultural aspects
	Social cohesion
Ecological	Ecological limits and ecosystem functioning
	Biodiversity and nature conservation

Although the aim was to classify and define the various criteria and categories as clearly as possible, some of them are overlapping. Since some issues are connected one criterion may apply also for more than one category. In addition, it should be noted, as also stated in other publications (THE NORWEGIAN BIOTECHNOLOGY ADVISORY BOARD 2003), that it is possible that not all issues are relevant for all applications. Which criteria are to be used for a specific GMO application must be decided on a case-by-case basis.

3.2.2 Economic aspects

In order to cover the economic aspects of GMO cultivation relevant for Austria, seven criteria have been identified, accompanied by respective key issues (Table 2). These criteria can be assigned to three categories. The three categories, classifying areas of economic issues, cover potential negative impacts on productivity and the tourism sector as well as potential negative impacts on cost development.

Table 2: Economic issues to be taken into account in a socio economic assessment of GMO cultivation

Category	Criterion	Sector	Key issues
Productivity	Profit	Agricultural sector	Risk of reduced profits in the agricultural sector e. g. by reduced yield, harvest security or price of contaminated products.
		Special products	Risk of reduced profits in existing sectors like the production of special products (GMO-free seed, organic products ...). Risk of the squeezing out of existing production that should be maintained.
Prosperity	Employment		Risk of reduced employment possibilities especially in the rural area e. g. by intensification of agriculture or decreasing numbers of agricultural enterprises.
		Rural income	Risk of reduced income in rural areas with consequences for social cohesion e. g. rural depopulation.
		Natural resources	Risk of negative effects on environment, energy and other natural resources, especially resulting from economic growth based on GM technology, e. g. regarding genetic resources, seed diversity or gene banks.
Costs	Ecosystem services		Risk of negative effects on ecosystem services, e. g. pollination.
		Costs for the producer	Risk of increased costs for producers, e. g. by increased herbicide use, resistance management, coexistence management or higher seed prices.
		Security and control	Specific costs for insurance of GMO-free cultivation could be substantial e. g. for security and control, quality assurance or analysis.
		Damage, liability and redress	Legislation regulating liability and redress is necessary to stipulate the costs resulting from e. g. contamination of GM-free products. Besides specific costs e. g. for decontamination there are also non-monetary costs like the image loss of special regions (e. g. GMO-free regions).
Indirect costs	Welfare system		Risk of increased costs for the welfare system, e. g. for unemployment especially in the rural area caused by land use changes.
		Tourist expectations	Risk of negative effects on the tourist sector, e. g. loss of confidence in a former GM-free area or area with organic cultivation.
Tourism	Possibility to implement regional policy	Landscape aesthetics	Risk of landscape changes as an effect of GM cultivation, e. g. caused by monocultures
		Sustainability concepts	Risk that sustainability concepts especially in the rural area cannot be implemented successfully, e. g. regarding GMO-free regions or "Genussregionen" (areas known particularly for their local produce).

3.2.2.1 Category “Productivity”

The category “productivity” covers the national economy but is focused on the rural area and the agricultural sector. In addition, environmental issues need to be included since a healthy environment is seen as a basis of the national economy. These different issues are covered by the criteria “profit”, “prosperity” and “preservation of the environmental basis”.

The criterion “profit” includes on the one hand the agricultural sector as a whole as well as the production of special products, e. g. organic or GMO-free products. Products especially at risk from GMO cultivation should, for this reason, be assessed separately. Risks from GMO cultivation for profits in the whole Austrian agricultural sector are related to coexistence issues. Contaminated products, for example, may lead to profit losses for those special products. In addition, reduced yield or reduced harvest security can lead to reduced profits. Products especially at risk from GMO cultivation are e. g. organic products, GMO-free seed or traditional delicacies (e. g. regional products produced in so-called “Genussregionen”, i.e. areas known particularly for their local produce). If these products are contaminated with GMOs they will lose their price premium. Given the sceptical reception of GMOs in Austria and the participation of all nine Austrian federal provinces in the European network of GMO-free regions, it can be assumed that GMO cultivation side by side with traditional ways of production will cause problems. A possible loss of consumer trust in regional products may also lead to reduced marketability, accompanied by reduced profits. Possible negative influences on the production of special products could also lead to job losses e. g. if this particular (often more work-intensive) branch of production were to be squeezed out as a result of a high contamination risk and loss of profits. This is especially relevant for Austria with its small-structured agriculture and a high percentage of organic production.

The criterion “prosperity” covers two aspects – the prosperity of the individual, related to employment possibilities and the prosperity of the rural area. Both aspects are not exactly the same since reduced employment possibilities in an area can either lead to an increased rate of people commuting between the place where they live and the place where they work, or to migration. The former may contribute to rural income whereas the latter leads to reduced rural income. Potential intensification of agriculture based on GMO cultivation could intensify such challenges because intensification often goes hand in hand with a reduction in manpower needed for production. In addition, intensified agriculture is better suited to a few large farms rather than many small ones. Such developments could lead to a reduced employment rate in the agricultural sector, which may cause losses in rural income when followed by rural depopulation, a problem especially important for the mountain areas in Austria where this aspect should be taken into account also when developing policy strategies for these areas.

As stated above, the last criterion in this category “preservation of the environmental basis” covers the environment as a basis for the economy. This includes on the one hand the natural resources *per se* needed for the production of energy or the production of agricultural goods. On the other hand, ecosystem services provided by the environment are covered by this category. Natural resources that could be negatively affected, either directly or indirectly, by GMO cultivation itself as well as by industrialised agriculture as a result are mainly genetic resources (e. g. seed diversity, gene banks). These genetic resources are of major importance for the agricultural sector. What is also important in this

respect is genetic diversity in those countries where a particular crop has its centre of origin or centre of diversity. Landraces and wild relatives are important sources regarding the development of new cultivars which are necessary to combat resistance development and new pathogens. Ecosystem services, the second sector covered by this criterion, are important because they build the basis of livelihood and have an influence not only on the agricultural sector (e.g. pollination, soil function) but also on tourism (e. g. landscape scenery). Negative effects from GMO cultivation could not only result from the GMO itself (e. g. lethal or sub-lethal effects on pollinator species) but also from more intensified agriculture (e. g. loss of habitats, boundary structures).

3.2.2.2 Category “Costs”

The category “costs” covers two types of additional costs caused by GMO cultivation – direct and indirect costs. These issues are covered by the criteria “costs incurred during the whole production chain” and “indirect costs”.

Direct costs incurred during the whole production chain are costs for producers alone, costs for security and control as well as possible costs for liability and redress resulting from some kind of damage (e. g. contamination). Costs that have to be borne by the producer (the non-GM or the GM producer) alone are e. g. those related to guaranteed GMO-free production (avoiding contamination, quality control ...) as well as higher seed prices, costs for coexistence and resistance management or the costs of increased herbicide use in the case of resistance weeds emerging. Measures aimed at ensuring separate commodity flows may have also a social effect. Neighbourly help and shared machinery – as is common in rural areas – would increase the risk of contamination, which might contribute to the creation of conflicts. Some costs which are related to security and control are not only borne by producers but also, to some extent, by society (e. g. for general GMO control system). In the case of damage (e. g. GMO contamination), there may be additional costs e. g. for decontamination, product withdrawals, compensation or legal costs. However, a potential loss of image and a resulting loss of income need to be considered as well in this context, e. g. for a specific organic product or for a region which has been designated as a GMO-free region.

The criterion “indirect costs” covers possible costs for the welfare system which may arise due to higher unemployment rates in the agricultural sector, caused by the factors described above.

3.2.2.3 Category “Tourism”

The category “tourism” is an important economic issue in Austria. Influences on recreation are covered here by the criteria “tourist expectations” and the “possibility to implement regional policy”.

It is assumed that GMO cultivation could lead to difficulties for the image of Austria and that it may be incompatible with tourism in rural areas which are dedicated to recreation, the experience of nature or healthy food (e. g. “Urlaub am (Bio-) Bauernhof” i.e. (organic) farm holidays). This is a view supported by many initiatives at the regional level establishing GMO-free regions or other regions promoting sustainability schemes (e. g. “Genussregionen” which focus on local

produce and delicacies). GMO cultivation could lead to a loss of confidence in the image of Austria with respect to environment and nature. If GMO cultivation were to lead to intensified agriculture, this aspect might be amplified e. g. by negatively affecting the aesthetics of landscape through increased monoculture. These changes could have a negative impact on the number of tourists, especially in rural areas, leading to reduced regional income. In addition, the cultivation of GMOs could compromise the success of regional policies or schemes focused on sustainable development or the marketability of regional products. This aspect applies not only to the tourist sector but also to rural income.

3.2.3 Social aspects

The social aspects of GMO cultivation which are relevant for Austria are covered by seven criteria, accompanied by respective key issues (Table 3). These criteria can be assigned to four categories. The four categories cover potential negative impacts on the individual (e. g. health and welfare, freedom of choice) as well as society (social cohesion). In addition, the cultural aspects are covered. Many social aspects are related to or caused by economic aspects such as those elaborated above.

Table 3: Social issues to be taken into account in a socio-economic assessment of GMO cultivation

Category	Criterion	Sector	Key issues
Health and welfare	Quality of life	Income	Risk of negative effects on people's income especially in rural areas.
		Health	Risk of negative effects on the health of producers and people living in rural areas, e. g. effects of changes in pesticide use.
	Food availability	Recreation	Risk of negative effects on recreation abilities e. g. by changes in landscape aesthetics.
		Food security	Risk of negative effects on food security e. g. higher prices for GMO-free products or effects on their availability.
		Food sovereignty	Risk of negative effects on food sovereignty.
Choice	Labelling regime	Consumers	Labelling of GM as well as of GMO-free products needs to be guaranteed in order to allow for freedom of choice.
	Accessibility of alternatives and dependency	Farmers	Risk that farmers' freedom of action regarding the cultivation of non-GM crops is reduced e. g. because of cost development and availability of GMO-free seed. Risk of increased structural dependency e. g. access to complementary herbicides, contractual obligations, licence costs
		Enterprises	Risk that access to GMO-free products will be reduced e. g. by reduced availability, higher cost, etc.
Cultural aspects	Freedom of research	Research and technology development	Risk that work on innovations as well as the freedom of research will be reduced, especially research on GM crops e. g. by patents on breeding techniques and genetic resources, or due to higher costs for use of patented seed.
	Preservation of cultural heritage	Traditions	Risk that traditional production techniques or crop varieties, GMO-free/organic production or certain crops will be squeezed out.
	Autonomy	Autonomy	Risk that the autonomy of the local population will be negatively affected e. g. regarding their decisions about GMO-free production.
Social cohesion	Social changes	Social structure	Risk that agricultural practices will change, resulting in negative effects for social structures, especially in rural areas, e. g. regarding the survival of small enterprises and small agricultural holdings or employment possibilities.
		Conflicts	Risk of increased conflicts e. g. between people benefiting from GMO-technology and those who do not benefit, or between neighbouring farmers.
	Adaptability	Adaptability	Risk that the adaptability of society to changes will be reduced, e. g. regarding problem solving skills as a result of changes in the social structures.
	Generations	Generations	Risk of negative impacts on the distribution of the burdens of the new GMO technology among today's and future generations e. g. risk of long-term effects.

3.2.3.1 Category “Health and welfare”

The category “health and welfare” comprises relevant issues at various parts of life that may be affected by GMO cultivation. These issues are covered by the criteria “quality of life” and “food availability”.

“Quality of life” covers not only health and recreational aspects but is also related to employment and prosperity since it is also an element of the economic aspects. Negative effects on people’s income, e. g. reduced employment possibilities caused by intensified agriculture or by the squeezing out of the production of special products (organic products, GMO-free seed), has implications on the quality of life. Negative health effects, on the other hand, are more directly related to actual cultivation and could arise if herbicide use has to be increased because of resistance development. However, health issues could also be the result of changed labour conditions. Recreation, the last criterion in this context, applies - as some of the other criteria – to possible landscape changes that could be the result of an intensification of agriculture as a consequence of large-scale GMO cultivation.

The criterion “food availability” covers, on the one hand, the availability of GMO-free products and on the other hand food sovereignty, the former also being related to the freedom of choice for consumers. Increasing the prices of GMO-free products or increased efforts to ensure GMO-free production could lead to the reduced availability of those products. Many consumers, especially in Austria, would be affected if GMO-free production were to be no longer profitable. Major changes in the agricultural sector, related to increased GMO cultivation, may also affect food sovereignty, e. g. if the production of GM crops for certain purposes (e. g. biofuels) replaces the production of food.

3.2.3.2 Category “Choice”

The category “choice” covers not only the freedom of choice for consumers but also for farmers, enterprises and research institutions. The three criteria which have been identified are “labelling regime”, “accessibility of alternatives and dependency” and “freedom of research”.

The criterion “labelling regime” includes a key issue which is relevant to ensure that consumers (and enterprises) are able to purchase GMO-free products. In this respect it is not only important that GMO-free goods are provided but also that the consumer is able to distinguish GM products from GMO-free products.

The criterion “accessibility of alternatives and dependency” covers aspects specifically relevant for farmers and enterprises. Although the availability of GMO-free seed is the main issue for farmers, other aspects also need to be taken into account, e. g. coexistence or possible dependencies of farmers producing GM plants. Regarding GMO-free seeds, an important issue is not only the general availability of GMO-free seed but also the availability of a wide range of different GMO-free cultivars (adapted e. g. to the respective climatic or soil conditions). In this respect, the preservation of old cultivars could also be seen as an important issue in Austria. A very important aspect regarding the freedom of choice for farmers is that effective coexistence legislation is in place, ensuring that the products of GMO-free farmers are not contaminated by e. g. GMOs growing on neighbouring fields. If coexistence legislation is not enforced or effective enough there is the potential risk that farmers are forced to switch to GMO cultivation as

a result of contamination and the need to sell intended GMO-free products as GM products. However, there might be specific risks not only for those farmers producing GMO-free products but also for farmers who have decided to grow GMOs. Since e. g. the cultivation of herbicide tolerant GMOs entails the use of the respective complementary herbicide, dependencies could develop (e. g. regarding access to the herbicide). In addition, possible contractual obligations or licence costs could lead to dependencies of GMO farmers. For enterprises, access to GMO-free products is the main issue. Possible negative effects of GMO cultivation as described above (e. g. reduced availability of GM-seed, reductions in GMO-free cultivated areas) could successively lead to the reduced availability of GMO-free products for enterprises or higher prices for these products.

The criterion “freedom of research” covers aspects especially relevant for independent research institutions, e. g. the access to GM seed. There is a potential risk that the freedom of research will be influenced by e. g. patents on breeding techniques and genetic resources or high costs for the use of patented seed. Another issue which may arise in research institutions is how the freedom of individual researchers to conduct independent research will be affected.

3.2.3.3 Category “cultural aspects”

In the category “cultural aspects” only the preservation of cultural heritage is covered (as represented by the respective criterion).

The criterion “preservation of cultural heritage” covers not only applications and traditions but also the autonomy of local populations. The former covers traditional production techniques or the use of special crop varieties. It is assumed that local crop applications in Austria are mostly not compatible with GMO cultivation since there is a general negative attitude to GMO cultivation. The autonomy of the local population refers to the freedom of the population to decide on GMO-free production or GMO-free areas.

3.2.3.4 Category “social cohesion”

Relevant issues regarding the category “social cohesion” in Austria are covered by the criterion “social changes”. Further aspects can be identified but are mostly relevant for third countries.

The criterion “social changes” covers issues that could be influenced by large-scale GMO cultivation in the long term, leading to negative changes in society. Examples are changes in the social structure or an increased potential for conflicts between neighbouring farmers. It should be noted that those potential risks would be indirect effects, which cannot easily be separated from the overall effects of conventional agriculture. Social structures could be negatively affected as a result of negative economic effects such as those described above (e. g. a reduction of small enterprises or agricultural holdings or reduced employment possibilities in the agricultural sector). An increased potential for conflicts could arise especially between neighbouring farmers if coexistence measures are not applied properly or if fear of contamination increases. These conflicts could lead to serious problems especially in small rural communities where people depend to some extent on each other (e. g. neighbourly help, shared machinery). An additional aspect is whether there could be changes in the adaptability of a so-

ciety as a result of the transformations of society. In this context it should be noted that such possible negative influences could also have an impact on future generations, e. g. negative effects showing up as the result of long-term and/or large-scale cultivation.

3.2.4 Ecological aspects

Although the European notification procedure requires an environmental risk assessment, there are ecological aspects which also need to be taken into account when undertaking a socio-economic assessment. Some of the aspects mentioned below are not covered by the current environmental risk assessment (e. g. ecosystem services, climate change, national and regional characteristics). In addition, ecology is one of the main pillars of sustainability. The concept of sustainability shows that there are mutual influences between ecology, economy and society. These influences can only be identified when assessing all the three aspects. In this respect it should be noted that an assessment of ecological aspects from the point of view of sustainability needs to take longer time frames into consideration.

In order to cover the ecological aspects of GMO cultivation relevant for Austria, four criteria have been identified together with their respective key issues (Table 4). These criteria can be assigned to two categories. The two categories cover the potential negative impacts on ecosystem functioning as well as on biodiversity. Nature conservation is included in the latter category.

Table 4: Ecological issues related to a socio-economic assessment of GMO cultivation

Category	Criterion	Sector	Key issues
Ecological limits and eco-system functioning	Preservation of resources	Natural resources	Risk of negative effects on natural resources e. g. by their increased, inefficient or unsustainable use. Risk of increased use of non-renewable instead of renewable resources e. g. by increased use of fertilisers based on mineral oil.
		Energy	Risk of negative effects on energy use e. g. by increased, inefficient or unsustainable use.
		Soil	Risk of negative effects on soil quality e. g. regarding pollution, nutrient balance, pathogen presence or soil fertility.
		Water	Risk of negative effects on water balance e. g. by increased irrigation or increased water pollution.
		Air	Risk of negative effects on air quality e. g. by increased pollution or emissions of ammonia.
		Greenhouse gases	Risk of increased emissions of greenhouse gases e. g. by changes in the balance of CO ₂ emissions and uptake, increased emissions by transport and processing or land use change.
		Agro-biodiversity incl. seed diversity	Risk of negative effects on species diversity e. g. by decrease/disappearance of vegetal species or crop diversity including cultivar variety.
		Habitat diversity	Risk of negative effects on the biodiversity of habitats/ecosystems e. g. by decrease/disappearance of habitats associated with cultivated areas (e. g. boundary structures).
		Protected and vulnerable biodiversity	Risk of negative effects on biodiversity on various levels (genetic, species, habitats, ecosystems) by e. g. decrease or disappearance.
		Gene pool	Risk of negative effects on wild relatives of GM crops by e. g. decrease/disappearance of gene reservoirs.
Biodiversity and nature conservation	Preservation of biodiversity in cultivated areas		
	Preservation of biodiversity in uncultivated areas		

3.2.4.1 Category “Ecological limits and ecosystem functioning”

The category “ecological limits and ecosystem functioning” covers not only the limits of natural resources but also the status of the environment (since there is e. g. a threshold value for environmental compartments regarding pollution). The importance of climate change is underlined. The possible negative effects which have been identified would mostly be the result of intensified agriculture. The indirect effects of intensified agriculture due to GMO cultivation have already been discussed (see above). However, for an assessment of negative effects a baseline (be it organic or conventional agriculture) must be established. The different issues in this category are covered by the criteria “preservation of resources” and “preservation of environmental quality”. Aspects of ecosystem functioning and ecological limits are related to issues that have - to a greater extent - an impact on our daily life but are also related to economics, since the economy relies to some extent on a healthy environment and the natural resources. The key issues identified in this chapter are mainly related to sustainability.

The criterion “preservation of resources” comprises issues relating to natural resources as well as energy. A possible negative effect would be an increased or inefficient use of natural resources, a topic very much related to sustainability questions. Natural resources, in this context, could refer to renewable (e. g. plants for biofuel production) or non-renewable resources (e. g. mineral oil used for the production of fertiliser or fuel). The consequences of these negative effects could be widespread and not easy to determine because e. g. reduced biodiversity as a result of increased production of plants used for biofuel production could not only be the result of increased demands from the agricultural sector but also the result of the increased demands of society on the whole. These assumptions are also valid for any negative effects resulting from the increased or unsustainable use of energy.

The criterion “preservation of environmental quality” covers potential negative effects on soil, water and air as well as emissions of greenhouse gases that could be related to GMO cultivation. In this context those issues which are not covered in the environmental risk assessment need to be dealt with. Negative effects could be alterations in the nutrient balance or the fertility of soil or an increased pathogen presence. Negative effects on the water balance could be the result of increased irrigation or pollution, e. g. caused by increases in fertiliser use. Air quality could also be negatively affected by pollution. Climate change is one of the major issues discussed at the national and international level. Effects that could result in a negative impact on climate change are e. g. increased emissions of CO₂ along the entire product chain (development, production, processing and transport).

3.2.4.2 Category “Biodiversity and nature conservation”

The second category “biodiversity and nature conservation” covers biodiversity in cultivated as well as in uncultivated areas, reflected by two respective criteria. Biodiversity issues cover aspects relating to politics in this area, and they are also related to ethical issues like the intrinsic value of nature. However, biodiversity is also related to economic aspects, e. g. the gene reservoirs of crops.

The criterion “biodiversity in cultivated areas” mainly covers the biodiversity of species and habitats. Agro-biodiversity, the biodiversity of species in agricultural areas, includes also seed diversity. A negative effect could be the decrease or disappearance of segetal species caused by the management measures applied. In addition to this, there is also the risk of a decrease in crop diversity including cultivars. This might happen if GMOs are cultivated on a large scale with a very limited range of cultivars. If GMO cultivation is widespread the area available for the production of traditional cultivars will decrease. The second biodiversity aspect covered by this criterion is the biodiversity of habitats or ecosystems in the rural area. A variety of different habitats also facilitates species diversity. Especially habitats associated with cultivated areas (e. g. boundary habitats) are important in this respect. Changes in landscape structure or agricultural management could cause negative effects on biodiversity.

The criterion “biodiversity in uncultivated areas” covers, on the one hand, nature conservation aspects on various biodiversity levels and on the other hand issues related to wild relatives of GM crops. Negative effects for protected and vulnerable species or habitats could result from neighbouring GMO cultivation, an aspect which is becoming increasingly important for large-scale cultivation. Specific aspects of GMO cultivation could have a negative impact on biodiversity because of the specific management of GMOs. This is most important for the gene pool of respective particular crop species which may play an irreplaceable role in fighting resistance development or decreased resilience e. g. against new pathogens.

3.3 Other aspects

As stated above, some additional topics have been raised in the ongoing discussion which are either not core issues of socio-economic implications or not of major relevance for GMO cultivation in the EU. However, the discussion on how socio-economic aspects could be included in the GMO authorisation procedure is still in its early stages, and as no common understanding has been reached as yet regarding the scope of socio-economic aspects to be considered, some of these additional issues are addressed in the following.

3.3.1 Ethics

In order to cover the ethical aspects of GMO cultivation, three criteria have been identified together with their respective key issues (Table 5). These criteria are related to morality in one way or another. The aspects described below are not only related to the values upheld by the local population but also to important general values of the European civilisation as a whole. In addition, a related theme covering more ecological aspects has been identified.

Aspects described in this report are based on the preconditions of Norwegian GMO policy and the respective law (GOVERNMENT OF NORWAY 1993, GOVERNMENT OF NORWAY 2005). The aspects considered in the Norwegian law are based on an assessment of the Norwegian Biotechnology Advisory Board (THE NORWEGIAN BIOTECHNOLOGY ADVISORY BOARD 2003).

Table 5: Ethical issues relevant for socio-economic assessment of GMO cultivation

Category	Criterion	Key issues
Morality	Population`s values	Risk that ethical principles of the population at large will be violated. Risk that marketing and sales come into conflict with ethical norms and values.
	Solidarity and equality	Risk of conflict with the ideals of human solidarity and equality, e. g. risk of effects on the weaker groups of society.
	Intrinsic value of nature	Risk of conflict with the intrinsic value assigned to animal species. Risk that species barriers will be crossed that are materially different from those otherwise found in cultivation or in the wild. This is especially relevant if this is considered incompatible with the value assigned to the integrity of species by society Risk of causing unnecessary suffering to animals.

The criterion “population’s values” covers the general ethical principles of a population. If ethical aspects are to be included in the GMO authorisation procedure, there needs to a discussion as to whether there is a potential risk of violating the ethical principles of the population at large. However, it should be noted that when identifying relevant principles, contradictory views may also need to be taken into account. These ethical principles might not only be relevant for the cultivation of GMOs but also apply to the marketing and sale of the product.

The criterion “solidarity and equality” is an aspect which is most relevant for European societies, especially regarding the weaker groups of society. Although there are some ethical aspects that are agreed upon on international level (e.g. basic human rights), one needs to be find out if other, regional or national ethical principles apply. In this context there needs to be a discussion as to whether it may be appropriate to assess cultivation in third countries (when assessing a GMO notification for import) by solely applying European values.

The last criterion, the “intrinsic value of nature”, is related to the ethical or religious view on nature. In this context, potential risks – like whether there are potential risks for species of a certain cultural or religious value — or detrimental effects on animal welfare may be discussed. In addition, the risk of outcrossing may be assessed from an ethical point of view.

As one can see, only some of the ethical aspects are concerned with risks. The issue here is much more complicated, being also an intermediate issue to risk-benefit analysis. The only difference is that it is not only considered whether there are risks and benefits to be compared but also whether a product is worth the risk (e. g. whether there is a clear need for the product without alternatives). Therefore, a risk-benefit analysis which includes ethical issues has to be much broader and needs much more in-depth analysis.

3.3.2 Third countries

As described above, some themes have been identified that are mainly relevant for third countries (Table 6). These are related to social as well as ethical aspects. Five themes are related to social aspects covering the categories “safety” and “social cohesion”. One theme is related to ethical aspects covered by the category “minority’s rights”. No criteria have been described for the respective themes since only little information is available on possible effects.

Table 6: Issues relevant for third countries

Aspect	Category	Theme	Key issues
Social	Safety	Humans and animals	Legislation needs to be in place ensuring a safety assessment for humans and animals as well as for food and feed safety.
		Environment	Legislation needs to be in place ensuring an environmental risk assessment.
	Social cohesion	Social changes	Risk that basic human needs will be negatively affected.
		Distribution	Risk of negative impacts on the distribution of burdens between rich and poor countries, e. g. between exporting and importing countries. Risk of negative effects on the distribution of economic growth and wealth between rich and poor countries.
Ethical	Minorities’ rights	Interests	Risk that indigenous people, people with strong ties to their traditional cultures and weaker groups of society will be exposed to serious adverse consequences of the decisions of mainstream society.

In the category “safety” the safety of humans and animals is covered as well as environmental safety. The main issue is whether or not legislation is in place for a safety assessment. This may no longer be an issue for the European Union but it needs to be considered whether it is acceptable to import GMOs from third countries where no thorough assessment procedure is in place.

The category “social cohesion” has also been identified as relevant for Austria. However, there are some issues in this category that are not relevant for Austria but maybe for third countries. One of the questions is whether or not basic human needs might be negatively affected. Other themes include the distribution of burdens between rich and poor countries (in general or regarding any potential negative effects of economic growth). These aspects may be considered in the light of the responsibilities vis-à-vis the population of those countries which produce GMOs for the European Market. In this context reference is made to other initiatives like the "Fair Trade" label.

The last category “minority’s rights” is an ethical aspect. Here the potential risks for indigenous people, people with strong ties to their traditional cultures and for the weaker groups of society need to be assessed separately. Although potential benefits of a technology may be identified for mainstream society, this may not be the same for minorities. Also, these minorities need to be in control of cultural changes within their own communities.

Producing countries should also be given freedom of choice but it needs to be considered that especially regarding developing countries, the introduction of new technologies from outside may have serious and unintended side effects, as shown by previous experience (e. g. the Green Revolution) as also discussed by DANO (2007). One also needs to consider that the importing countries have a major influence on the policies and economies in the producing countries.

Developed countries make substantial claims on the natural resources and biodiversity elsewhere in the world. While some countries import agricultural products, the resources of other, producing and exporting countries are exploited in many cases. This may contribute to the damage caused to the ecosystems in this country. Sustainable production of imported products could lead to a reduction of the ecological footprint of a developed country. This should be considered when defining the scope of socio-economic assessment in the European Union.

4 EC REPORT ON SOCIO-ECONOMIC IMPLICATIONS

According to Directive 2001/18/EC, the report on the implementation of this Directive to be provided by the European Commission in 2004 should also have included an assessment of the socio-economic implications of the deliberate release and placing on the market of GMOs. Since the experience gained for such an assessment was not sufficient by 2004, this report was postponed and finally provided by the European Commission in 2011 (EUROPEAN COMMISSION 2011b).

The European Commission's report is mainly based upon a consultation process with the EU Member States and a review of research programmes and scientific publications regarding the socio-economic aspects of GMO cultivation. In order to facilitate the consultation process a questionnaire was provided by the European Commission. This questionnaire was aimed to provide guidance and could be used by the Member States on a voluntary basis. The Member States were asked to provide *ex post* as well as *ex ante* information, thus covering both impacts of GMO cultivation in the respective country and implications of future GMO cultivation. The questionnaire covered questions regarding economic and social issues as well as agronomic sustainability and also provided room for other implications.

This report is analysed in the following from an Austrian perspective, not only to get an impression of the views of Member States on socio-economic issues but also to get an idea of the overall perspective on how to implement those issues in the authorisation procedure for GMOs. The analysis focuses on aspects which are especially relevant for Austria, as stated in the response of Austria to the European Commission's questionnaire (MINISTRY OF HEALTH 2010)

In this response the major concerns of Austria about the socio-economic implications – mainly linked to coexistence – were addressed, e. g. concerns regarding the quality of organic products and seeds produced in Austria as well as the special risk of contamination due to Austria's small-structured agriculture. In this context, not only outcrossing and contamination remain as an issue but also the resulting questions of liability and the reduced marketability of products. Concerns were also raised regarding the latter, e. g. GMO-free food or feed. It was noted that a complete logistical separation between GM and non-GM products does not seem to be feasible in Austria. Another major topic addressed in the Austrian response is the cost associated with GMO cultivation, e. g. administrative costs, costs for coexistence measures, costs for storage as well as logistical costs for the separation of commodity flows. Austria also pointed out the social consequences, e. g. the risk of major problems in neighbour relations between GM and conventional farmers.

4.1 Main aspects of the report

The core report of the European Commission gives some indications of the data sources used by the Member States and provides a short summary of a few main elements of the responses received (e. g. meaning and scope of the

socio-economic dimension, coexistence issues or economic impacts of GMO cultivation on the farm level). In addition, some information is provided regarding the socio-economic dimensions of GMO cultivation in third countries and the results of EU-funded research projects addressing socio-economic perspectives.

The compilation of the main elements of the responses provided by the Member States and contained in the report of the European Commission is focused on two different aspects. On the one hand, issues with regard to content are listed and on the other hand, more evaluative aspects are mentioned.

Regarding the latter, the European Commission e. g. notes that socio-economic aspects were often not assessed in an objective way. Most Member States also consulted stakeholders and therefore their responses covered a variety of views. As a result, neither a political position nor a holistic view of national stakeholders' opinions was provided, since in many cases only part of the stakeholder spectrum responded and the contributions were thus not homogeneously distributed. In addition, it should be noted that data provided by the Member States originated not only from peer reviewed studies but also from other sources like opinion polls or were based on scenarios. The European Commission notes that information provided by the Member States could not be processed statistically since it differed in relevance and quality and that Member States' contributions were obviously influenced by a general positive or negative perception on GMOs. In addition, it should be noted that the contributions reflect polarised opinions and are built upon a limited fact-based background in the specific European context.

Since the European Commission was of the opinion that, in most cases, data and statistics were missing to back the respective views, the different responses of the Member States were not further analysed in detail (e. g. regarding economic impacts on farm level). Member States refer to scientific literature and studies but impacts on the last part of the seed-to-shelves chain and wider society impacts were in many cases not scientifically or statistically documented and Member States not growing GMOs based their estimations largely on extrapolations of relevant literature as well as experience from third countries.

Regarding the scope of socio-economics, the European Commission notes that common understanding is lacking (e. g. whether to include ethical aspects or impacts on third countries). Many Member States noted that a definition of terms and indicators is needed and clarification on whether organic or conventional agriculture should be the baseline for comparisons. The socio-economic implications mentioned by Member States and summarised by the European Commission were largely coexistence issues (e. g. presence of GMOs in neighbouring fields, segregation along the feed/food chain, consumer choice, costs, practicability of coexistence measures), impact on biodiversity, modification of farming practices or marketability of products. The European Commission states that Member States focused largely on social and economic impacts of GMO cultivation at the first stages of the seed-to-shelves chain. However, socio-economic impacts on the later stages were also mentioned (e. g. transport, insurance, food industry, testing laboratories, employment patterns, administrative activities, and consumer choice). Direct effects, like for instance costs, were more often mentioned and assessed than indirect effects (e. g. social issues).

Based on this review of knowledge of socio-economic dimensions, the European Commission drew some conclusions regarding Bt crops and HT crops for which studies on farm level impacts exist, mostly based on farmers' surveys. Studies on wider micro-economic effects seem to be very scarce. Some more studies are available on the macro-economic level but the results vary considerably since they are based on economic modelling. Less information seems to be available on social impacts.

The European Commission is of the opinion that the discussion about the socio-economic aspects of GMO cultivation should be deepened, since more objective results are necessary. An important issue named in this respect is the development of solid and reliable factors for the compilation of socio-economic effects, as well as of precise respective indicators. In addition, standards for data collection are needed. Moreover, the possibility to make use of an increased understanding of these multi-dimensional socio-economic factors should be assessed. In this respect, different approaches should be explored. In the opinion of the European Commission, the process should be continued together with Member States and the active involvement of all stakeholders.

Annexed to the report is a Commission Staff Working Paper (EUROPEAN COMMISSION 2011c). It contains not only the questionnaire distributed to the Member States and summaries of their individual responses but also a list of publications extracted from the project "Assessment of the economic performance of GM crops worldwide" (KAPHENGST et al. 2011).

4.2 Commission Staff Working Paper

The key issues for Austria discussed in the Commission Staff Working Paper have been reviewed for this report and the results are presented in the following. The aim was to get more information on the aspects which are most relevant for Austria, since the European Commission's report contains only a rough overview. As stated above, these issues comprise coexistence, cost development and possible conflicts. In addition, the Member States' views on sustainable agriculture have been analysed. Also, issues regarding the implementation of an assessment of socio-economic aspects in the GMO authorisation process are important, e. g. procedural aspects, scope and the next steps. However, it should be noted that many Member States stated that their response contained the view of a variety of stakeholders. Therefore, the Member States' opinions presented in the following do not necessarily represent the official political opinion.

4.2.1 Coexistence

Regarding coexistence measures, the main concern of the Member States is about seed production and organic farming as well as about the applicability of these measures. Concerns are also raised with regard to beekeeping, the livestock sector and inefficient coexistence measures, which also raise issues of liability and may cause the loss of price premiums for organic products.

Regarding the applicability of coexistence measures, some Member States have raised concerns that these measures are not feasible or effective because of the predominantly small-scaled structure of agriculture in the respective countries (i. e. Austria, Cyprus, Greece, Hungary, Latvia, and Malta). Also, some other Member States have noted that coexistence measures may not always be sufficient. In such cases, non-GMO farmers may be forced to set self-protection measures.

Additional concerns mentioned by some Member States are related to the possible challenge of finding sufficient cultivation areas for conventional seed if GMO cultivation significantly expands. Others state that outcrossing and contamination is unavoidable.

4.2.2 Cost development

Almost all Member States list examples of additional costs arising from the cultivation of GMOs. These can be identified at all levels of the production chain from farming to transport, storage and processing and they include costs for logistics and control. Some examples are provided below.

- Costs related to public administration: e. g. increase of staff for risk assessment, inspection and enforcement, monitoring of field trials, post-market monitoring and control
- Costs for farmers: coexistence measures (especially regarding the preservation of GMO-free seed and organic products), costs for non-GM livestock farmers to guarantee provision of non-GM feed
- Segregation costs regarding the transport and handling of products: e. g. physical separation, cleaning, storage
- Costs related to labelling
- Costs related to identity preservation
- Costs related to contamination: e. g. loss of organic labels and organic price premiums

It is stated that the occurrence of GMOs will increase the costs for the production of GMO-free seed and organic products.

4.2.3 Conflicts

Like Austria, some other Member States (i. e. Czech Republic, Estonia, Greece, Finland, Ireland, Latvia, Romania, Slovenia) also noted in their responses a potential for conflicts between GM growers and their neighbours, as well as protest campaigns and legal disputes. Special reference is made to conflicts involving organic farmers. Latvia states that not only conflicts with neighbours would be unavoidable but also with neighbouring countries. On this topic only the Czech Republic presented data in its response to the European Commission. 56 % of the responding stakeholders in the Czech Republic reported either neighbouring conflicts or the threat of such conflicts.

4.2.4 Sustainable agriculture

There are some discussions underway regarding the baseline for an assessment of GMO cultivation, e. g. whether organic farming or conventional agriculture is suitable as a baseline for comparison. In addition it is noted that it may be difficult to define conventional agriculture since agricultural management may differ between regions or states. As it was also stated by COGEM, there are some difficulties regarding the definition of sustainable agriculture (COGEM 2009).

In order to get some impression as to whether there is a common understanding regarding the term “sustainable agriculture”, the answers provided by the Member States regarding the impacts of GMO cultivation on sustainable agriculture, as summarised in the Commission Staff Working Paper, were analysed.

A variety of issues are mentioned by the Member States, one of the key issues being the use of agricultural chemicals (herbicides, insecticides etc.). However, it is not clear if there is some kind of threshold between sustainable and non-sustainable agriculture. Member States only refer to a reduced use of agrochemicals. In addition, sustainable agriculture is generally seen as associated to the sustainable use of soil (preservation of soil productivity and quality), water (preservation of water and groundwater quality) and energy (sustainable use of renewable resources, less use of fossil fuels) and other natural resources (e. g. efficient use of field and forest biomass).

Another topic mentioned by most Member States is biodiversity and nature conservation. In this respect, influences on protected species or nature conservation areas as well as effects on the fauna and flora in general are mentioned. Also, the preservation of (traditional) cultivar varieties and small-scaled agriculture are important aspects in Member States.

Influences on and the adaption to climate change are also topics mentioned, by many Member States, as falling within the scope of sustainable agriculture. In this respect reference is made to the possibility that GMO cultivation could contribute to carbon sequestration, reduced fertiliser use or reduced greenhouse gas emissions.

4.2.5 Implementation of socio-economic aspects

In their response, some Member States refer to the proposal of the European Commission on the right of Member States to decide on GMO cultivation on their territory (EUROPEAN COMMISSION 2010). This proposal was welcomed by Austria. Also Ireland and the Netherlands state in their responses that they are in favour of a relevant modification of the regulatory framework.

Whereas some Member States support the inclusion of socio-economic criteria in the authorisation procedure for GMO cultivation (e. g. Luxembourg), others remain cautious. Germany e. g. states that the evaluation of socio-economic consequences should be carried out separately from the risk assessment. However, such criteria can be included, in addition to the scientific risk assessment, in risk management decisions. The inclusion of socio-economic criteria in the authorisation process is not welcomed by Germany because these criteria would be too subjective. Sweden notes that the European regulatory framework already allows for taking socio-economic aspects into account and that the gen-

eral application of these aspects is unlikely to make the process easier, more consistent or foreseeable. Also, the transparency of the decision process may be negatively affected.

Regarding the actual implementation of socio-economic aspects, some Member States refer to the criteria developed by COGEM (i. e. Austria, The Netherlands, Slovenia) as a starting point for discussions on EU level. However, further discussions are needed regarding the definition and relevance of these criteria for GMO cultivation. The Netherlands also state that it would be desirable that indicators linked to the criteria are objectively measurable and allow for an estimation of the effects in advance. The Belgian response includes a proposal for a step-by-step evaluation of socio-economic impacts by gaining information from the field trial phase onwards. Criteria should be precise and completely defined. Regarding the inclusion of sustainability aspects, the Dutch response includes a comment that these aspects could raise questions regarding the sustainability of certain conventional crops and cultivation methods that are at present not assessed for their socio-economic impacts. It is also stated that the regulatory framework should be based on sound science as well as on the precautionary principle. The scientific evaluation of the safety of GMOs must not be compromised. The Belgian response contains some concerns regarding the possibility of an *ex-ante* evaluation due to a lack of technical and economic information. It is also noted that socio-economic criteria should not bypass biosafety criteria.

Other Member States have included references to the Norwegian law. The Hungarian response to the Commission's questionnaire suggests installing a new system of evaluation in the European Union, taking into account Norwegian legislation. In this respect, the impact assessment of GMO cultivation should also consider the benefits for society and the promotion of sustainable development. The Irish response to the questionnaire also includes the suggestion that an assessment of socio-economic implications should be carried out prior to decision-making, as in Norway. Suggestions made by Belgium regarding the identification of alternatives and considerations of other potential innovative pathways are also in line with the Norwegian requirements. A GM product should be better than conventional ones.

Only a few references are made by Member States regarding the scope of the socio-economic implications. In referring to the Norwegian law, Hungary e. g. proposes not only to consider crop-producing countries in the assessment but also importing countries. Belgium indicates as well that also imported GMOs should be considered. Greece states that GMO cultivation does not take into account ethical-philosophical-religious concerns. Also Sweden states in its response that the socio-economic effects on developing countries need to be considered.

All in all, the need for further discussion on the EU level is pointed out by various Member States. In this respect Austria stated that the different opinions and socio-economic backgrounds of the various Member States should be considered. Regarding the next steps and the process that needs to be started, Austria refers to a study by SPÖK (2010), proposing that a process for policy development should be launched allowing inputs from a broad range of stakeholders. Impact dimensions should be identified and research conducted on possible impacts of GMO cultivation. In the following transdisciplinary research should be conducted on best practice models, approaches and methods appropriate for measuring and assessing the socio-economic impacts of GMO cultivation.

4.3 Appraisal in the Austrian context

Although the criticism put forward by the European Commission is to some extent comprehensible, e. g. regarding the different views of the Member States on socio-economic aspects or the problem that stakeholder responses were refined by the Member States in different ways, a more detailed analysis of the Member States' responses would have been appreciated, especially regarding the main elements which have been identified.

Up to today there has only been little experience (regarding time and scale) with GMO cultivation in the EU. In addition, the topic socio-economics is an emerging issue and also rather complex. This problem is reflected by the Member States' responses e. g. regarding the limited information available *ex post*. A lot of issues raised in the questionnaire are difficult to assess (esp. social issues). Therefore it is only logical that Member States, in their responses, present only limited data and statistics and refer to experiences in third countries, assumptions and anticipatory views instead. It is also assumed by the European Commission that many of the apprehensions raised are caused by the limited experience in GMO cultivation. The differences regarding the relevance and quality of the issues raised by Member States are also an indication of the complex nature of this issue.

Although the intention of the questionnaire was to streamline the survey of the Member States' knowledge it should be noted, as also stated in the Austrian response to the questionnaire, that many questions are phrased in such a way that it is very difficult to answer them because of the very limited experience with GMO cultivation in Europe. As there are only limited data on socio-economic effects, the assumptions of actual benefits should be further evaluated and the concerns raised, although they are also mostly based on assumptions, should be taken into account seriously and studied further. The precautionary principle should serve as overarching guidance.

As stated before in the Austrian response to the Commission's questionnaire, it is noted that many questions should have been phrased differently in order to receive more meaningful answers. Only after a thorough discussion and an EU-wide common understanding of the criteria for an evaluation of the socio-economic effects of GMO cultivation, can a questionnaire phrased in such a way as the current one be answered on the basis of sound data.

In this respect, the European Commission's initiative to address this issue further with the aim of substantiating various aspects is important. However, it is crucial that some basic issues are discussed first and that the basic problems are solved, e. g. the definition of the scope of socio-economics, or whether or not ethical aspects should be included in the assessment. In addition, it should be discussed how to deal with those aspects mainly relevant in third countries. With respect to the work on criteria and indicators it seems important that also long-term aspects, like social changes and sustainability issues, are taken into account. In addition, the problem of the baseline for comparison needs to be solved as soon as possible. Many of these aspects were also noted by the Member States, underlining the importance of further discussions.

5 CONCLUSIONS

The analysis of an implementation of the legal framework on an EU – and also at the international – level shows that the application of the socio-economic considerations of GMO cultivation in decision-making is very limited. Nevertheless, the discussions are going on, even though they are only at the beginning due to the lack of experience with GMO cultivation and socio-economic assessment in the EU. In addition, there is still no common understanding with regard to a clear definition and use of socio-economic aspects in the context of GMO authorisation.

There are also significant differences between an environmental risk assessment and a socio-economic assessment, e. g. with regard to an event-specific, GMO-species or trait-specific assessment, respectively. One also needs to recognise that in contrast to an environmental or health risk assessment, no data can be generated in the laboratory, and that there is a clear need for modelling approaches.

When entering into in-depth discussions, one should consider that social, economic and environmental impacts are inherently and inextricably connected. Consequently, any changes in any of these fields will entail changes in another. So, even more important than the allocation of certain impacts to one field or another is the development of an understanding of impact pathways.

This is also reflected in the criteria developed in this report, which are categorised on the basis of the three pillars of sustainability: economy, social aspects and the relevant ecological issues. For each of these categories separate criteria are suggested:

- for economic issues: profit, prosperity, preservation of the environmental basis, costs during the whole production chain, indirect costs, tourist expectations and the possibility to implement regional policy,
- for social issues: quality of life, food availability, labelling regime, accessibility of alternatives and dependency, freedom of research, preservation of cultural heritage and social changes,
- for ecology-related issues: preservation of resources, preservation of environmental quality, preservation of biodiversity in cultivated areas and preservation of biodiversity in uncultivated areas.

However, it is also clear that there are a number of overlapping issues or issues which are linked to each other and which cannot be assessed in an isolated way.

The report at hand defines the most important topics and open questions regarding the socio-economic aspects of GMO cultivation. Together with the criteria which are of importance for Austria, a basis for ongoing discussions is provided. This could be used not only in discussions on socio-economic assessments but also for considerations of “other legitimate factors” in the context of Regulation (EC) No. 1829/2003. Furthermore, it could also serve as a starting point for the development of justifications if the Member States are going to be granted the freedom to decide on the cultivation of GMOs on their own territory, according to the proposal put forward by the European Commission in 2010.

However, the report also discusses the problem of data availability, e. g. that little data are available on social issues or that the costs of coexistence measures are not included in profit calculations. In addition, it is shown that available data must be carefully assessed for their usability, e. g. regarding their quality, the parameters used in models or the methods applied and whether or not comparable data are available. It becomes clear that most of the available data sets are restricted to certain regions and/or countries or to a certain economic level, e. g. household or farm. As these datasets cannot easily be extrapolated or transferred to other regions or economic levels, their usability is limited.

Though it is important to define criteria and indicators for the assessment of socio-economic impacts, it is crucial to decide first on the basic issues, like defining the scope and baseline. This is necessary in order to define a common starting point and provide a framework for the discussion process of this broad and complex issue. Then in-depth discussions on suitable criteria, indicators, data requirements and methods can be launched at EU level.

The main open questions which have been identified and that need to be discussed at EU level are as follows:

- What is the scope of socio-economic assessment?
- What is the baseline/comparator for a socio-economic assessment?
- Who is to provide socio-economic data and conduct respective studies?
- Which data are needed (especially in terms of ex-ante data) and which scientific methods should be applied?
- On which level (e. g. farm, macro-economic level) should the assessment be carried out?

Though the framework for a socio-economic assessment in the context of GMO authorisation has to be defined on a European level, the assessment itself needs to take into account specific national and/or regional conditions. Therefore, unlike the environmental and health risk assessment which is carried at EU level, an assessment of socio-economic impacts ought to be carried out at the national level. The results, however, need to be submitted by the Member States to the European Commission in order to be taken into account when drafting a decision on the authorisation of a GMO. According to the proposal of the European Commission on the right of Member States to decide on the cultivation of GMOs on their own territory, such a national assessment also needs to be conducted in order to justify any restrictions.

The socio-economic implications of GMO cultivation will most certainly remain an important topic on the EU – as well as the international – level. Therefore, it is recommended that Austria gets actively involved in the relevant processes.

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This study discusses the socio-economic aspects of the cultivation of genetically modified organisms (GMOs), a topic emerging at the international level as well as in the European Union. It provides a basis for ongoing discussions regarding the possible consideration of socio-economic aspects in GMO authorisation procedures.

In this respect, the report gives an overview of the legal and political as well as the scientific background of a socio-economic assessment of GMO cultivation. Experiences with socio-economic assessments are discussed and important issues identified. In addition, a catalogue of assessment criteria is presented, focusing mainly on aspects which are of major relevance for Austria, as well as on the risks and potential negative effects of GMO cultivation.